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VINDMÅLINGER I DRØBAKSUNDET DESEMBER 1989 - MARS 1990

D. Tønnesen

SAMMENDRAG

Norsk institutt for luftforskning (NILU) har på oppdrag fra Statens Vegvesen, Buskerud Vegkontor, målt vind og turbulens i Drøbaksundet i Oslofjorden. Målingene ble startet 12. desember 1989, og avsluttet 30. juni 1990. Denne rapporten omhandler målinger fra 12. desember 1989 til 30. mars 1990. På bakgrunn av litt over 3 måneders målinger kan følgende konklusjoner trekkes:

- I måleperioden har sterk vind forekommet vesentlig oftere enn normalt for området og årstiden.
- Fremherskende vindretning i Drøbaksundet under måleperioden var fra sør.
- De høyeste middelvindstyrkene forekom ved vind fra sør.
- Vind fra vest var mer turbulent enn vind fra øvrige retninger.

INNHold

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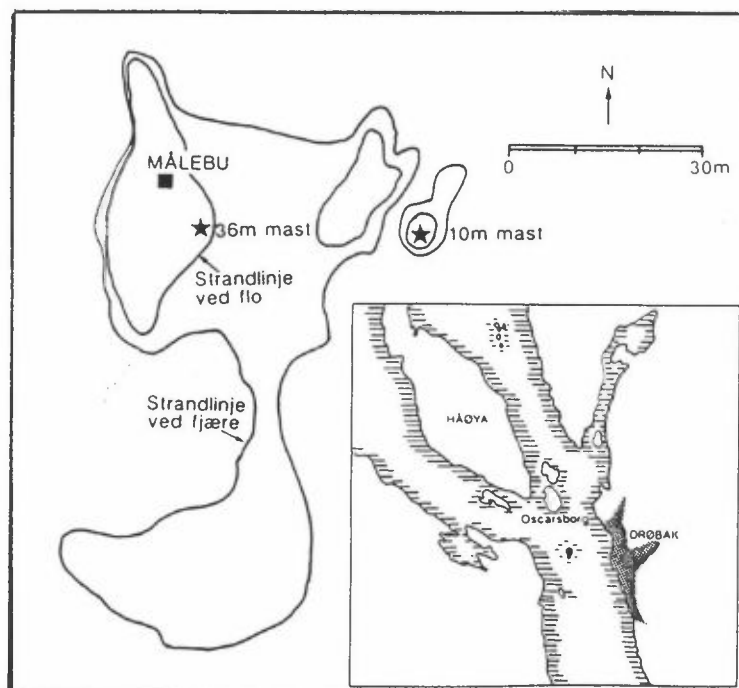
VINDMÅLINGER I DRØBAKSUNDET DESEMBER 1989-MARS 1990

1 INNLEDNING

Norsk institutt for luftforskning (NILU) har på oppdrag fra Statens Vegvesen, Buskerud Vegkontor, utført målinger av vind og turbulens i Drøbaksundet i Oslofjorden. Målingene er igangsatt i forbindelse med utredning om veiforbindelse fra Drøbak til Hurum. Målingene startet i desember 1989. Denne rapporten omhandler data samlet inn t.o.m. mars 1990.

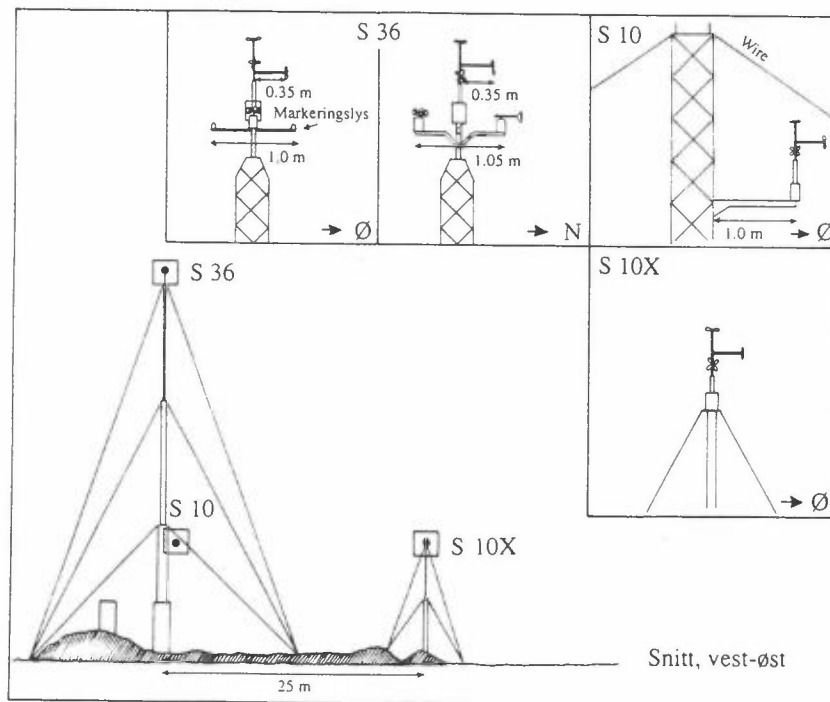
2 STASJONSBEKRIVELSE

Målestasjonen er plassert på Småskjær i Drøbaksundet, ca. 700 m sør for Oscarsborg festning. En av de alternative brutraseene går over målestasjonen. Det høyeste punktet på Småskjær er ca. 3 m over normalt havnivå. Målestasjonens beliggenhet er vist på figur 1a.



Figur 1a: Skisse av Småskjær med plassering av målestasjon.

Figur 1b viser en skisse av målestasjonen og sensorplasseringen i de tre målepunktene. En beskrivelse av sensorene er gitt i kapittel 3.



Figur 1b: Skisse av målestasjonen og sensorplasseringen i mastene.

3 INSTRUMENTERING

På målestasjonen er det to instrumentmaster, henholdsvis 36 m og 10 m høye. Mastene er utstyrt med sensorer for vindmåling i 10 m høyde og i 36 m høyde. I tillegg måles temperaturen i 36 m høyde og temperaturdifferansen mellom 36 m og 2 m høyde. To typer vindmålere er installert i mastene, en Aanderaalogger i 36 m og tre Gillanemometre, ett i 36 m, og ett i hver mast i 10 m høyde.

Aanderaamåleren består av et skålkors og en retningsfløy. Den registrerer middelvindstyrke hvert 10. minutt, sterkeste vindkast midlet over 2 sekunder og vindretning hvert 10. minutt. Skålkorset har et måleområde på 0-60 m/s, en starthastighet på

0,3 m/s, og en avstandskonstant på 1,5 m. Målenøyaktigheten for vindstyrke er 2%.

Gillanemometrene består av propeller montert på 3 faste akser orientert i retninger øst, nord og loddrett. Armene er 35 cm. For hver av de ni sensorene logges antall propelleromdreininger hvert 1,17 sekund (512 registreringer på 600 sekunder). Instrumentet har et måleområde på 0-40 m/s, en starthastighet garantert til 0,4 m/s og en avstandskonstant på 2,1 m. Målenøyaktigheten er 3%. En mikroprosessor kontrollerer at logging av de ni sensorene foregår synkront. Dersom differansen i innlogging overstiger 1,17 millisekunder, resynkroniseres opptellingsperiodene. Slik resynkronisering har ikke vært nødvendig. Mikroprosessen beregner også middelvei og standardavvik for hver serie av 512 registreringer, samt registrerer maksimalt utslag for de vertikale sensorene og maksimal vektor for de tre horisontale komponentene. Mikroprosessen opererer med pulser fra sensorene som enhet.

Dataene overføres pr. telefon ca. 3 ganger i døgnet til en lokal lagringsenhet på NILU. Både 10 minutters statistisk bearbejdede data og sekund-seriene overføres. Dataene kontrolleres under oppringning på stikkprøvebasis og senere under bearbejding. De viktigste indikasjonene på feil er at det er dårlig sammenheng mellom målingen i ett målepunkt i forhold til de andre.

4 DATATILGJENGELIGHET

Aanderaamåleren har vært operativ nær 100% av tiden i måleperioden. I noen korte perioder med svært svak vind gir måleren konstant vindretning på grunn av den innebygde tregheten i rettingsfløya.

Gillanemometrene har variabel datatilgjengelighet, både fra sensor til sensor og på de tre målepunktene. Regulariteten er best på sensorsettet i 10 m-masta.

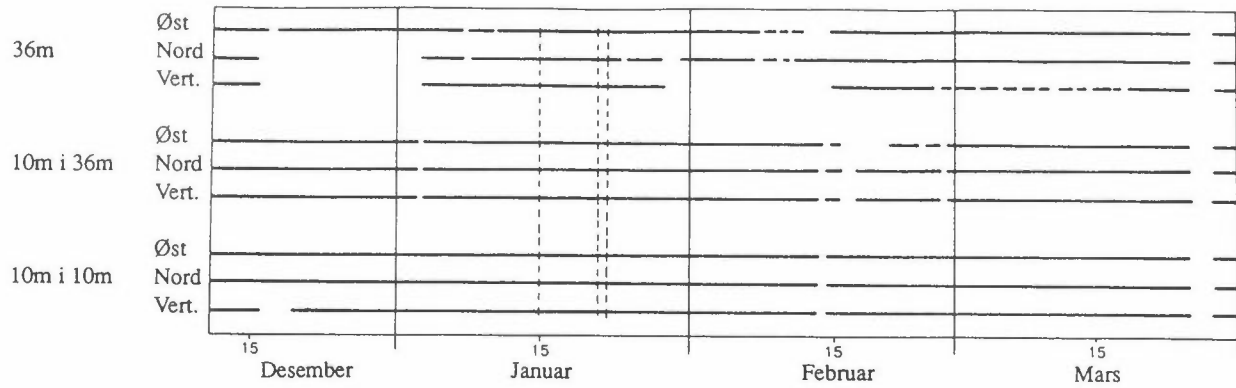
Problemene med Gillanemometrene oppsto på grunn av vanninntrenging i sensorene og korrosjon på kabelkontaktene. Hvert trearmet instrument var utstyrt med vifte som tok inn luft gjennom et skumplastfilter og førte en luftstrøm over lagrene til propelleraksene, for å redusere støvbelastning på propellerlagrene. Dette systemet fungerte dårlig på Småskjær der både luftas saltinnhold og fuktighet er høy. Etter at vifta ble koblet ut ble datatilgjengeligheten mye bedre. Et større vedlikehold på stasjonen ble utført i slutten av mars. Alle sensorer ble tatt inn og rensset. Feil eller manglende data fra Gill-sensorene identifiseres ved at standardavviket for 10-minutterperioden er null eller at en måler viser verdier som avviker sterkt fra de andre målerne.

Manglende eller dårlige data i prosent av total tid er vist i tabell 1 for vertikale sensorer og på sett av 2 horisontale sensorer. Målingene av vertikalhastighet i 36 m nivå inneholder i tillegg korte perioder hvor sekundverdiene på sensoren er null, mens øvrige delene av 10-minutters perioden indikerer at sekundverdien burde ha vært forskjellig fra null.

Tabell 1: Manglende eller dårlige data i prosent av måletiden.

	36 m		10 m i 36 m mast		10 m i 10 m mast	
	Horisontal	Vertikal	Horisontal	Vertikal	Horisontal	Vertikal
Desember	76.3	76.2	0.4	0.4	0.5	18.0
Januar	14.4	18.4	1.9	0.2	0.2	0.2
Februar	28.7	51.9	15.9	7.5	0.3	1.0
Mars	3.7	6.9	4.3	4.0	3.6	3.6
Totalt	26.4	34.1	5.9	3.1	1.2	4.7

På figur 2 er sammenhengende perioder der en sensor har vært ute av drift (ikke gitt noen verdier) vist som brudd i linjene.



Figur 2: Perioder der de enkelte sensorene har vært operative. Brutt linje markerer manglende data.

I tabell 2 er en liste over perioder med dårlige data vist. Lista er basert på en gjennomgang av 10 min. midlere vindretning og vindstyrke på de fire målepunktene. Deler av periodene omfatter også manglende data blant dårlige data.

Tabell 2: Dårlige data på målepunktene, identifisert ved gjennomgang av 10 min. middelerdi på 4 målepunkter.

36 m		10 m i 36 m mast		10 m i 10 m mast	
fra dato	til dato	fra dato	til dato	fra dato	til dato
kl.	kl.	kl.	kl.	kl.	kl.
23. jan. 1250	23. jan. 1400	30. jan. 1220	31. jan. 0010	28. jan. 1230	28. jan. 1710
24. jan. 2120	25. jan. 0210	31. jan. 0730	31. jan. 1020	14. feb. 0510	14. feb. 0650
25. jan. 1030	25. jan. 1210	1. feb. 1220	1. feb. 1250		
26. jan. 0150	26. jan. 0340	13. feb. 1650	14. feb. 1940		
27. jan. 0640	27. jan. 0710	15. feb. 0250	15. feb. 0420		
28. jan. 0400	29. jan. 0200	17. feb. 2200	18. feb. 0150		
29. jan. 2250	1. feb. 0730	18. feb. 0550	18. feb. 1720		
1. feb. 1200	1. feb. 1420	27. feb. 1530	27. feb. 1540		
1. feb. 2310	2. feb. 0230	5. mars 1030	5. mars 1240		
2. feb. 0640	3. feb. 0730				
3. feb. 1130	3. feb. 1530				
3. feb. 1820	3. feb. 2350				
4. feb. 0410	4. feb. 1010				
4. feb. 1710	5. feb. 1010				
5. feb. 1900	6. feb. 0100				
7. feb. 0620	7. feb. 0920				
7. feb. 1130	7. feb. 1340				
8. feb. 0430	8. feb. 0720				
8. feb. 1710	9. feb. 1840				
10. feb. 0310	10. feb. 2040				
11. feb. 0100	11. feb. 1600				
11. feb. 2320	14. feb. 1330				
15. feb. 0250	16. feb. 0830				
20. feb. 1400	21. feb. 0130				

5 REPRESENTATIVITET

Representativiteten av måleperioden er vurdert fra sammenligning mellom måleperioden og 15 års vindstatistikk for Ferder fyr, samt sammenligning mellom måleperioden og 10 års vindstatistikk fra Ås, nedre Telemark. Ferder fyr bør være representativ for ytre Oslofjord. Ås i nedre Telemark bør være representativ for kystnære strøk på Østlandet.

Under måleperioden har det vært høyere forekomst av sterk vind enn normalt for årstiden. Tabell 3 viser en sammenligning mellom 1990 og perioden 1960-1975 for Ferder fyr. Tallene er hentet fra Meteorologisk institutts klimatiske månedsoversikter og fra statistisk bearbejdede vinddata fra 1960-1975.

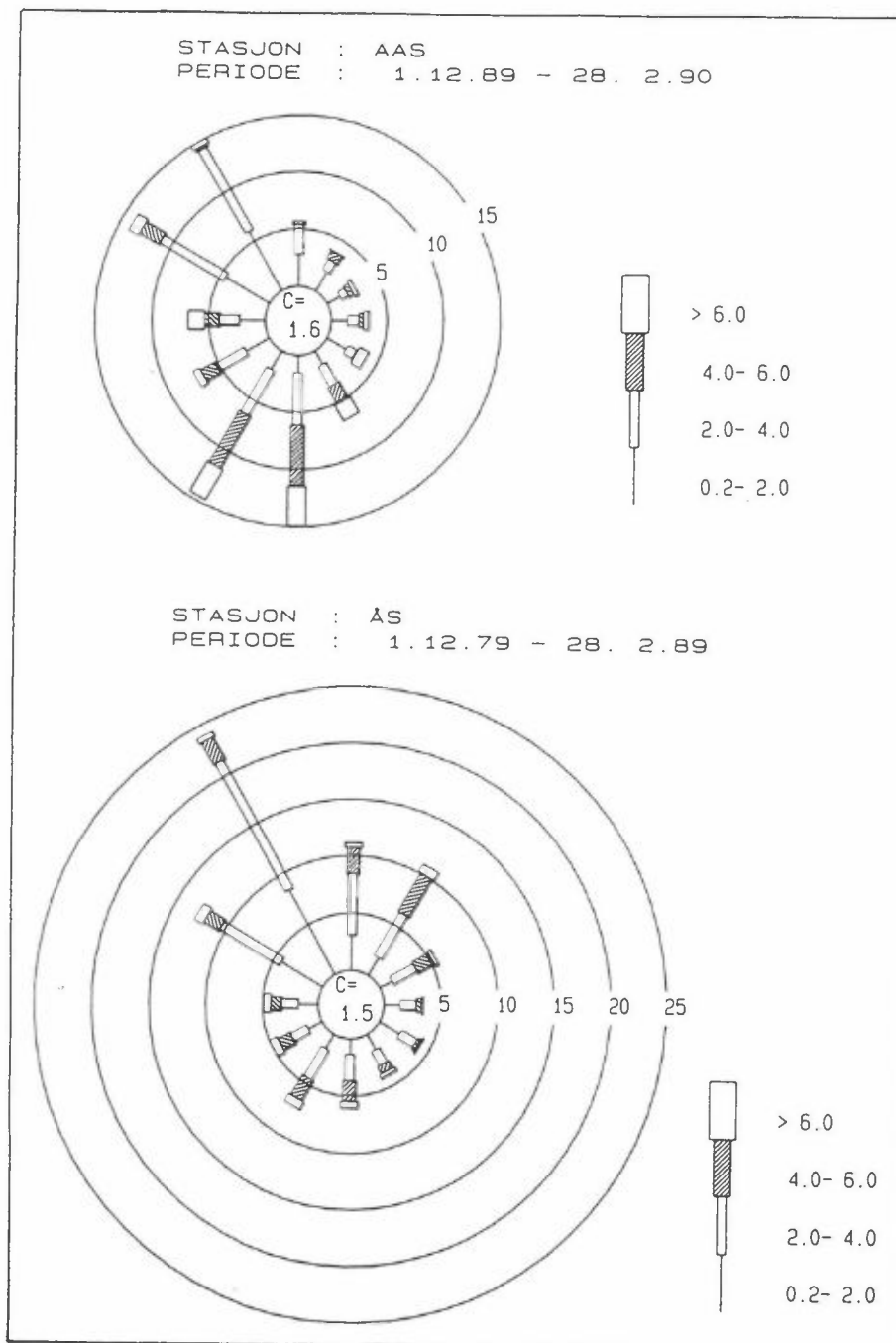
Tabell 3: Sammenligning mellom 1990 og perioden 1960-1975 for Ferder fyr.

Måned	1990				1960-1975		
	Temperaturavvik (grader)	Midlere vindstyrke (beaufort)	Prosent av døgn med maks. vind over 6 beauf. over 8 beauf.		Midlere vindstyrke (beaufort)	Prosent av døgn med maks. vind over 6 beauf. over 8 beauf.	
Januar	4,6	5,1	87	32	4,2	46	6
Febr.	6,4	5,2	86	43	3,9	39	5
Mars	5,3	5,5	90	48	3,9	30	3

Temperaturavviket illustrerer at frekvensen av pålandsvind har vært større enn normalt. Vindstyrkeklasse 5 beaufort (frisk bris) svarer til vindstyrker fra 8,0 m/s til 10,7 m/s. Vindstyrkeklasse 4 beaufort (laber bris) svarer til vindstyrker fra 5,5 m/s til 7,9 m/s. Forekomsten av døgn med maksimal vind over 6 beaufort (liten kuling) er 2-3 ganger høyere enn normalt. Forekomsten av døgn med maksimal vind over 8 beaufort (sterk kuling) er 5-10 ganger høyere enn normalt.

Figur 3 viser forekomst av vind delt i vindstyrkeklasser og retninger målt på Ås i Telemark (mellom Porsgrunn og Brevik)

for perioden 1979-1989 og vinteren 1989-1990 (desember-februar). Figuren viser at i måleperioden har vind fra sør og sør-vest, særlig for vindstyrker over 4 m/s, forekommet hyppigere enn under 10 års-perioden 1979-1989.



Figur 3: Vindretningsfordeling målt på Ås, nedre Telemark for desember 1989-februar 1990, og for tilsvarende måneder fra 1979 til 1989. Forekomsten av vind i en 30 graders sektor er delt inn i 4 vindstyrkeklasser.

6 MÅLERESULTATER

6.1 TIDSPLOTT

Tidsplott av vindretning og vindstyrke for 10 min. middelværdier på 4 sensorer er vist i vedlegg A.

6.2 DEKOMPONERING AV HORIZONTAL TURBULENS

Målingene langs de faste aksene øst-vest (u-akse) og nord-sør (v-akse) gir variansen av vindkomponenten langs akse for en 10 minutters periode. Turbulensen langs og på tvers av vindvektoren, uttrykt ved målingene langs aksene og vinkelen α mellom vindvektoren og øst-vest-aksen er

$$(1) \quad \sigma_L^2 = \sigma_u^2 \cos^2 \alpha + \sigma_v^2 \sin^2 \alpha - 2 \cos \alpha \sin \alpha \operatorname{cov}(u^1, v^1)$$

$$(2) \quad \sigma_T^2 = \sigma_u^2 \sin^2 \alpha + \sigma_v^2 \cos^2 \alpha + 2 \cos \alpha \sin \alpha \operatorname{cov}(u^1, v^1)$$

- Der - σ_L^2 er variansen langs vindvektoren
 - σ_T^2 er variansen på tvers av vindvektoren
 - σ_u^2 er variansen i målingene langs øst-vest akse
 - σ_v^2 er variansen i målingene langs nord-syd akse
 - α er definert ved $\alpha = \arctg\left(-\frac{u}{v}\right)$
 - cov er kovariansen
 - u^1 er måleserien langs u-aksen korrigert med \bar{u}
 - v^1 er måleserien langs v-aksen korrigert med \bar{v}

Da kovariansen mellom u og v ikke er lagret for 10 minutters seriene, er σ_L^2 og σ_T^2 beregnet etter formlene

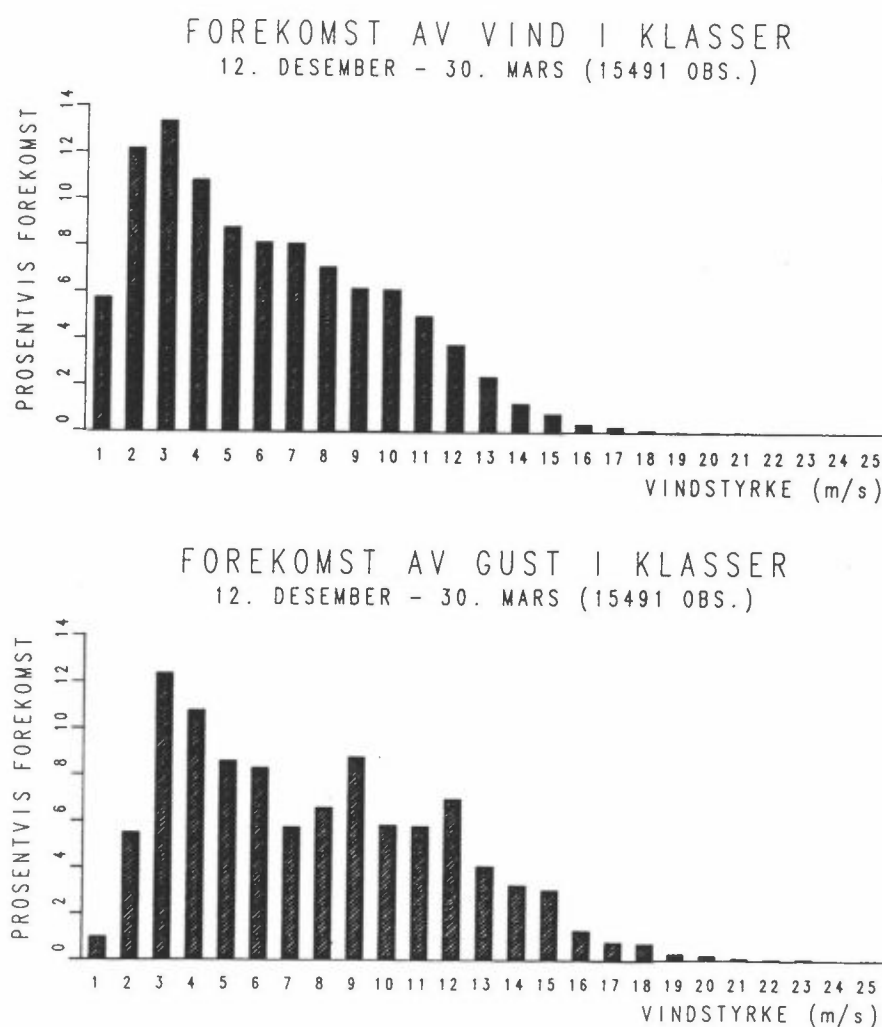
$$(3) \quad \sigma_L^2 = \sigma_u^2 \cos^2 \alpha + \sigma_v^2 \sin^2 \alpha$$

$$(4) \quad \sigma_T^2 = \sigma_u^2 \sin^2 \alpha + \sigma_v^2 \cos^2 \alpha$$

idet det forutsettes at $\operatorname{cov}(u^1, v^1)$ er liten, dvs. at σ_L^2 og σ_T^2 er av omtrent samme størrelse.

6.3 VINDSTYRKEFORDELING

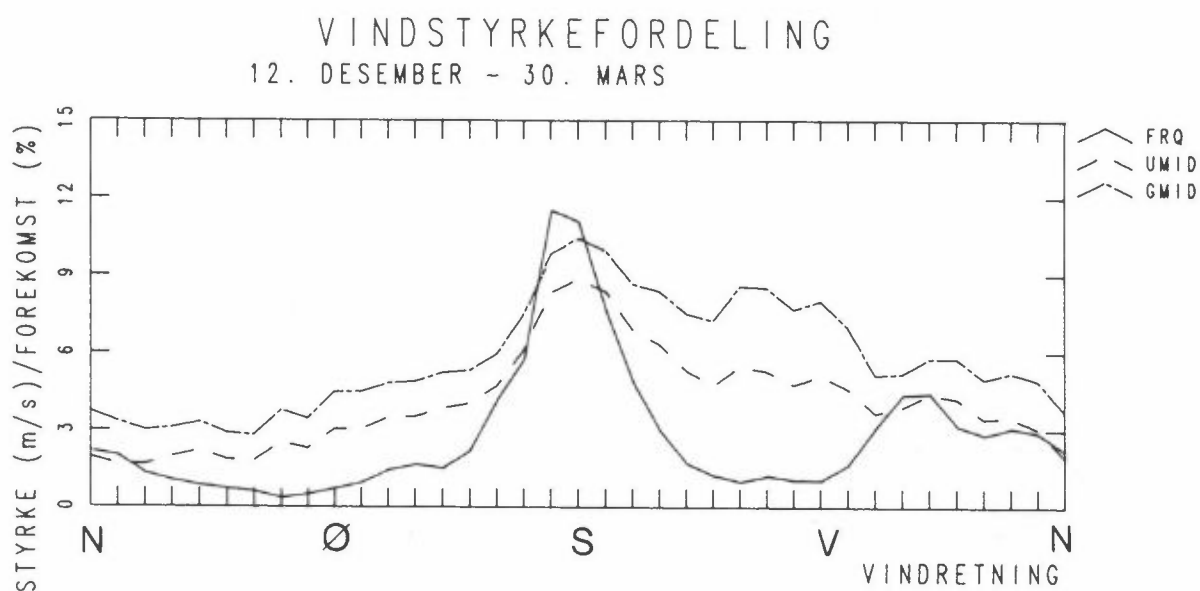
Vindstyrke og vindkast målt med Aanderaaloggeren er vist på figur 4. Figuren viser prosentvis forekomst av vindstyrke i klasser for hver m/s. (Klasse 1: vind av styrke 0-1 m/s, klasse 2: vind av styrke 1-2 m/s etc.). Forekomsten i hver klasse er vist i tabell i vedlegg B. Maksimal observert 10 min. middelvindstyrke i perioden var 20.8 m/s (15. januar kl. 0720). Høyeste vindkast var 24.2 m/s observert på samme tidspunkt. Vindretningen var da 177 grader.



Figur 4: Fordeling av vindstyrker og vindkast målt med Aanderaaloggeren i 36 m høyde. Stolpen viser forekomst av vind fordelt på vindstyrkeklasser á 1 m/s.

6.4 VINDRETNINGSFORDELING OG RETNINGSFORDELTE MIDDELVERDIER

Innholdet i de etterfølgende figurer er gjengitt i tabellform i vedlegg B. Målepunktene med gillsensorer er i figurene nummerert som følger: 36 m - Gill nr. 1, 10 m i 36 m mast - Gill nr. 2, 10 m i 10 m mast - Gill nr. 3. Vindretningsfordelingen på Aanderaaloggeren er vist i figur 5 sammen med midlere vindstyrke og midlere vindkast for hver 10 graders sektor. Verdiene for nordlig retning er vist i begge ender av figuren.

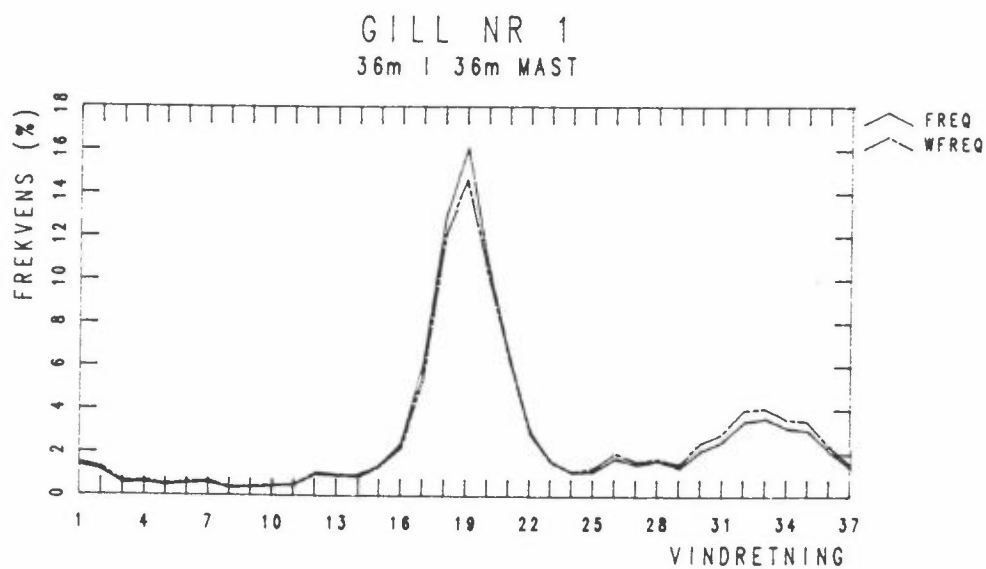
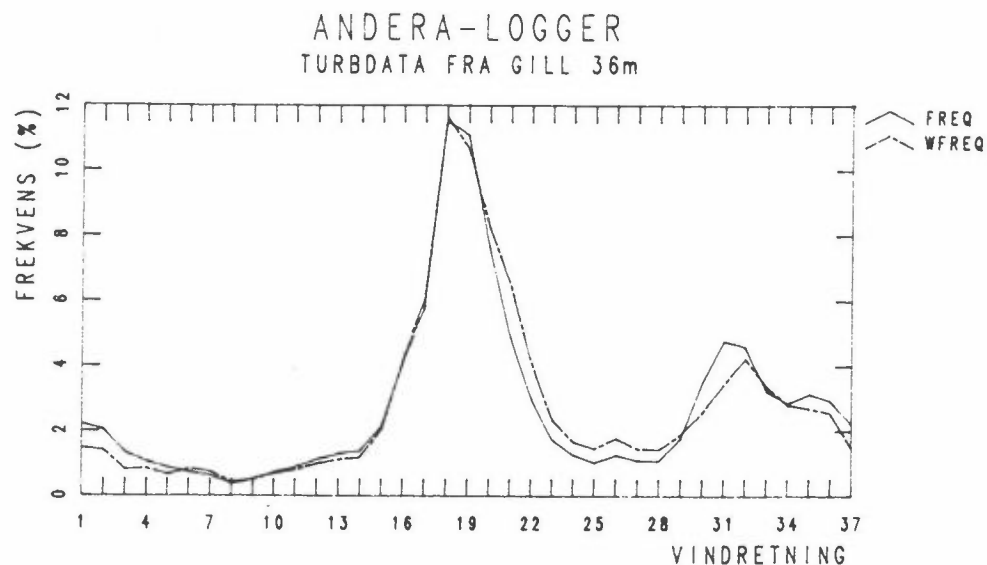


Figur 5: Vindretningsfordeling (FRQ), midlere vindhastighet og midlere vindkast for 10 graders vindretningsklasser målt med Aanderaalogger i 36 m høyde.

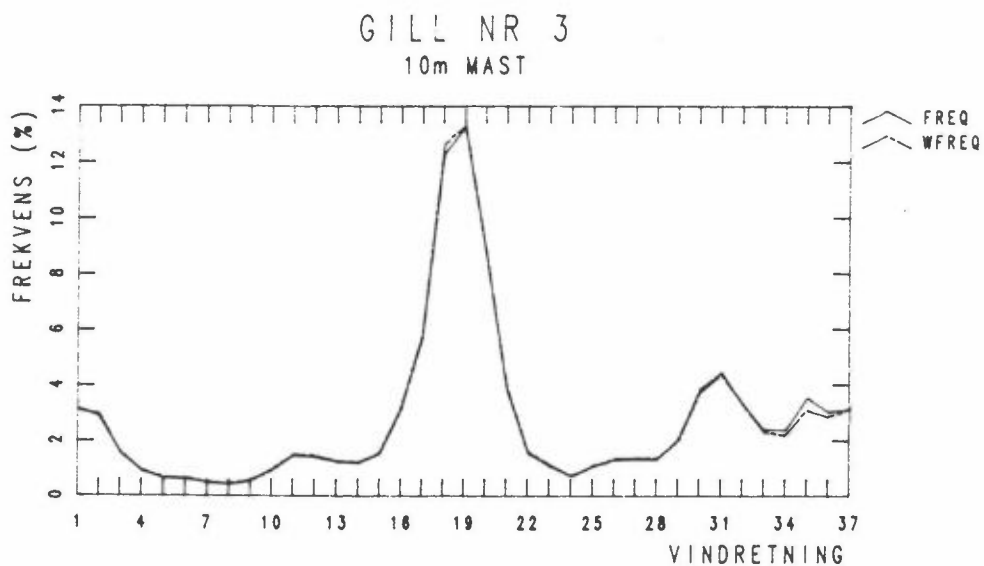
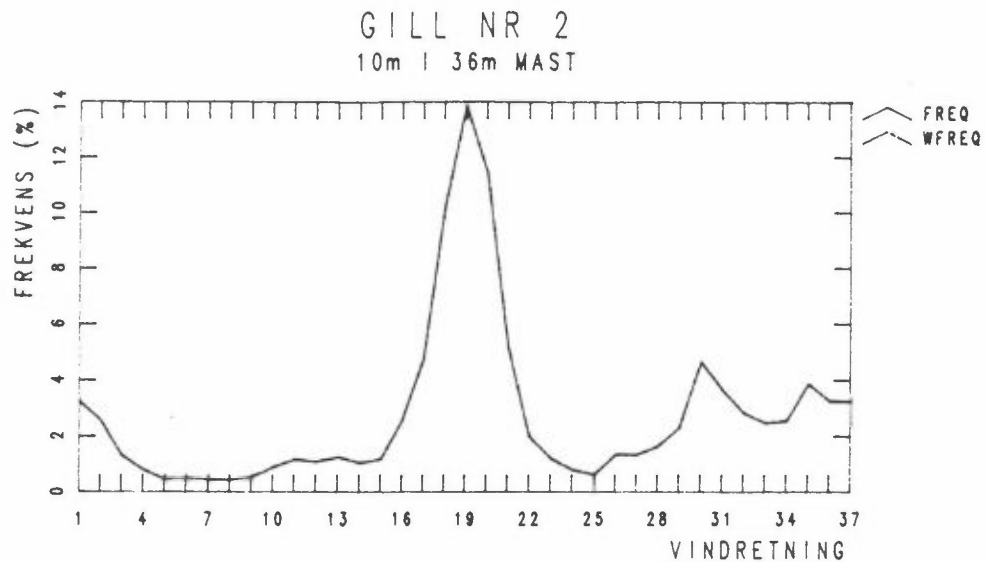
Figuren viser at vindretninger omkring sør forekom hyppigst i perioden. Figuren viser også en viss kanalisering fra nordvest, gjennom sundet på vestsiden av Håøya. Både vindhastighet og vindkast hadde høyest middelerdi for sørlig vindretning. Forholdet mellom vindkast og middelvind er størst for vindretninger fra omkring vest.

Figur 6 og figur 7 viser vindretningsfordeling på Gillmålerene, og på Aanderaaloggeren for de periodene det foreligger data

også for Gill nr. 1. Vindretningsfordelingen er vist for alle "gode" data (FREQ) og for "gode" data der det også foreligger data fra vertikal sensor (WFREQ). Avviket mellom "FREQ" og "WFREQ" er størst for målingene i 36 m høyde.



Figur 6: Vindretningsfordeling for Gillmåler i 36 m og Aanderaamåler i 36 m fordelt på 36 vindretningsklasser.

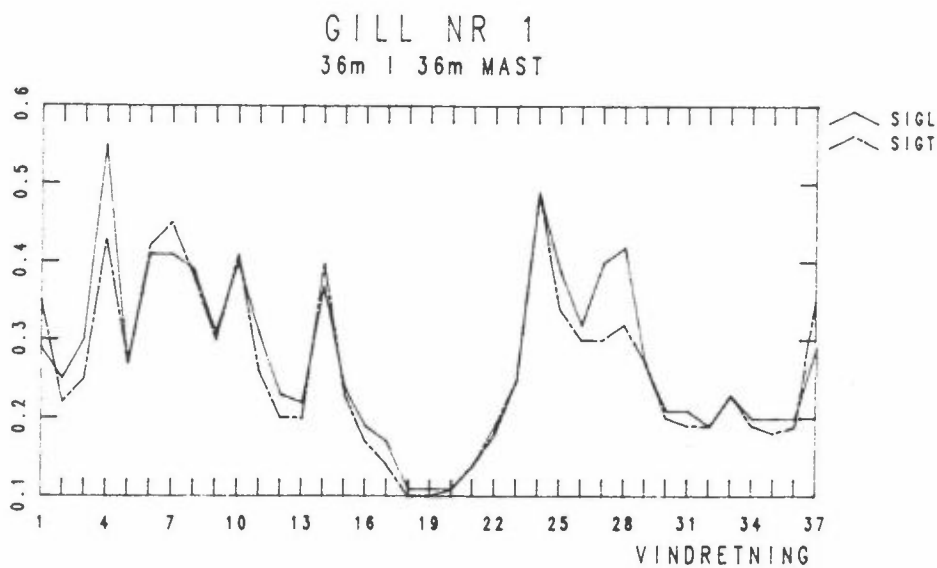
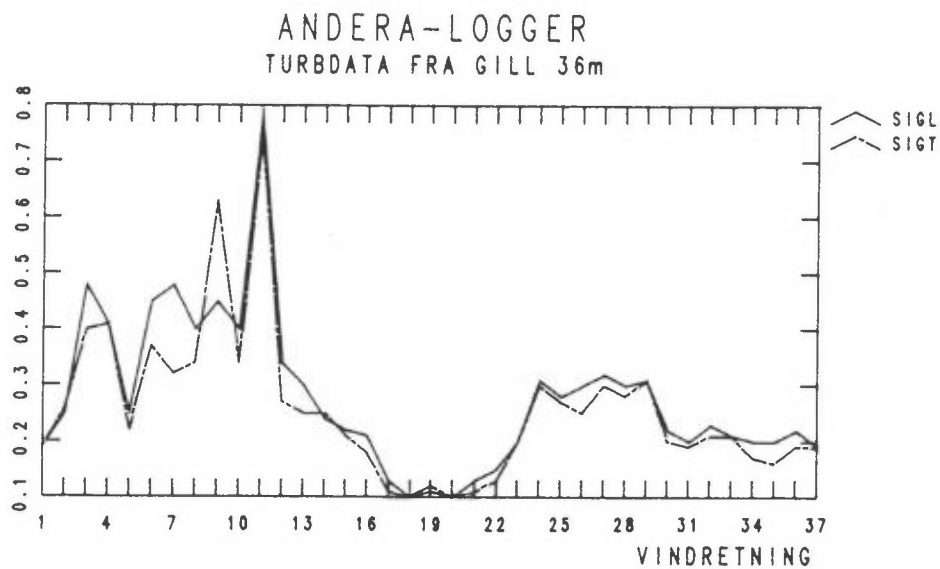


Figur 7: Vindretningsfordeling for Gill nr. 2 (i 36 m mast) og Gill nr. 3 (i 10 m mast) fordelt på 36 vindretningssektorer. Begge måleseriene er fra 10 m høyde.

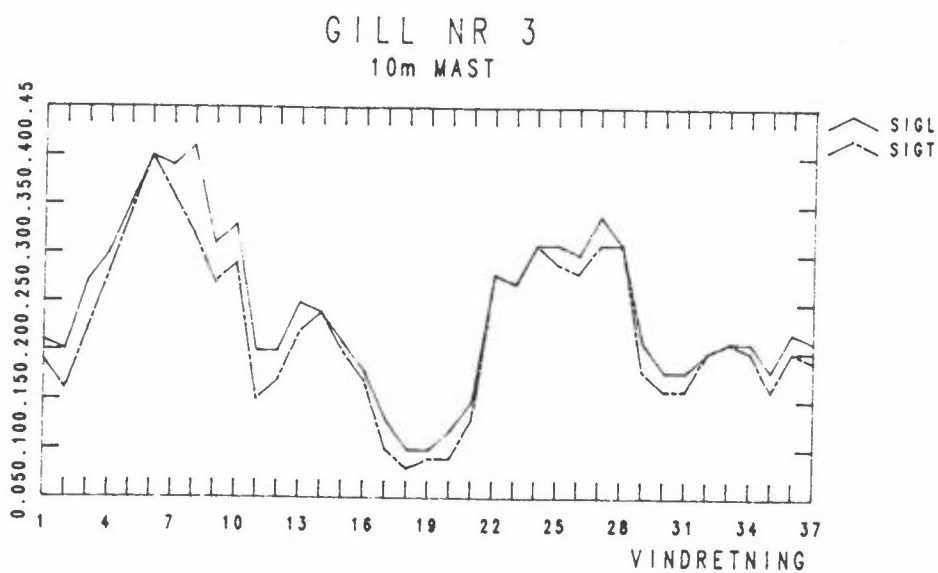
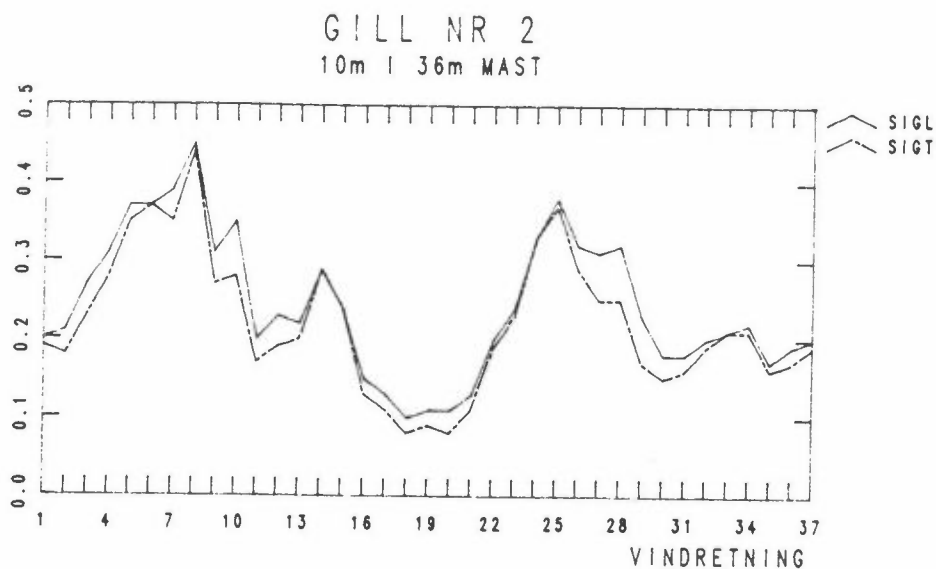
Gill nr. 1 viser en "skarpere" topp i retningsfordelingen rundt sør enn Aanderaaloggeren. Gill nr. 1 har også noe avvikende retningsfordeling fra Gill nr. 2 og Gill nr. 3, spesielt for sektoren vest til nord.

Figur 8a og figur 8b viser midlere turbulensintensitet langs og på tvers av vindvektoren for 10 graders vindretningssektorer. Turbulensintensiteten er lavest for vindretning rundt sør, og

høyst i sektorene nordøst og vest-sørvest. Midlere vindstyrke er større for vindretning fra vest-sørvest enn for sektor nordøst. Målingene tyder derfor på at de største turbulenselementene opptrer ved vest-sørvestlig vindretning.

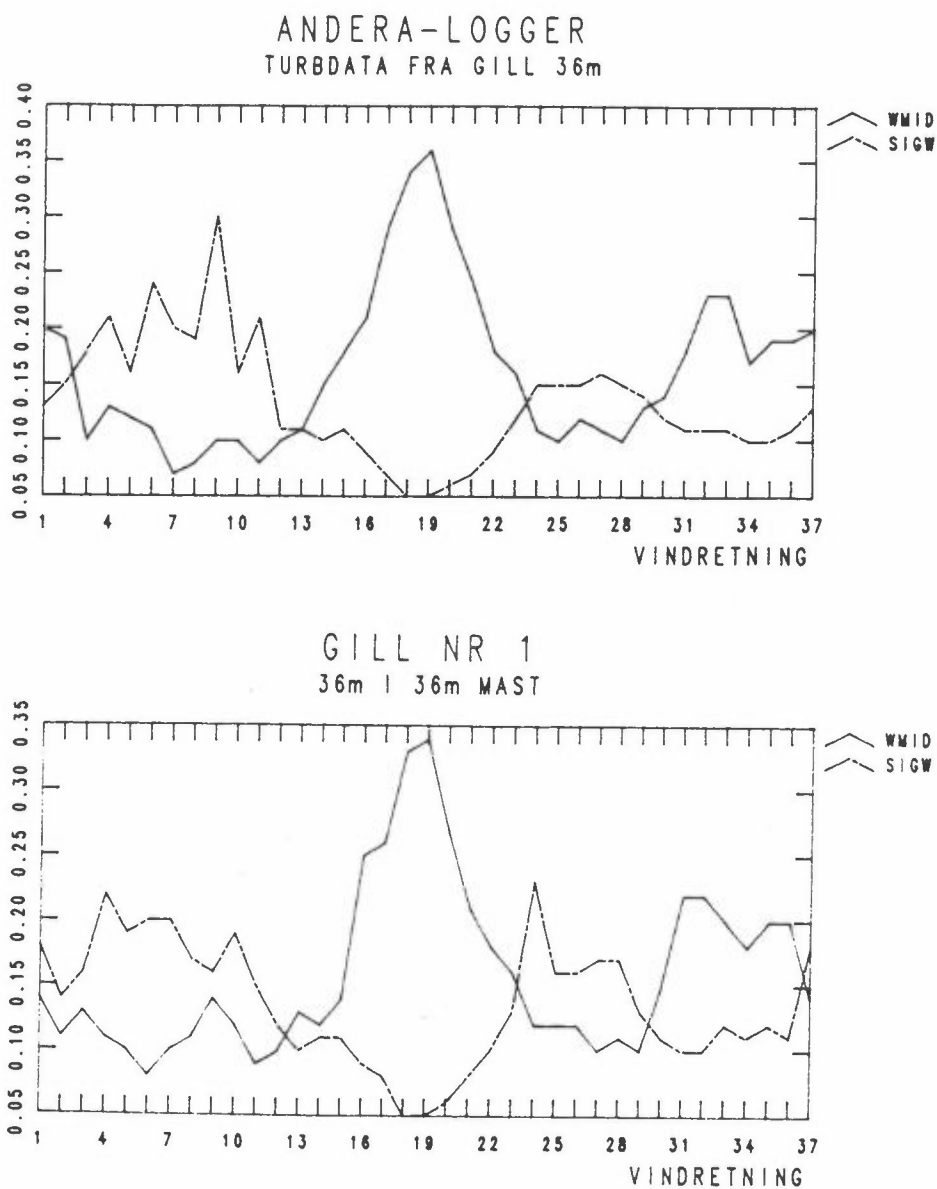


Figur 8a: Midlere turbulensintensitet på tvers av (SIGT) og på langs av (SIGL) vindvektoren for Gill og Aanderaa i 36 m høyde, fordelt på 36 vindretningsklasser.



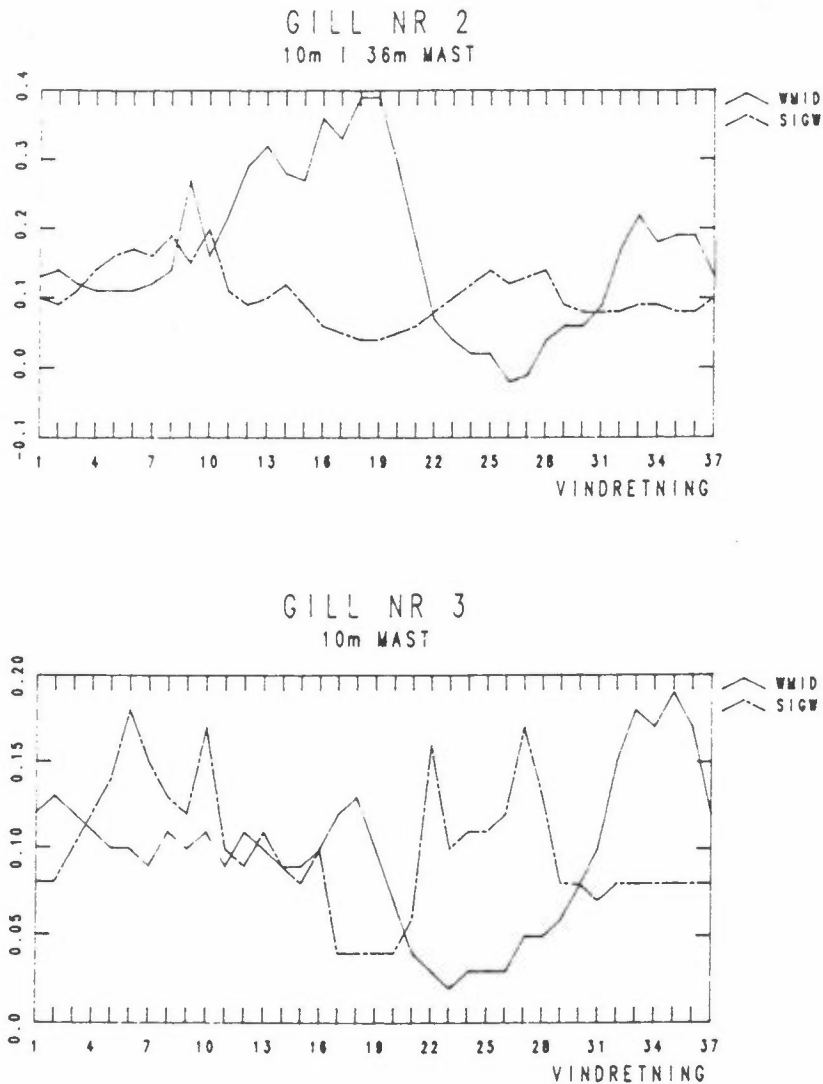
Figur 8b: Midlere turbulensintensitet på tvers av (SIGT) og på langs av (SIGL) vindvektoren for Gillmålerne i 10 m høyde, fordelt på 36 vindretningsklasser.

Midlere vertikalhastighet og midlere vertikal turbulensintensitet er vist på figur 9 og figur 10. Fordelingen av den vertikale turbulensintensiteten ligner fordelingen av horisontal turbulensintensitet. Midlere vertikalbevegelse er oppoverrettet på samtlige sensorer. For målepunktene i 36 m masta er den sterkest for sørlig retning.



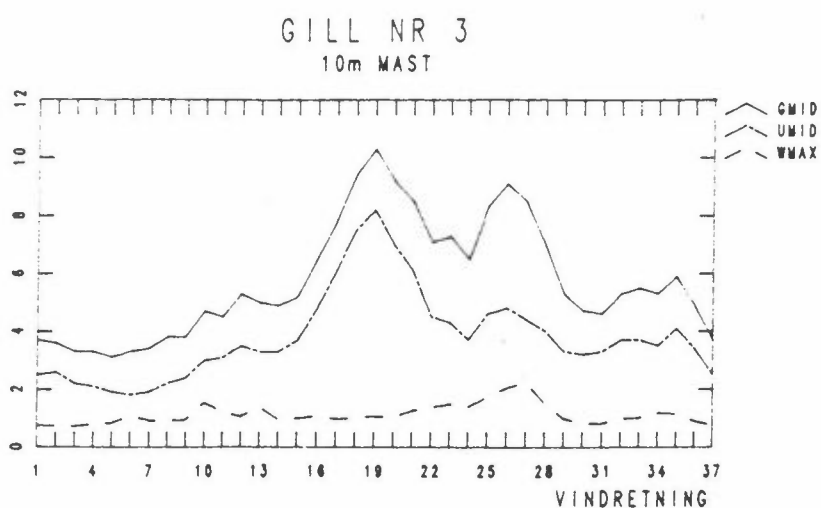
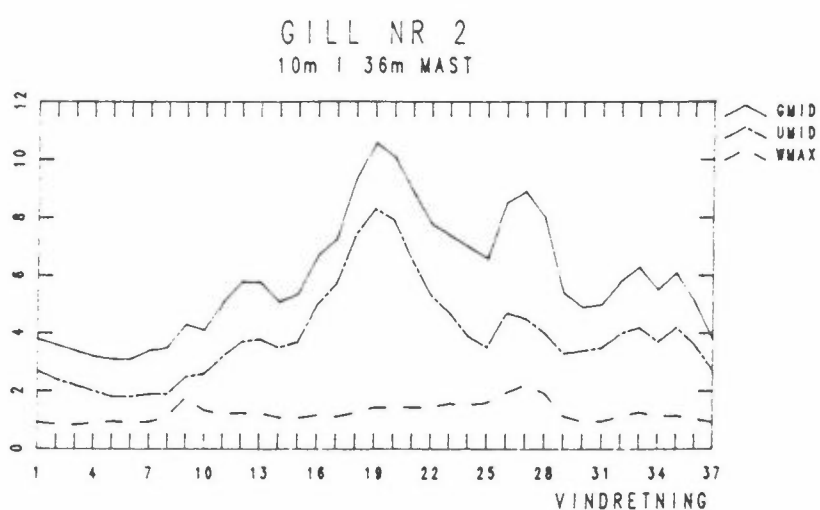
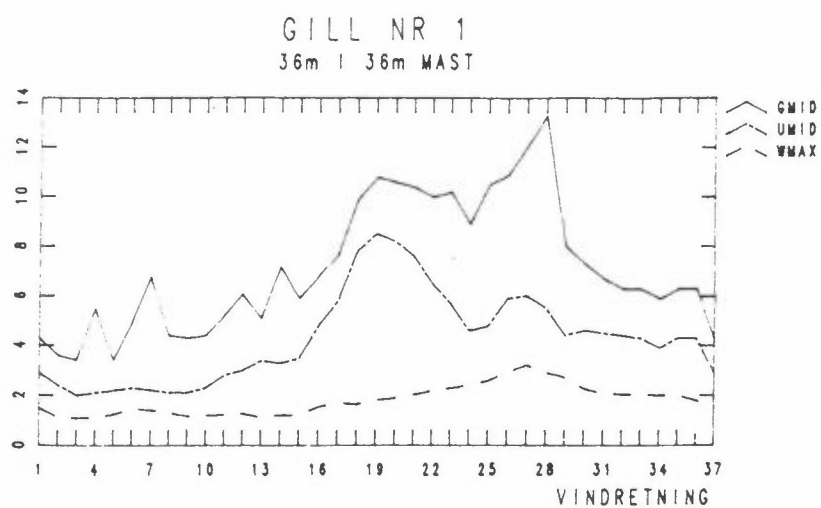
Figur 9: Midlere vertikalhastighet og midlere vertikal turbulensintensitet for 36 vindretningssektorer. Aanderaa-logger og Gill i 36 m høyde.

For målepunktet i 10 m masta er vertikalbevegelsen sterkest for nord-nordvestlig retning. Dette er trolig en følge av mastenes plassering i forhold til fasongen på Småskjær.



Figur 10: Midlere vertikalhastighet og midlere vertikal turbulensintensitet for 36 vindretningssektorer. Gill-målere i 10 m i 2 master.

Figur 11 viser midlere vindstyrke, midlere vindkast og midlere vertikale vindkast (tallverdi) for 36 vindretningssektorer. Figuren viser at midlere vindstyrke er størst for sørlig vindretning, og også har et maksimum for vind fra omkring vest. Vertikale vindkast er sterkest i middel for nord og vest. Fordelingene av midlere vindkast på retning er noe avvikende i 36 m i forhold til de to målerne i 10 m, idet de sterkeste vindkastene kommer ved vestlig vind i 36 m. Alle målere viser størst forhold mellom vindkast og middelvind for vind fra vest. Dette er nok en indikasjon på at turbulenselementene er størst under vestlig vindretning.



Figur 11: Midlere vindstyrke (UMID), midlere vindkast (GMID), og tallverdi av midlere vertikale vindkast (WMAX) for 36 vindretningssektorer. Gillanemometer i 36 m høyde og 10 m høyde.

7 AUTOSPEKTRA

Autospektra er beregnet for et utvalg av 10-minutters perioder. Spektra er beregnet for vindkomponenten langs aksene og for horisontal vindvektor for de tre sensorene. Tabell 4 viser de utvalgte periodene sammen med de loggede 10-minutters verdiene. Noen av periodene inneholder en overrepresentering av 0 m/s for vertikalhastigheten i 36 m nivå. Disse er markert med *.

Tabell 4: Utvalgte 10-minutters perioder for spektralanalyse og statistiske parametre fra disse periodene.

Periode		Aanderaa		Gill 1				
Dato	Kl.	Retn.	Hast.	Retn.	Hast.	w	σ_u	σ_v
15.01.90	0510	177	16,6	178	16,8	0,75	1,1	1,0
15.01.90	0520	171	16,9	178	16,8	0,77	0,9	1,1
17.01.90	2250	282	12,1	289	11,5	0,46	1,8	1,4
17.01.90	2300	294	13,2	292	12,7	0,53	1,6	1,8
23.01.90	1550	168	16,3	168	16,9	0,95	1,1	1,5
23.01.90	1600	169	16,6	170	16,5	0,84	0,9	1,7
17.02.90	2140	182	15,7	179	15,5	0,61*	1,3	1,2
19.02.90	1530	178	15,4	176	14,8	0,55	0,8	1,1
19.02.90	1540	183	15,2	177	15,0	0,67	0,8	1,1
04.03.90	1350	319	11,9	305	11,4	0,63*	1,5	1,1
04.03.90	1400	312	11,8	308	10,1	0,45	1,4	0,9
09.03.90	2030	337	12,8	344	15,2	0,65	1,2	2,3
09.03.90	2040	340	10,6	342	11,6	0,72*	1,0	2,1
16.03.90	1210	176	14,7	174	14,7	0,42*	0,4	0,4
16.03.90	1220	170	15,1	175	15,1	0,79*	0,6	0,4

Periode		Gill 2					Gill 3				
Dato	Kl.	Retn.	Hast.	w	σ_u	σ_v	Retn.	Hast.	w	σ_u	σ_v
15.01.90	0510	181	14,0	0,70	1,0	1,3	177	14,3	0,17	0,9	1,1
15.01.90	0520	182	13,6	0,75	1,0	1,5	178	14,6	0,15	0,9	1,2
17.01.90	2250	287	10,4	0,28	1,9	1,5	284	10,4	0,38	1,7	1,5
17.01.90	2300	290	11,4	0,27	1,8	1,7	287	11,3	0,35	1,1	1,5
23.01.90	1550	169	13,6	0,85	1,1	1,7	168	14,7	0,20	1,1	1,5
23.01.90	1600	173	13,3	0,77	1,0	1,7	171	14,0	0,25	0,9	1,5
17.02.90	2140	184	14,1		3,6	1,5	177	13,7		1,2	1,2
19.02.90	1530	179	13,1	0,77	0,7	1,2	174	12,7	0,20	0,7	1,0
19.02.90	1540	180	13,5	0,86	0,9	1,1	174	12,6	0,22	0,8	1,2
04.03.90	1350	303	10,6	0,28	1,5	1,1	301	10,0	0,40	1,5	1,1
04.03.90	1400	306	9,6	0,23	1,4	0,9	303	9,0	0,30	1,5	1,0
09.03.90	2030	340	13,3	1,04	1,3	2,1	339	12,7	0,59	1,4	2,1
09.03.90	2040	338	10,6	0,86	1,1	1,7	338	10,2	0,57	1,0	1,9
16.03.90	1210	176	12,9	0,70	0,4	0,7	172	12,4	0,23	0,4	0,8
16.03.90	1220	180	13,0	0,70	0,9	0,7	175	12,5	0,27	0,7	0,6

*: Overrepresentasjon av 0 m/s på sensoren for vertikalhastighet i 36 m nivå.

Analysen er utført ved hjelp av statistikpakken NAG Mk13, rutine G13CAF. Denne beregner et glattet spektrum med vindu. Vinduet som er anvendt er et Tukey-vindu med størrelse 60 tids-skritt.

Rutinen beregner $S^*(\omega)$ for $0 \leq \omega \leq \pi$ med skalering slik at

$$2 \int_0^{\pi} S^*(\omega) d\omega = \sigma_x^2$$

$S^*(\omega)$ blir beregnet for $\omega_i = \frac{2\pi}{L} i$, $i = 0, 1, \dots, \left[\frac{L}{2} \right]$ ved

$$S^*(\omega) = \frac{1}{2\pi} (C_0 + 2 \sum_{k=1}^M W_k C_k \cos(\omega k))$$

der C_k er autokovariansen, og

$$W_k = W \left[\frac{k}{M} \right], \quad K \leq M-1$$

er vinduet. For Tukey-vinduet er

$$W(\alpha) = \frac{1}{2} (1 + \cos(\pi\alpha))$$

For konvertering fra vinkelfrekvens til frekvens:

$$n(\omega) = \frac{\omega}{2\pi\Delta t}$$

$$S(n) = 2\pi\Delta t S(\omega); \text{ dvs. at } 2 \cdot \int_0^{\frac{1}{2\Delta t}} S(n) dn = \sigma^2$$

Da blir

$$n \cdot S(n) = \omega \cdot S^*(\omega)$$

Spektra er beregnet for 100 verdier av ω og skalert med $\frac{\omega}{\text{VAR}(\bar{U})}$. Frekvensaksen er så skalert med faktoren $\frac{Z}{\bar{U}}$ slik at "lengden" av definerte $nS(n)$ for enheten $\frac{nZ}{\bar{U}}$ varierer fra plott til plott.

De beregnede spektra er vist i vedlegg C.

Uten å tolke de enkelte spektra i detalj, kan det bemerkes at spekteret for 10 m nivå i 36 m masta viser en utypisk fordeling ved sørlig vind, med store deler av variansen knyttet til den

høyeste delen av det målte frekvensområdet. Dette gjelder spesielt komponenten på langs av hovedvindretningen (nord-sør bevegelse). Årsaken kan være påvirkning fra målemasta eller turbulens induisert lokalt fra bakken over Småskjær.

8 KORRELASJONSKOEFFISIENTER

Korrelasjonskoeffisienter for alle kombinasjoner av dekomponerte hastighetsvektorer og vindhastighetene er beregnet for de utvalgte periodene. Korrelasjonskoeffisientene er vist i tabeller i vedlegg D. Korrelasjonskoeffisientene for den enkelte sensor er diskutert nedenfor.

Følgende notasjon er brukt for vindkomponentene og vindhastigheten:

- 36U: Østlig vindkomponent i 36 m nivå
- 36V: Nordlig vindkomponent i 36 m nivå
- 36W: Vertikalhastighet i 36 m nivå
- 36H: Horisontal vindvektor i 36 m nivå
- 10U: Østlig vindkomponent i 10 m nivå i 36 m mast
- 10V: Nordlig vindkomponent i 10 m nivå i 36 m mast
- 10W: Vertikalhastighet i 10 m nivå i 36 m mast
- 10H: Horisontal vindvektor i 10 m nivå i 36 m mast
- X10U: Østlig vindkomponent i 10 m nivå, tilleggs mast
- X10V: Nordlig vindkomponent i 10 m nivå, tilleggs mast
- X10W: Vertikalhastighet i 10 m nivå, tilleggs mast
- X10H: Horisontal vindvektor i 10 m nivå, tilleggs mast

36W: Komponentene var sterkest korrelert med 10W. Korrelasjonen er sterkere ved vind fra vest og nordvest enn ved vind fra sør. Korrelasjonene med X10U var negativ og sterkest ved sørlig vindretning. Korrelasjonen med 36U var negativ og sterkest ved vestlig og nordvestlig vindretning. Største positive korrelasjonskoeffisient var 0,408 (17. januar kl. 2300). Største negative korrelasjonskoeffisient var -0,408 med 36U (17. januar kl. 2240).

- 10W: Komponenten var sterkest korrelert med 36W og hadde sterkest negativ korrelasjon med X10U. Største positive korrelasjonskoeffisient var 0,408 (17. januar kl. 2300). Største negative korrelasjonskoeffisient var -0,358 med X10U (23. januar kl. 1600).
- X10W: Komponenten hadde lavere korrelasjonskoeffisienter enn 36W og 10W. Største positive korrelasjonskoeffisient var 0,281 med 10W (17. januar kl. 2300). Største negative korrelasjonskoeffisient var -0,431 med X10H (15. januar kl. 0510). Korrelasjonskoeffisientene varierer usystematisk fra periode til periode.
- 36U: Komponenten var sterkest korrelert med 36H i perioder med vind fra vest. Korrelasjonen med 10U og X10U var som regel over 0,5 ved vestlig og nordlig vind, og oftest lavere enn 0,5 ved sørlig vind. Største positive korrelasjonskoeffisient med andre komponenter enn 36H var 0,721 med 10U (16. mars kl. 1220). Største negative korrelasjonskoeffisient med andre komponenter enn 36H var -0,432 med 10V (17. januar kl. 2300).
- 10U: Komponenten var sterkest korrelert med 10H i perioder med vind fra vest og ellers sterkest korrelert med X10U. Korrelasjonen med X10U var ca. 0,5 ved sørlig vind, og over 0,6 ved vind fra vest og nordvest. Største positive korrelasjonskoeffisient med andre komponenter enn 10H var 0,806 med X10U (4. mars kl. 1400). Største negative korrelasjonskoeffisient var -0,529 med 10V (17. januar kl. 2300). Den laveste korrelasjonskoeffisienten med X10U var 0,395 (19. februar kl. 1530).
- X10U: Komponenten var sterkest korrelert med X10H i perioder med vind fra vest og ellers sterkest korrelert med 10U. Korrelasjonen mellom 10U og X10U er beskrevet ovenfor. Største negative korrelasjonskoeffisient var -0,519 med X10H (16. mars kl. 1210).

36V: Komponenten var sterkest korrelert med 36H, særlig for sørlig vindretning. Ellers var korrelasjonen sterkest med 10V. Korrelasjonsfaktoren mellom 36V og 10V varierte ganske mye og var sterkere ved vind fra vest og nord enn ved vind fra sør. De største negative korrelasjonskoeffisientene var med en av U-komponentene ved sørlig vind og med 36H ved vind fra vest og nordvest. Største positive korrelasjonskoeffisient med andre komponenter enn 36H var 0,721 med 10V (4. mars 1350). Største negative korrelasjonskoeffisient med andre komponenter enn 36H var -0,414 med 36U (23. januar kl. 1600).

10V: Komponenten var sterkest korrelert med 10H, særlig for sørlig vindretning. Ellers var korrelasjonen sterkest med X10V og 36V. Korrelasjonene med disse komponentene var sterkere ved vind fra vest og nordvest enn ved vind fra sør. Største positive korrelasjonskoeffisient med andre komponenter enn 10H var 0,834 med X10V (17. januar kl. 2300). Største negative korrelasjonskoeffisient med andre komponenter enn 10H var -0,529 med 10U (17. januar kl. 2300).

X10V: Komponenten var sterkest korrelert med X10H, særlig for sørlig vindretning. Ellers var korrelasjonen sterkest med 10V og 36V. Korrelasjonen med disse komponentene var sterkere ved vind fra vest og nordvest enn ved vind fra sør. Ved sørlig vind var komponenten sterkest negativt korrelert med X10W. Største positive korrelasjonskoeffisient med andre komponenter enn X10H var 0,834 med 10V (17. januar kl. 2300). Største negative korrelasjonskoeffisient med andre komponenter enn X10H var -0,472 med X10U (17. januar kl. 2300).

Horisontale vindvektorer (36H, 10H og X10H):

Vindvektorene var sterkest korrelert med den sensoren som lå nærmest vindretningen. Innbyrdes korrelasjon mellom vindvektorene var større for vind fra vest og nordvest enn ved vind fra sør. Ved vind fra sør var korrelasjonen

sterkest mellom 36H og 10H. Ved vind fra vest og nordvest var korrelasjonen sterkest mellom 10H og X10H. De høyeste korrelasjonskoeffisientene var 0,794 mellom 10H og X10H, 0,742 mellom 36H og 10H og 0,674 mellom 36H og X10H (4. mars kl. 1350).

9 KOHERENSFUNKSJONER

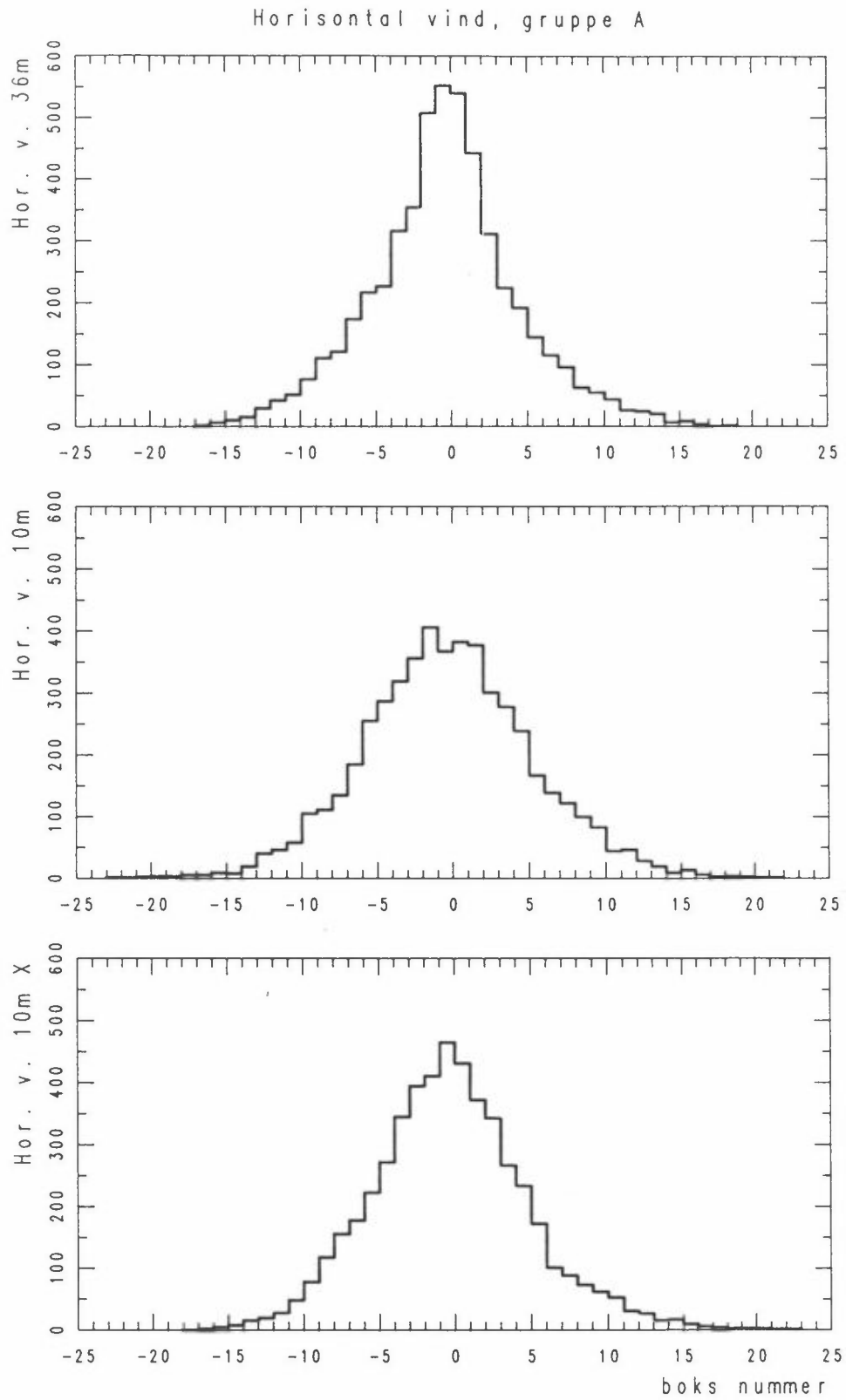
Koherensfunksjoner (koherensspektrum og kryss-amplitude) er beregnet for et spesifisert sett av parametere, 36V-10V, 36H-10H, 10V-10W, 10H-10W, 36V-36W, 36H-36W, 36W-10W, 10V-X10V, 10H-X10H og 10W-X10W. Disse er vist i vedlegg E.

Generelt blir kryss-amplituden liten for frekvenser over ca. 0,08 Hz (periode 12 sekunder), og koherensspektrumet er dermed insignifikant for den høyfrekvente delen.

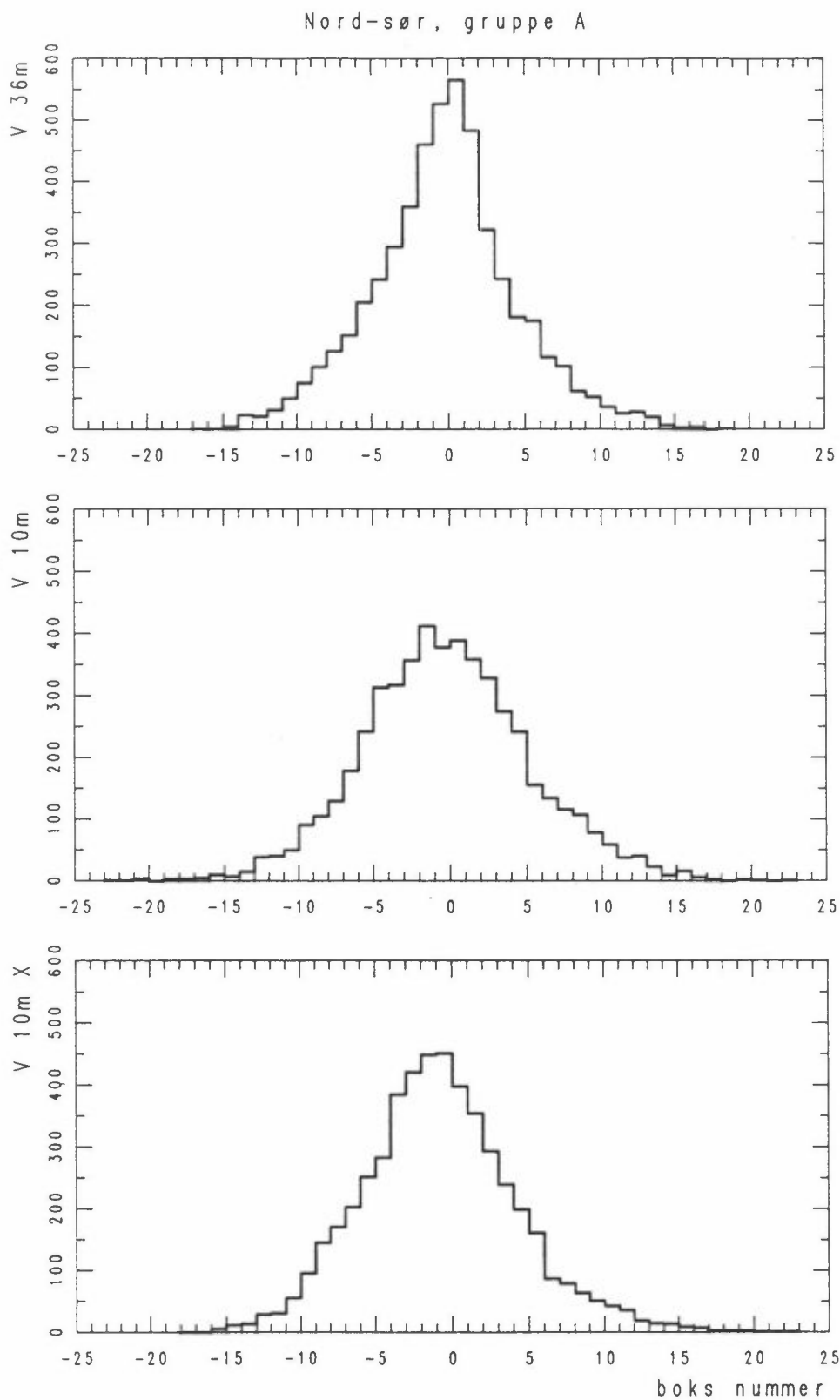
10 SANNSYNLIGHETSFORDELINGER

Individuelle fordelinger for dekomponerte vindhastigheter og horisontal vind er vist i vedlegg F.

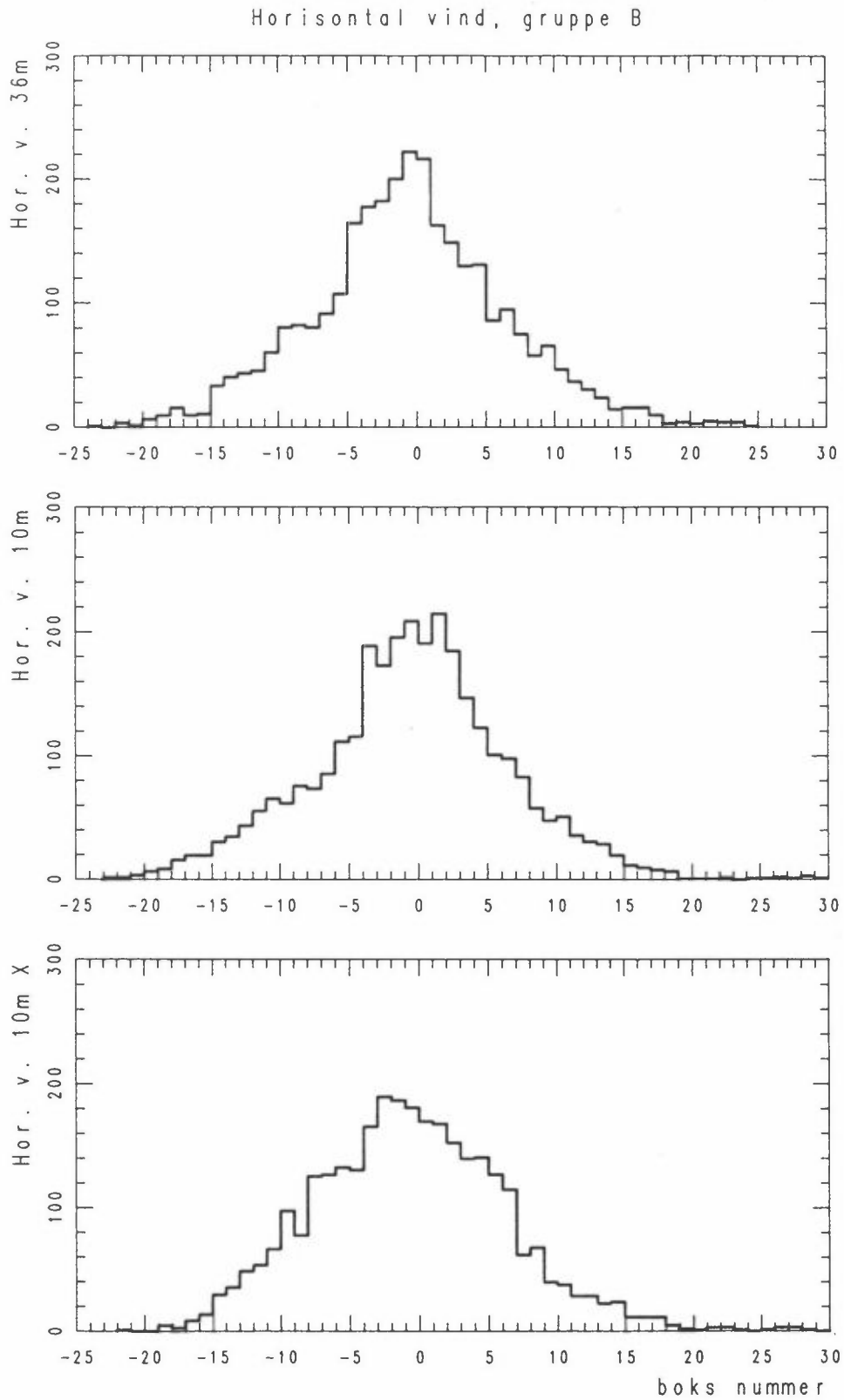
Formen på fordelingene varierer fra periode til periode. De er generelt "flatere" for komponenten på tvers av hovedvindretningen. Figurene 12-15 viser gjennomsnittlige fordelinger av sekundverdier for vindkomponenten langs sundet (nord-sør) og for horisontal vindvektor for to grupper av vindretning (sør og nordvest). Fordelingene er basert på forekomst av verdier i intervaller på 0,25 m/s og er normalisert med hensyn til midelvindstyrken i hver periode. Fordelingene er klokkeformet, og de er spissere for 36 m enn for 10 m og spissere ved sørlig vind enn ved nordvestlig vind.



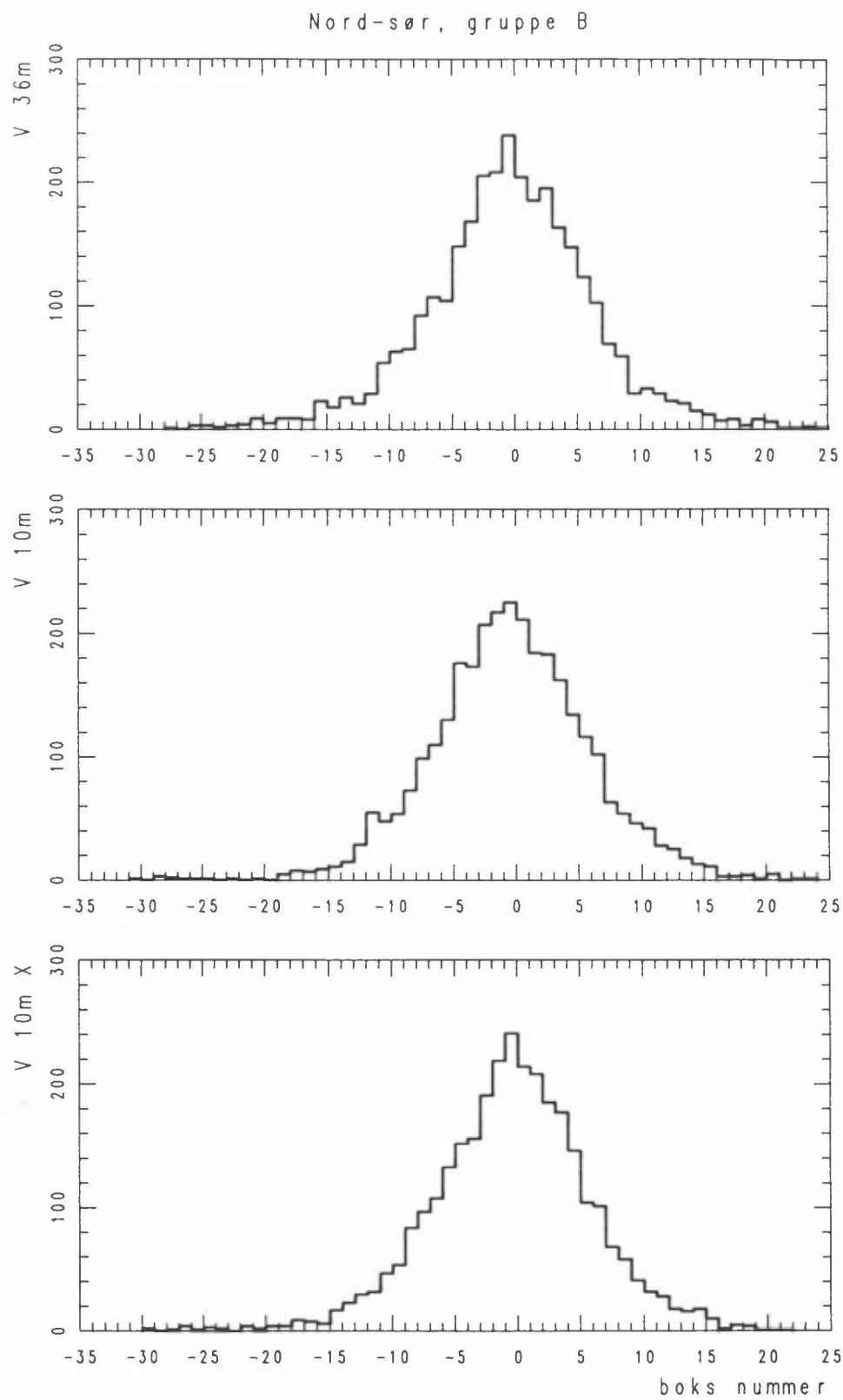
Figur 12: Fordeling av sekundverdier. Horizontal vindvektor, sørlig vindretning.



Figur 13: Fordeling av sekundverdier. Nord-sør vindkomponent, sørlig vindretning.



Figur 14: Fordeling av sekundverdier. Horisontal vindvektor, nordvestlig vindretning.



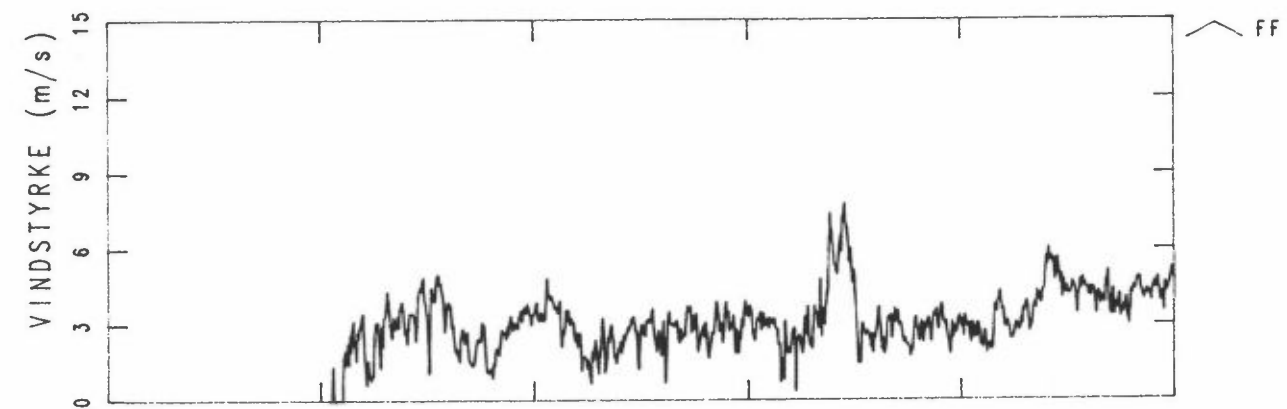
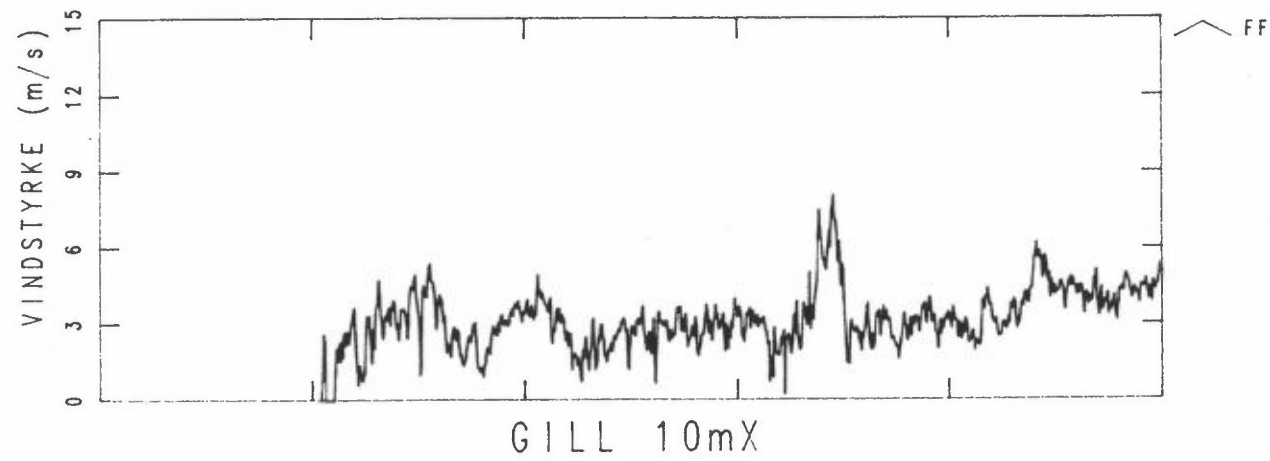
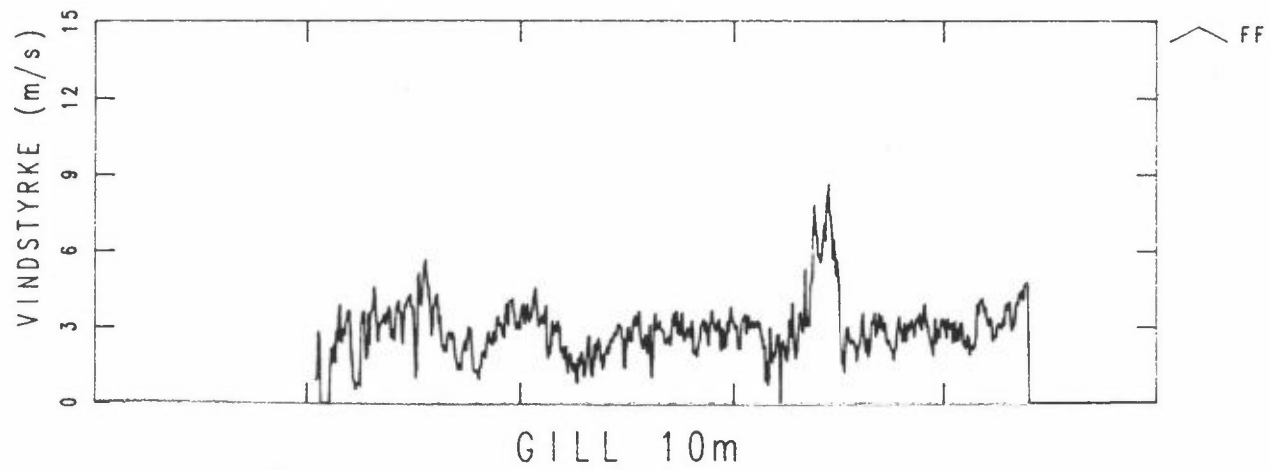
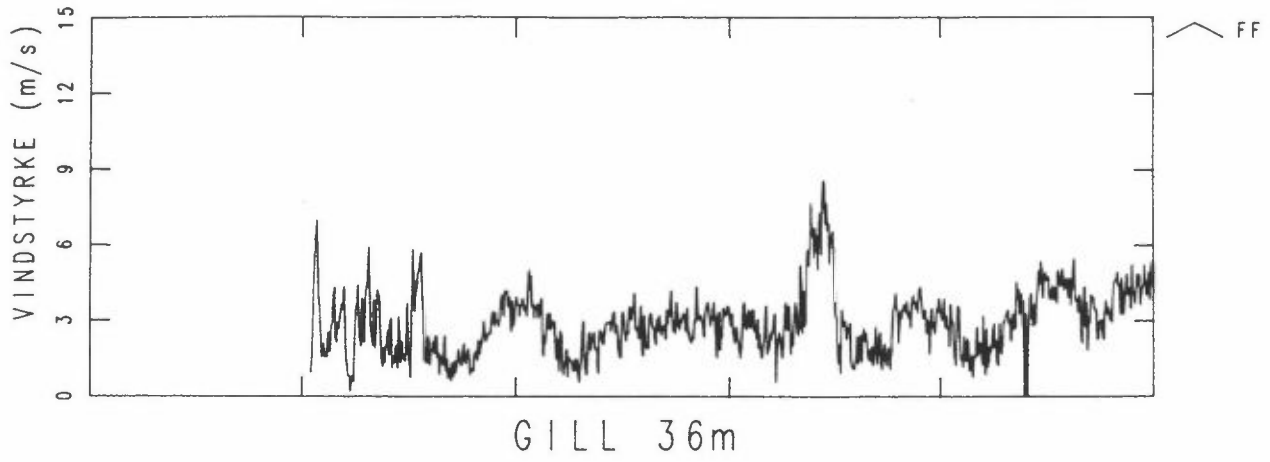
Figur 15: Fordeling av sekundverdier. Nord-sør vindkomponent, nordvestlig vindretning.

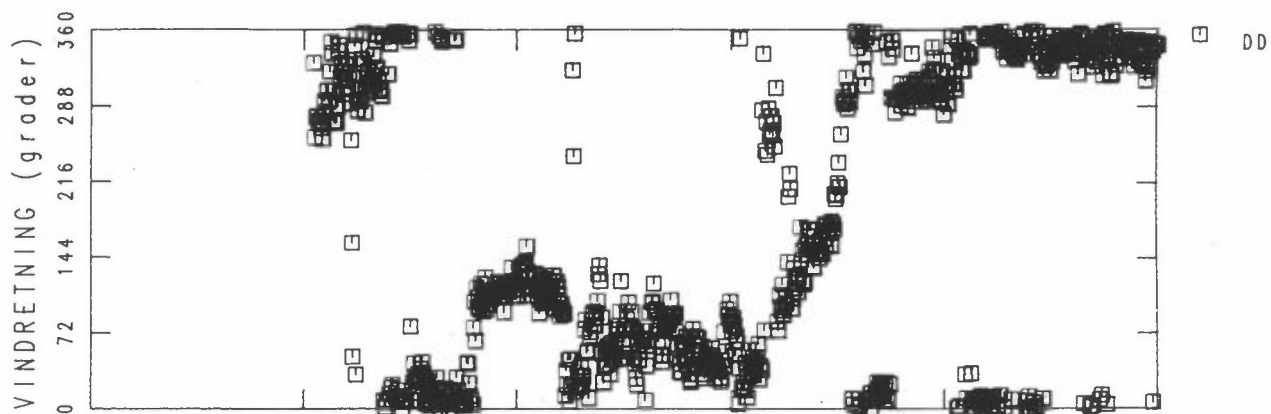
VEDLEGG A

Tidsplott for vindretning og vindstyrke

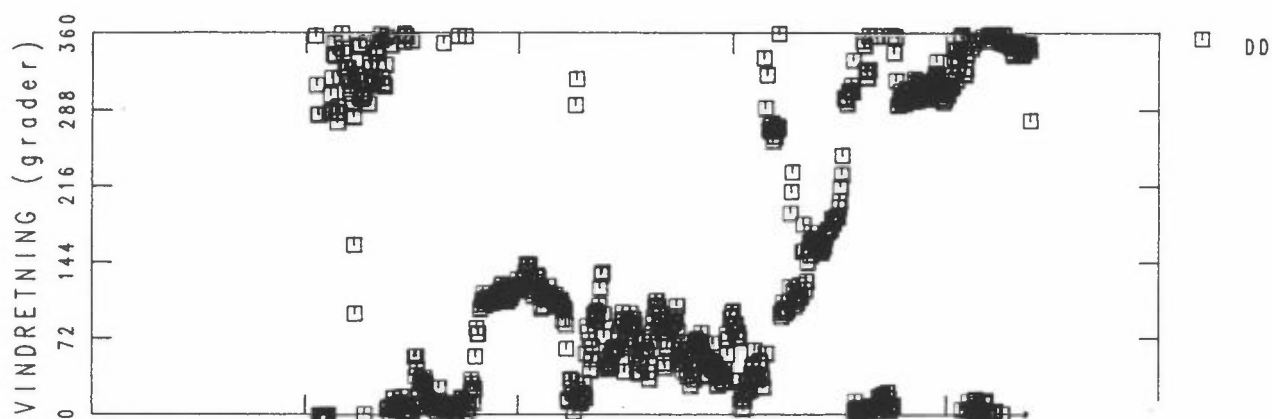
VEDLEGG A: TidsploTT av vindretning og vindstyrke.

Figurene viser tidsforløp av 10-minutters midlere vindretning og vindstyrke for hver uke for de fire målepunktene. Dersom en måler har vært ute av funksjon i en uke, er ukeplottet ikke vist. Dårlige data er fjernet. Dårlige og manglende data fremkommer som brudd i plottene for vindstyrke og som åpne felter i plottene for vindretning.





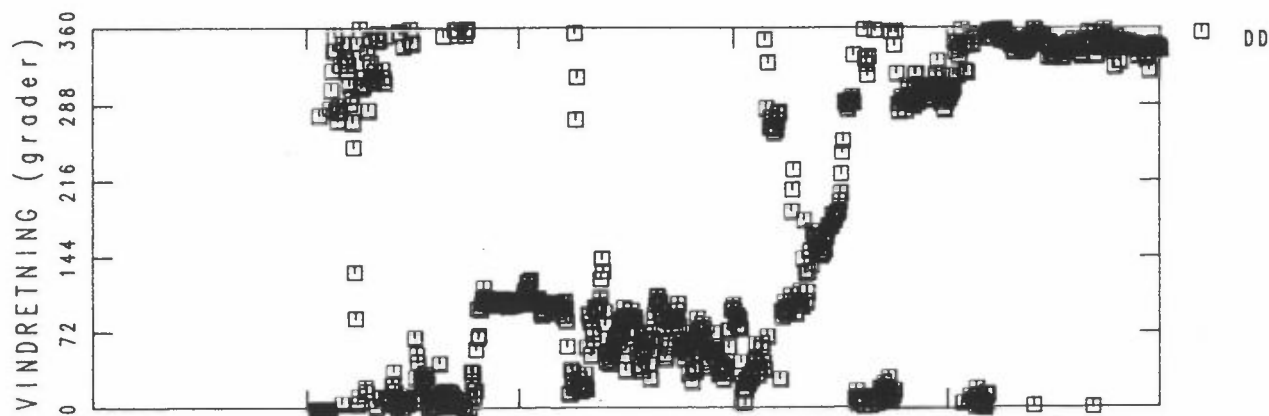
GILL 36m



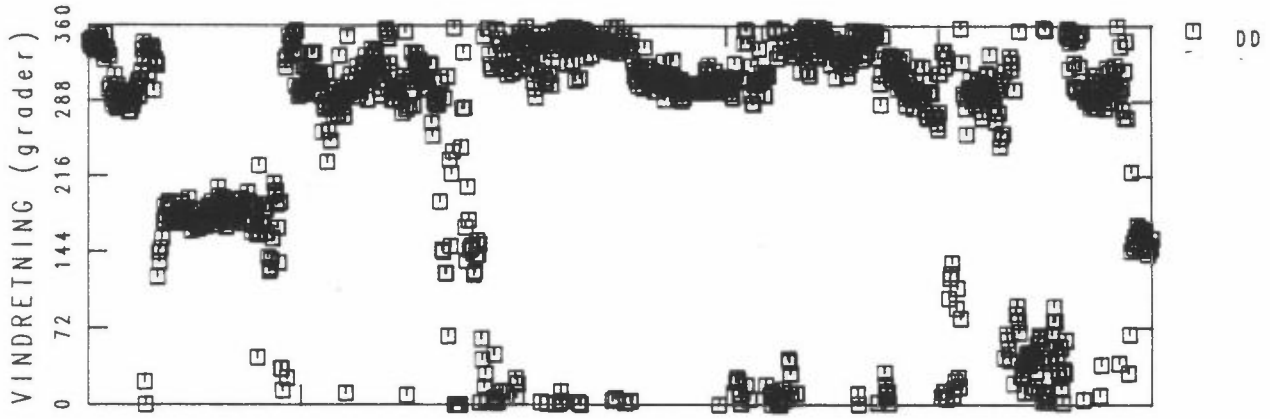
GILL 10m



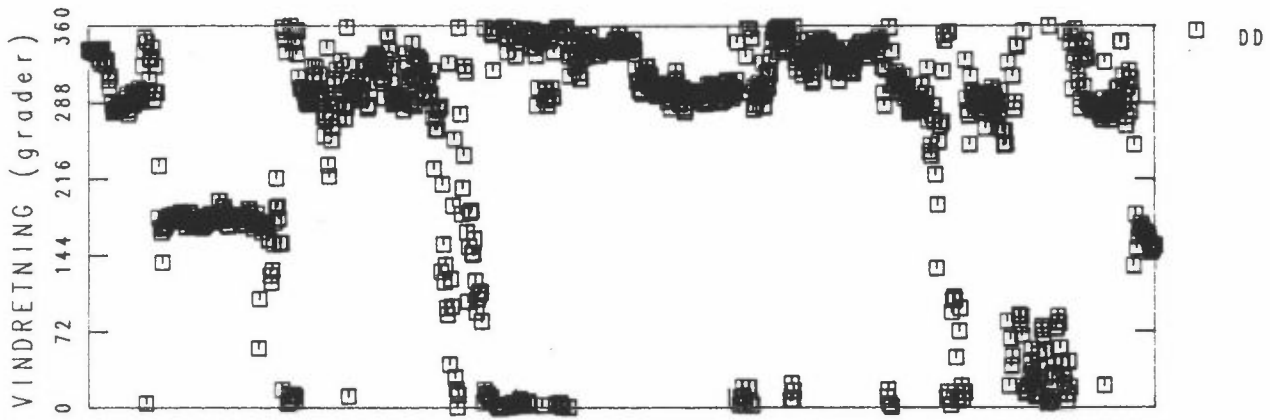
GILL 10mX



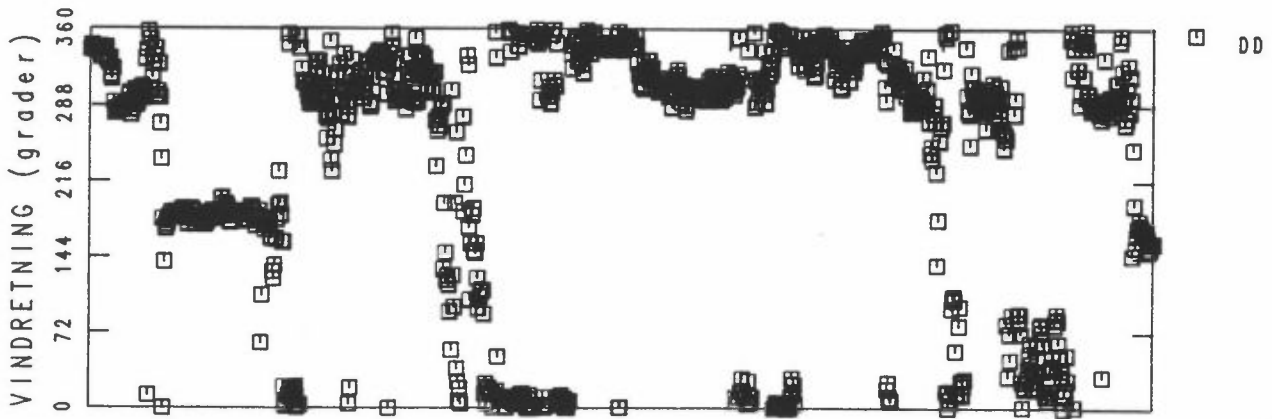
ÅNDERÅ 36m

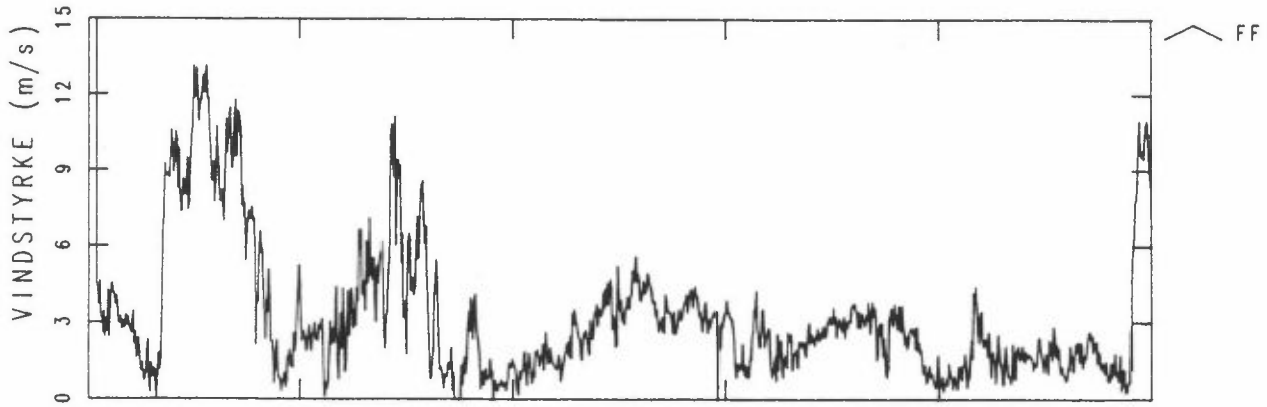


GILL 10m

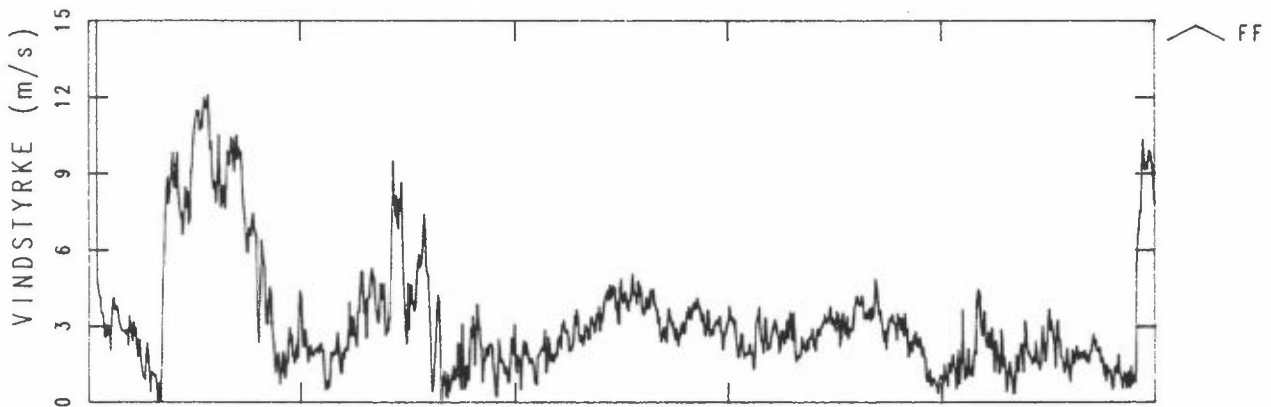


GILL 10mX

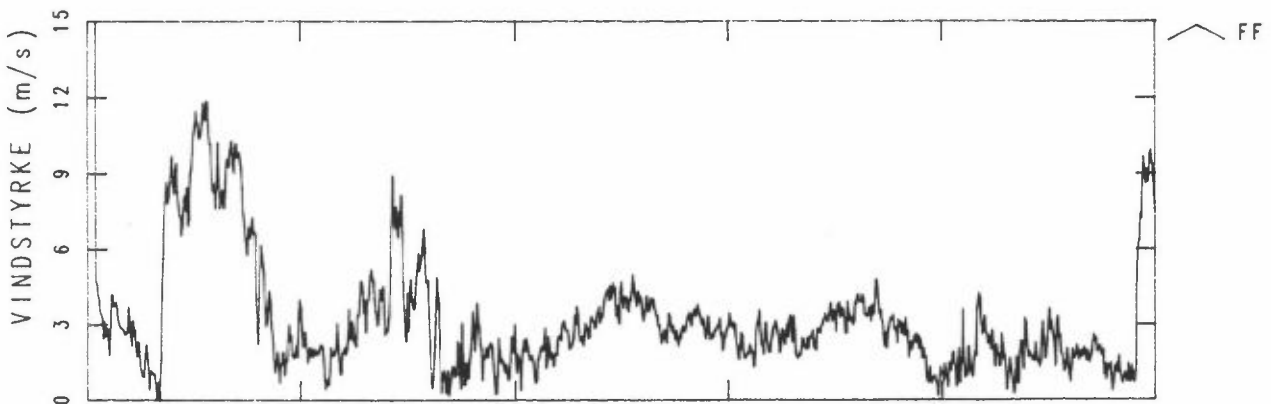




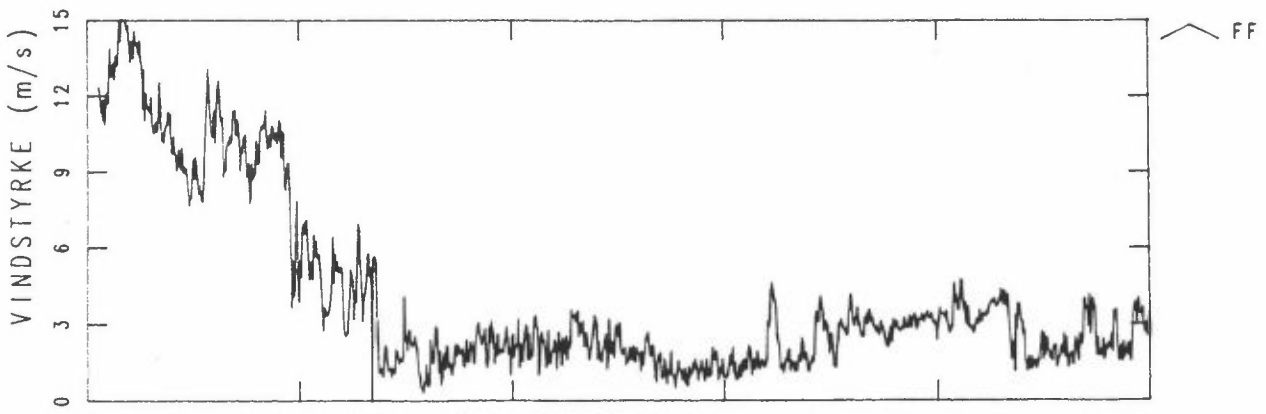
GILL 10m



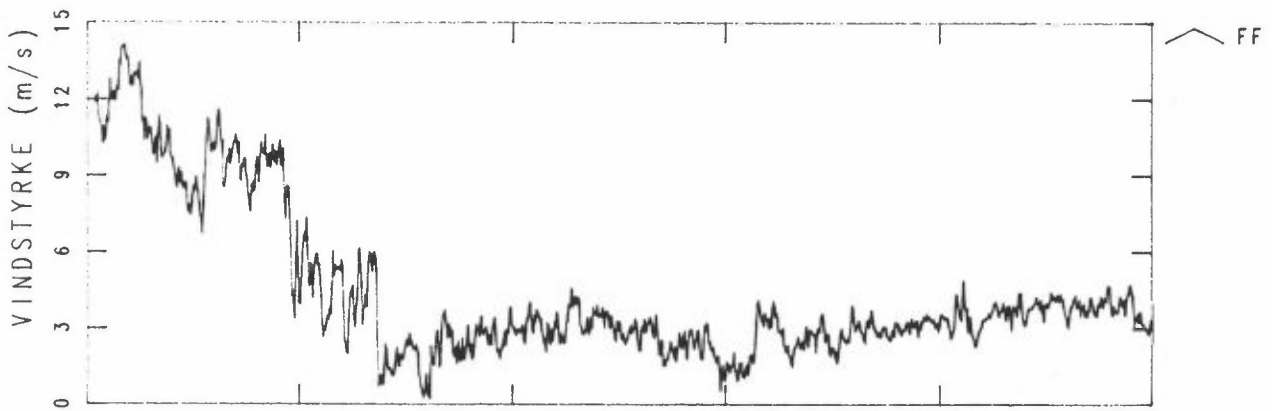
GILL 10mX



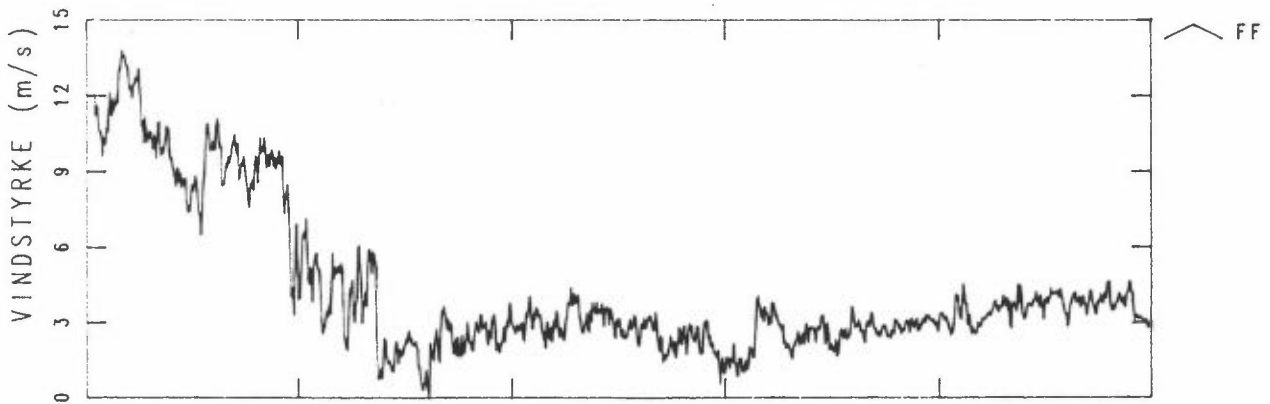
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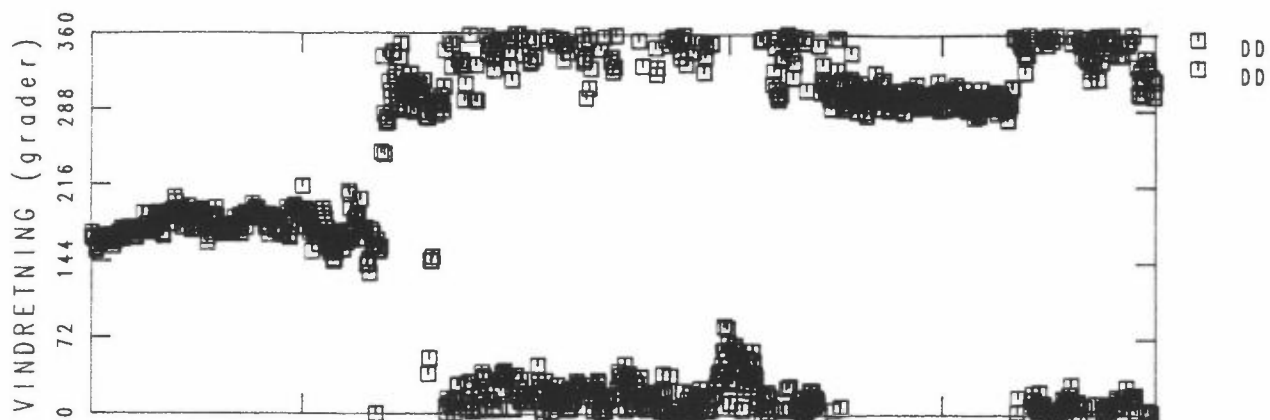
GILL 10m



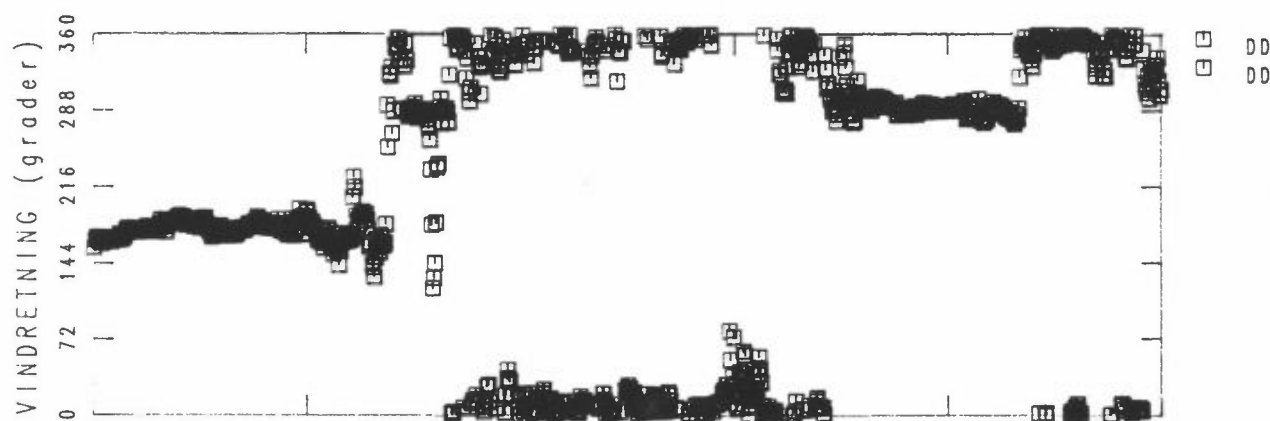
GILL 10mX



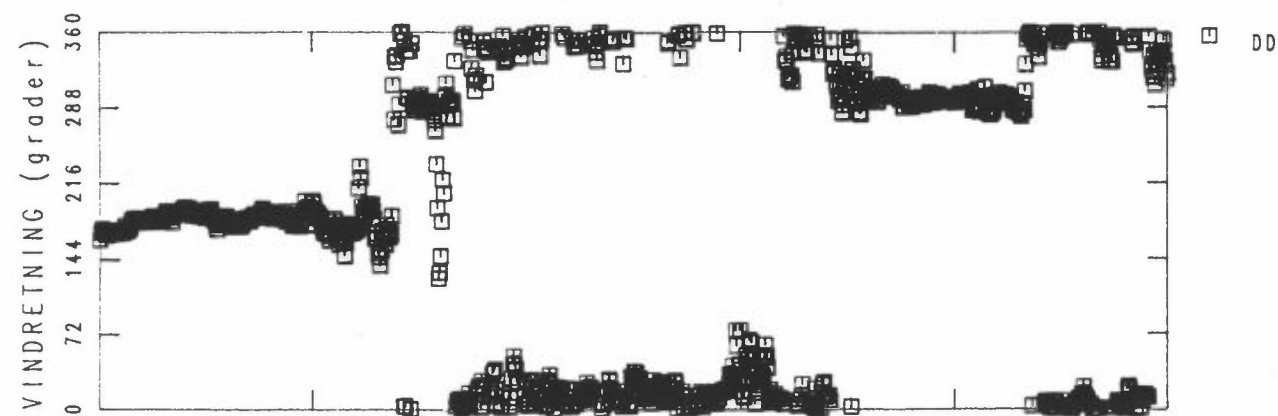
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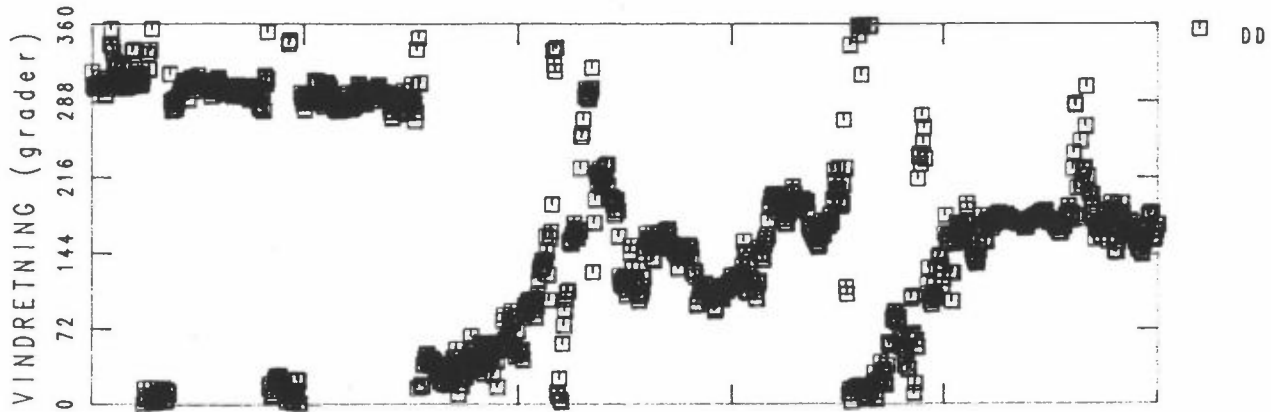
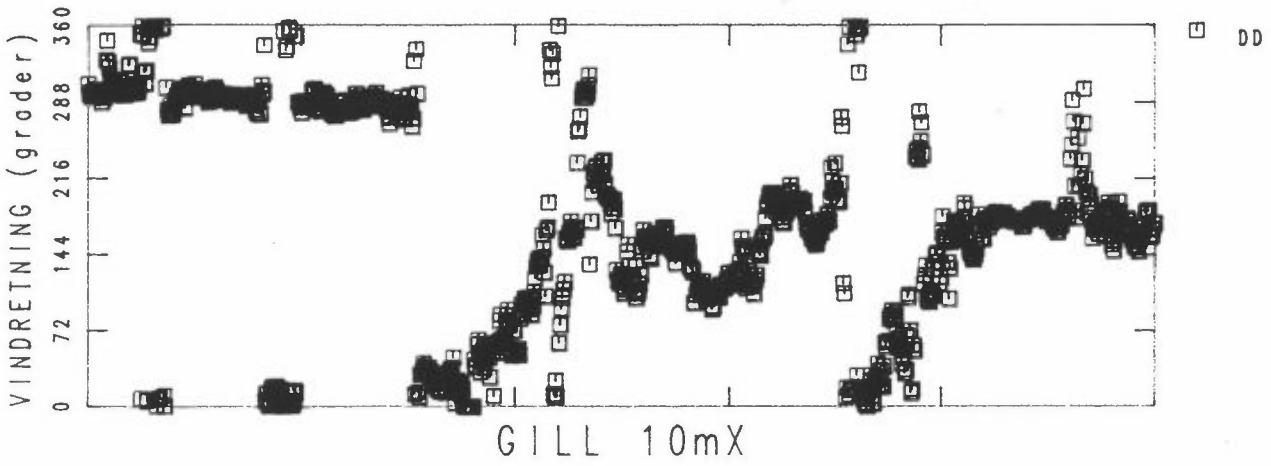
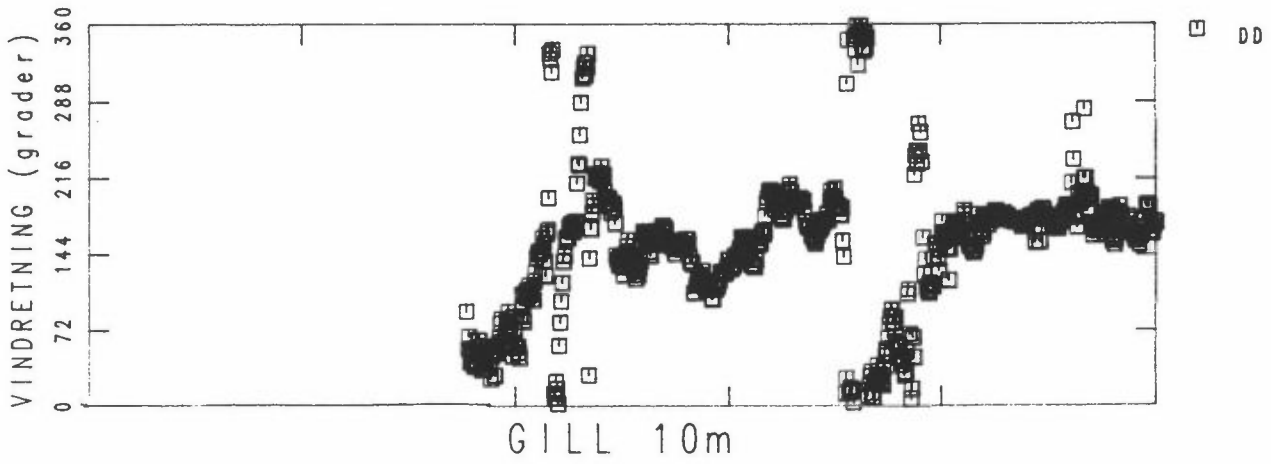
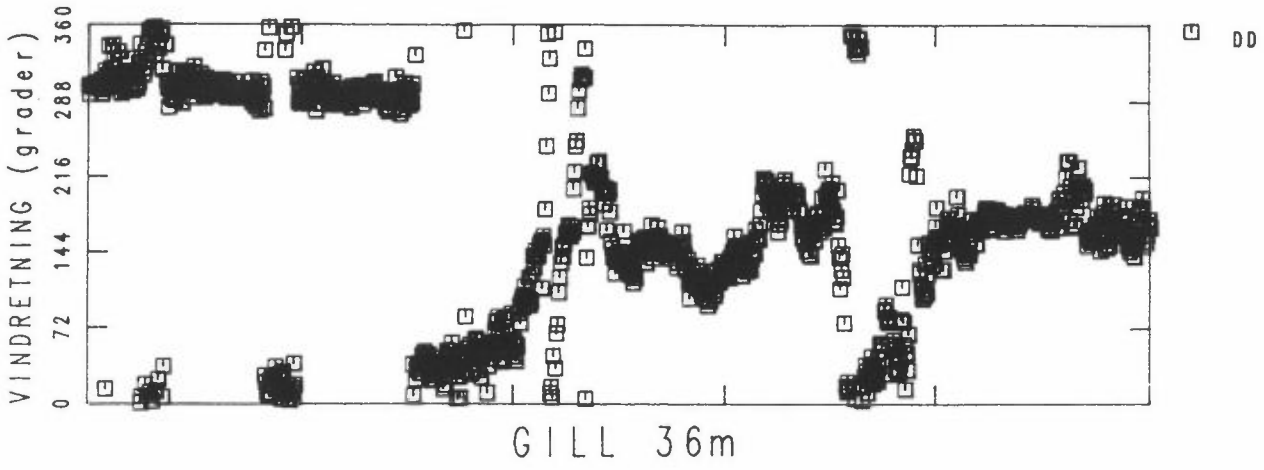


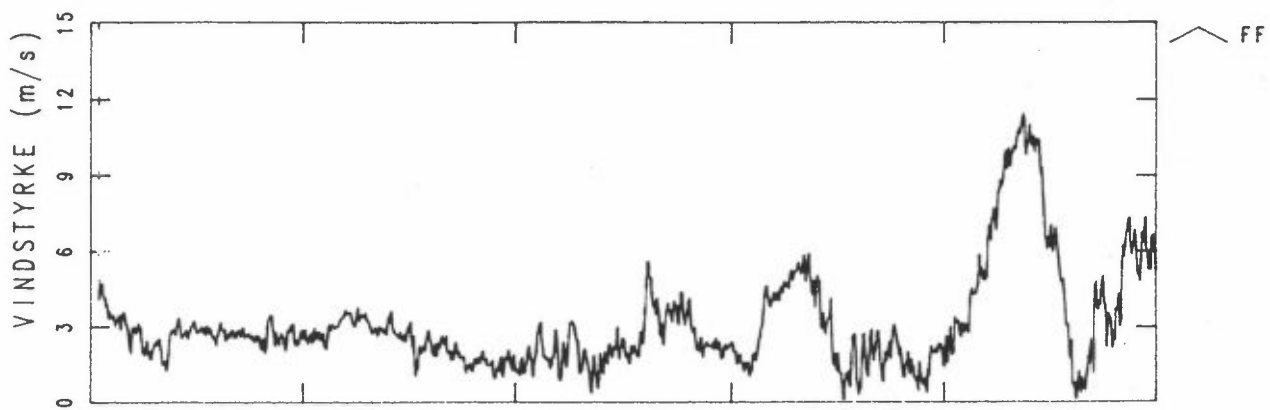
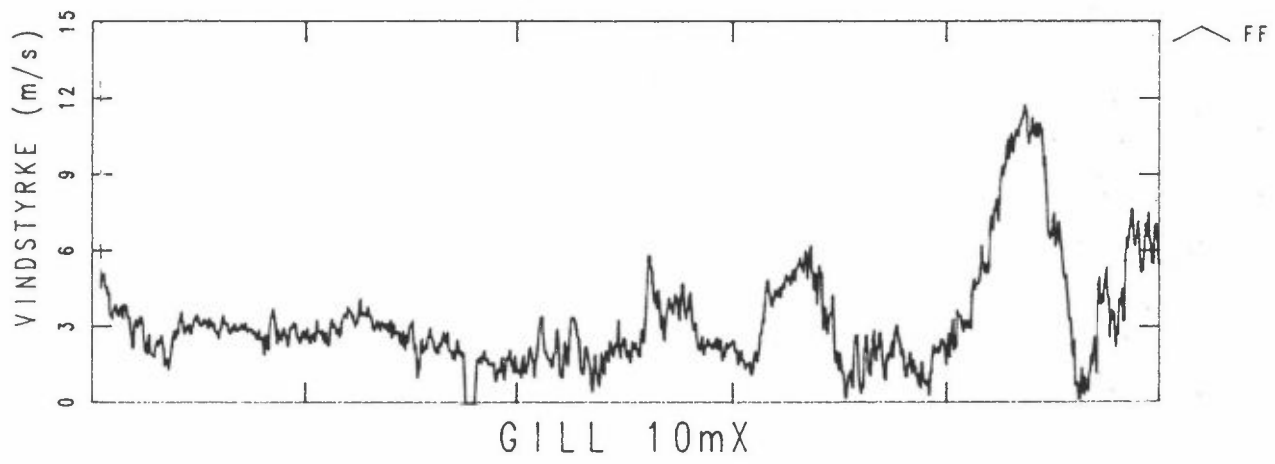
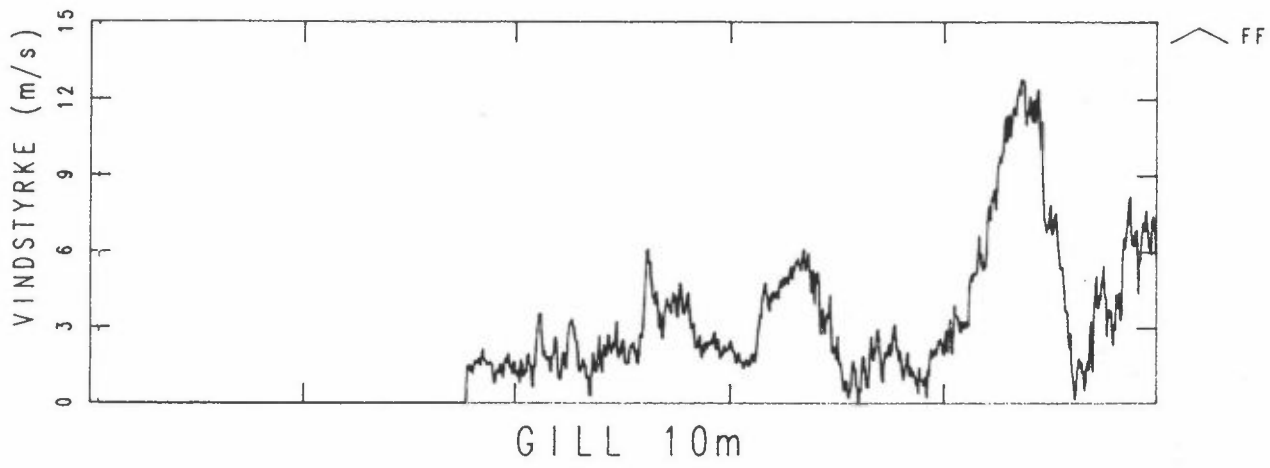
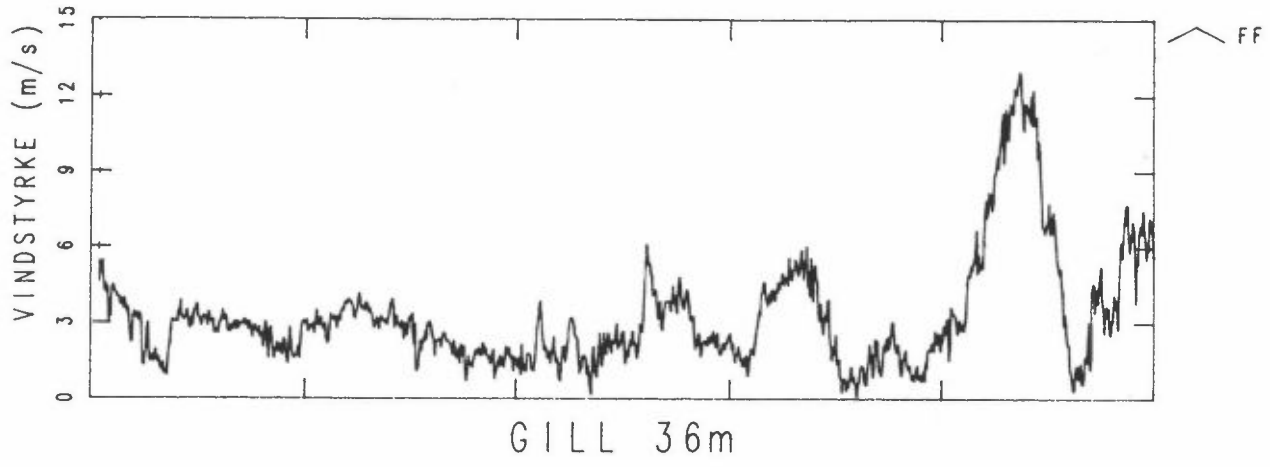
GILL 10m

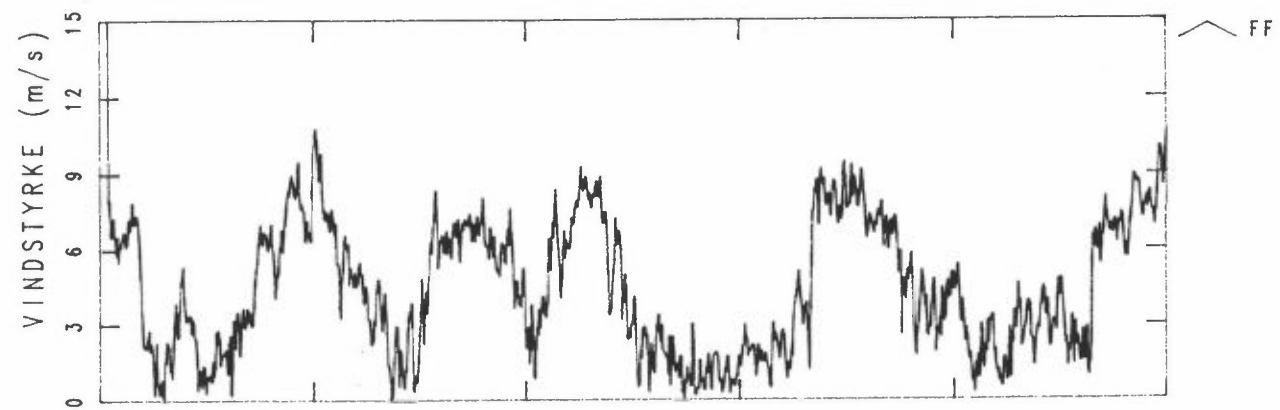
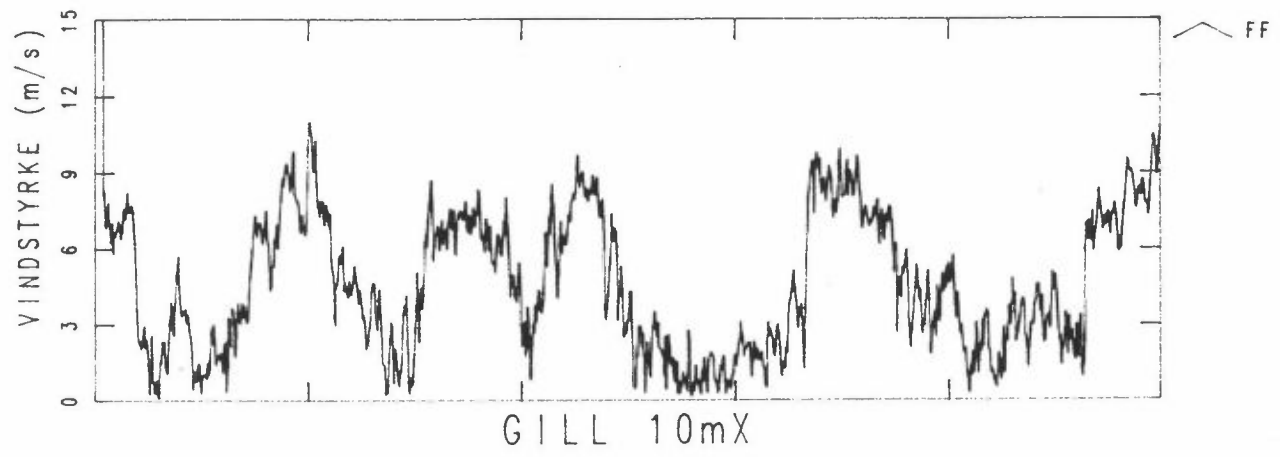
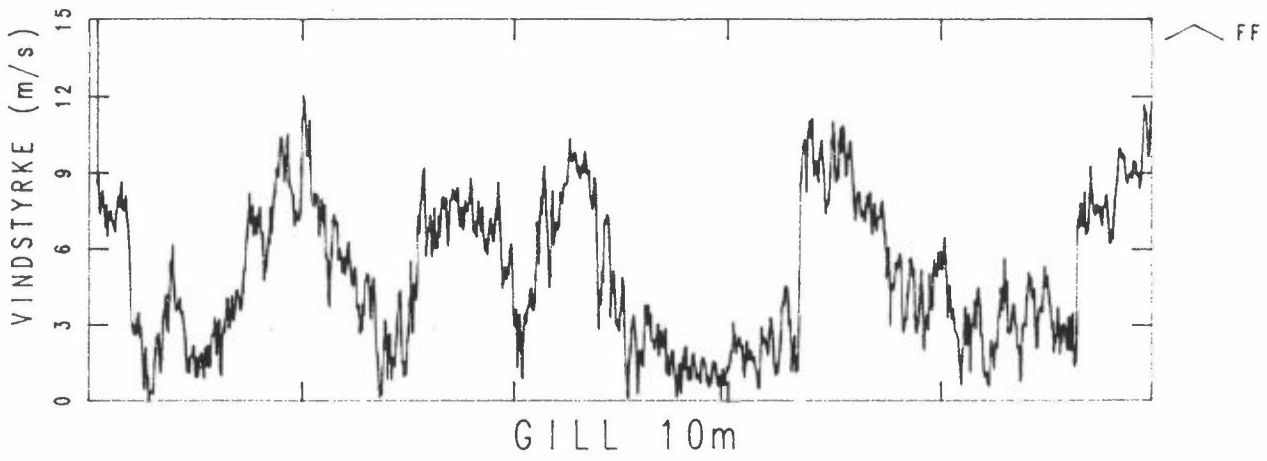
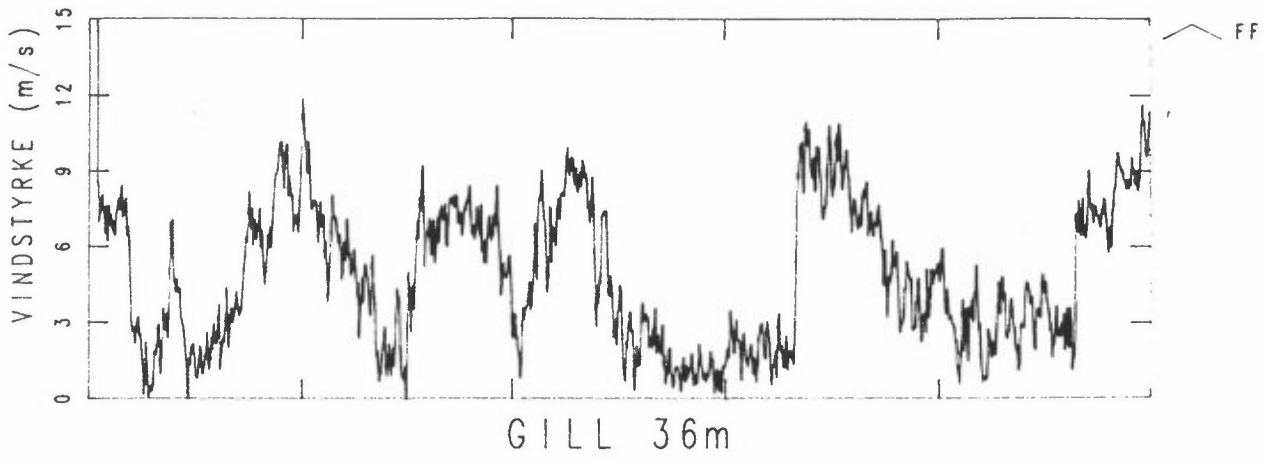


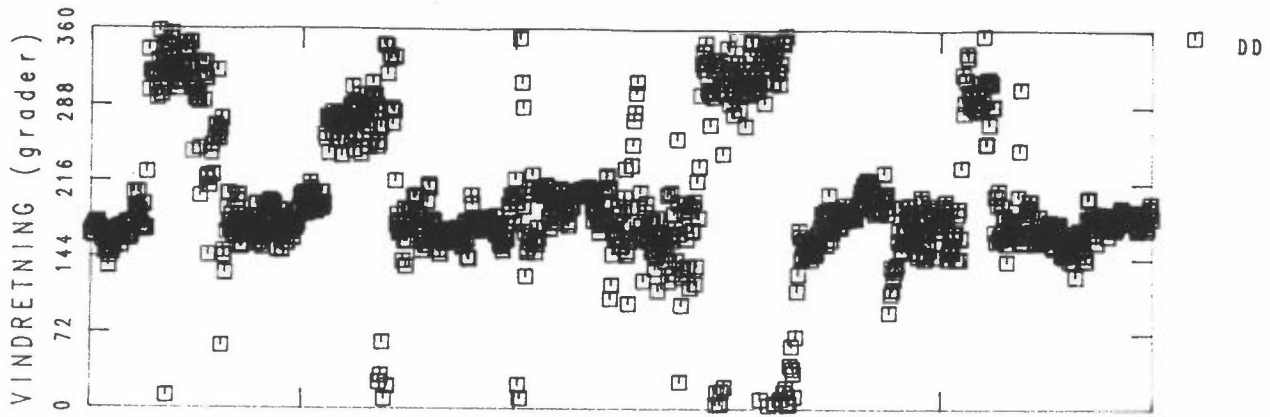
GILL 10mX



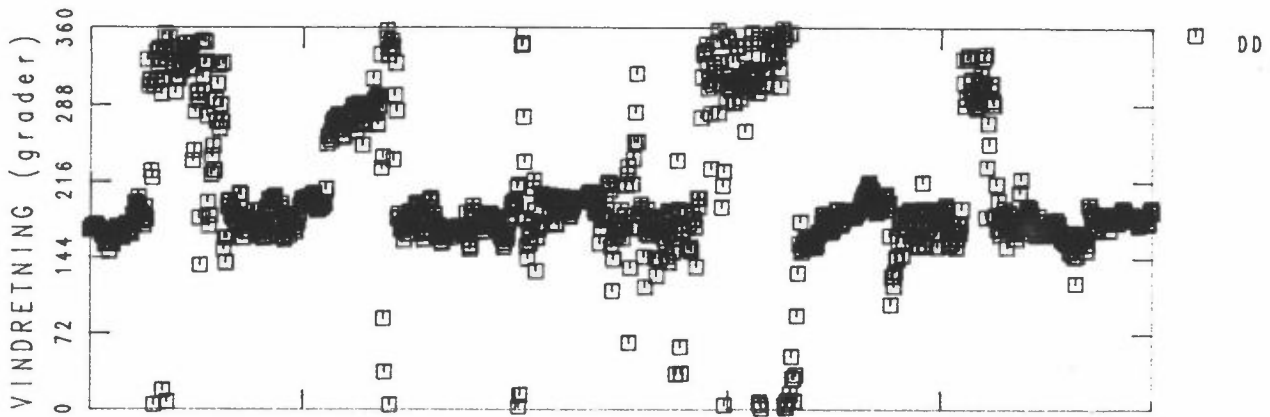




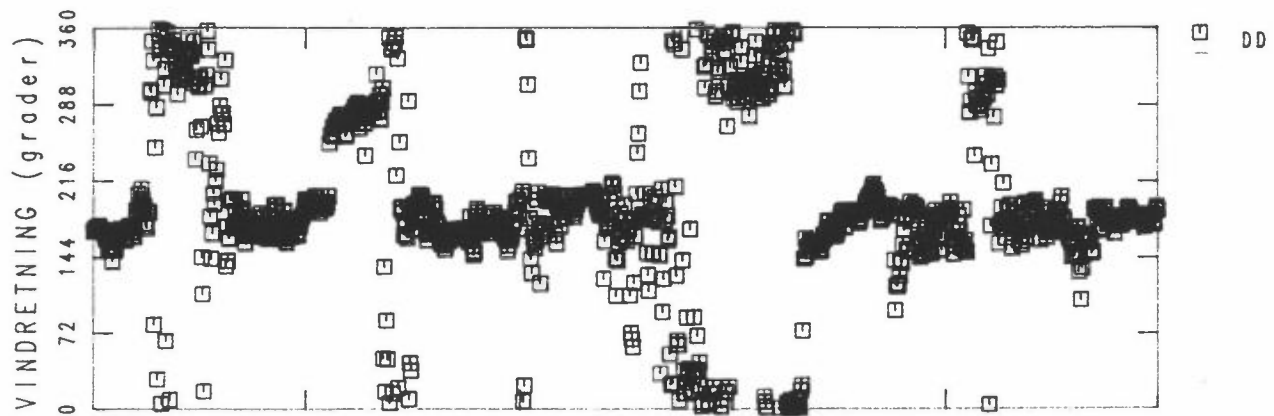




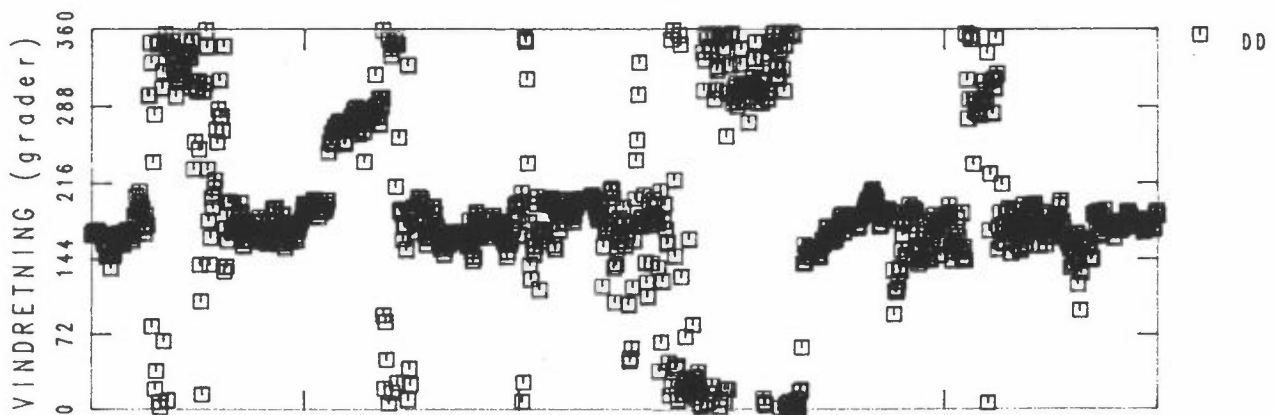
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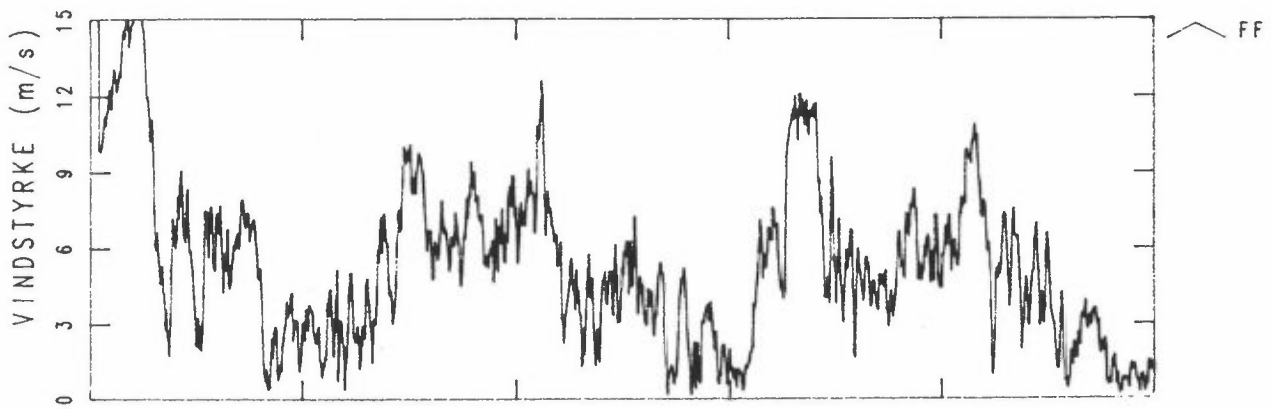
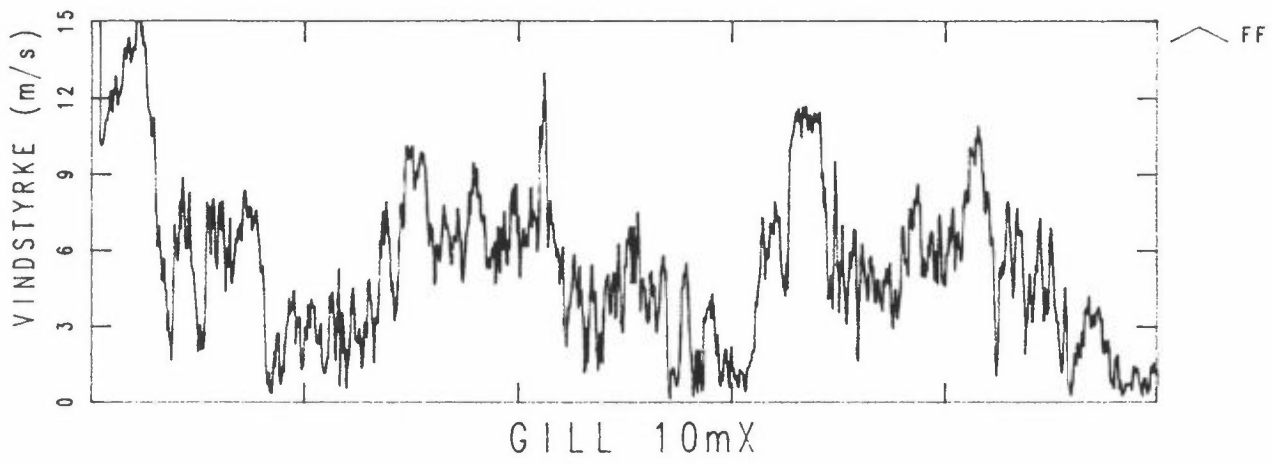
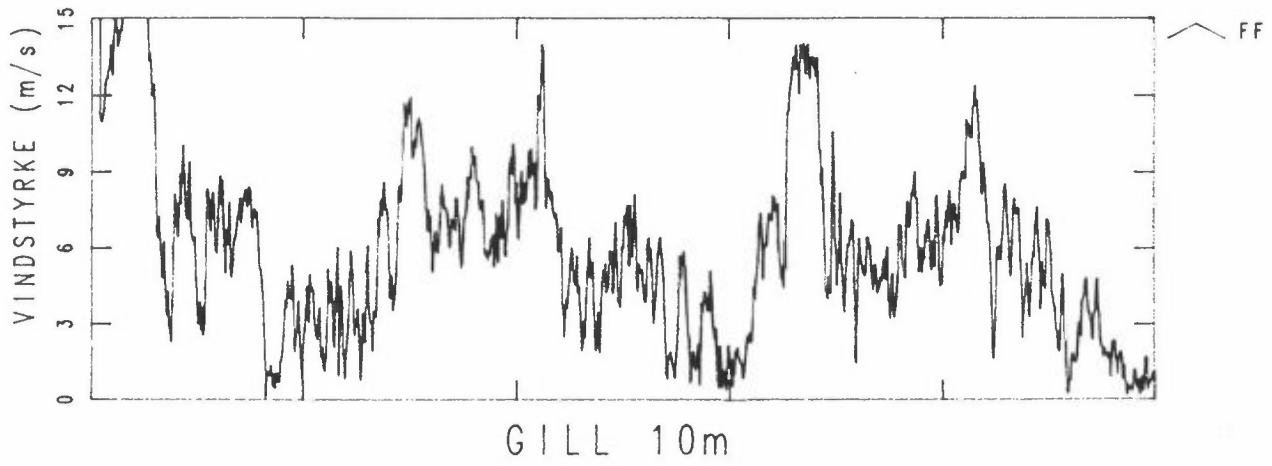
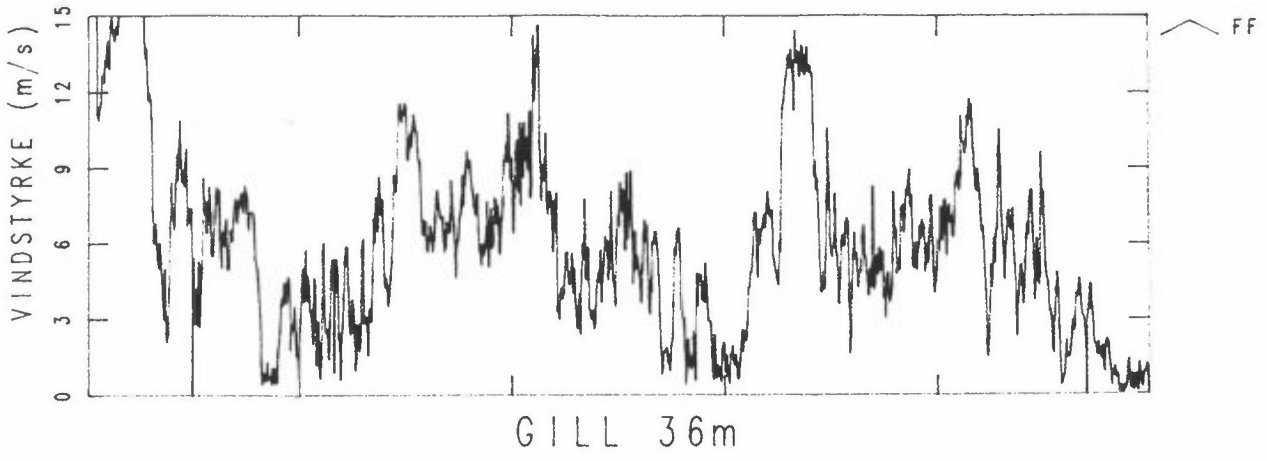


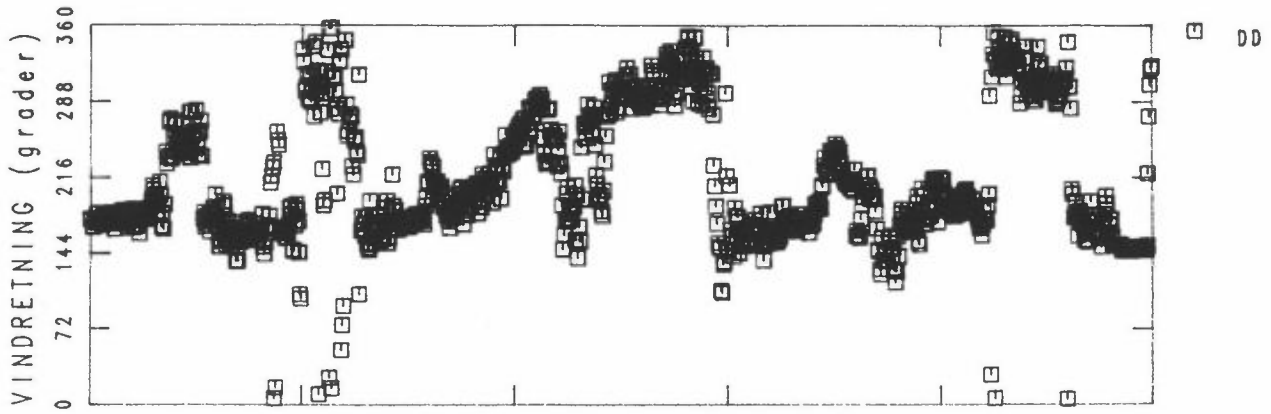
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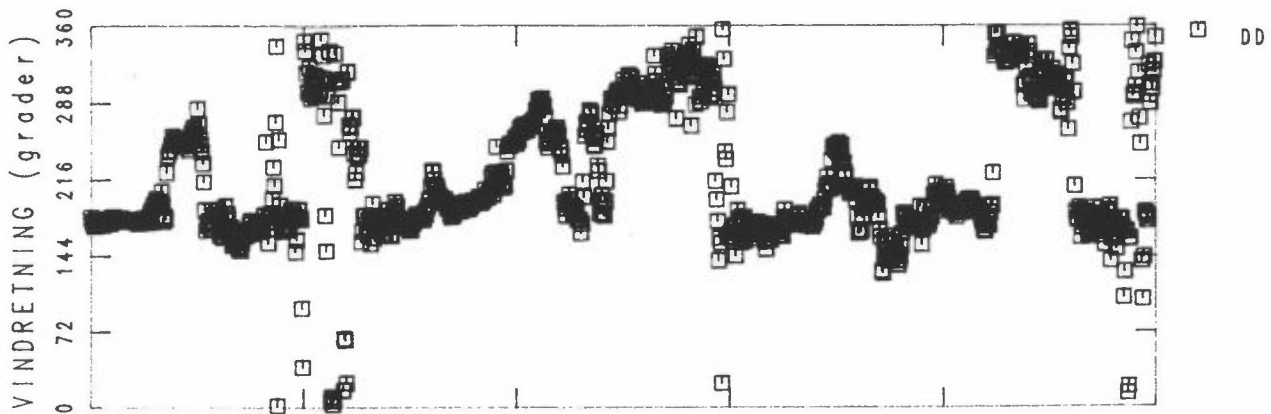
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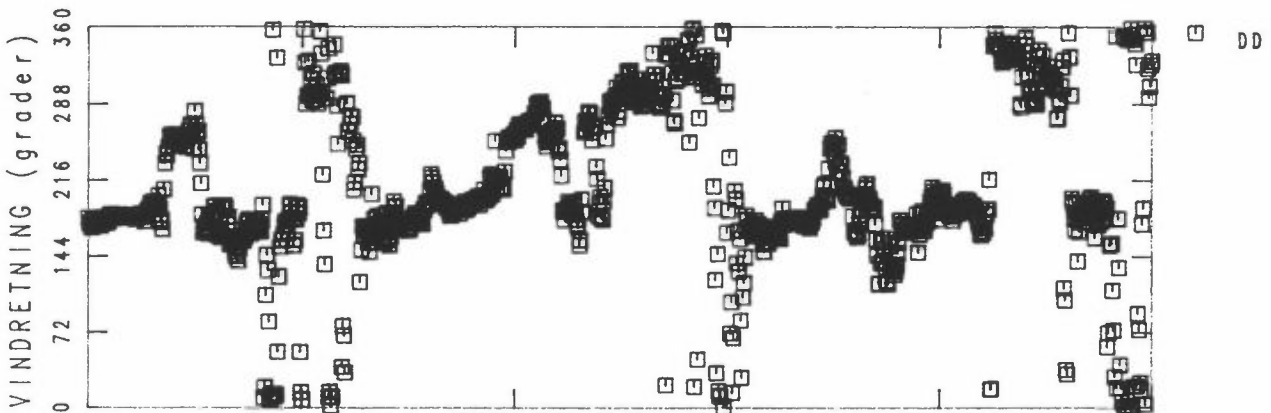




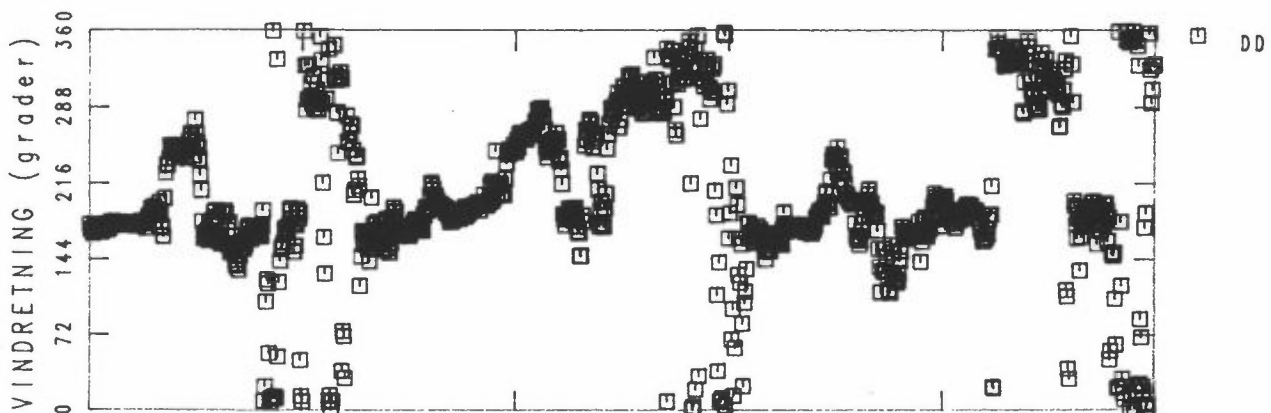
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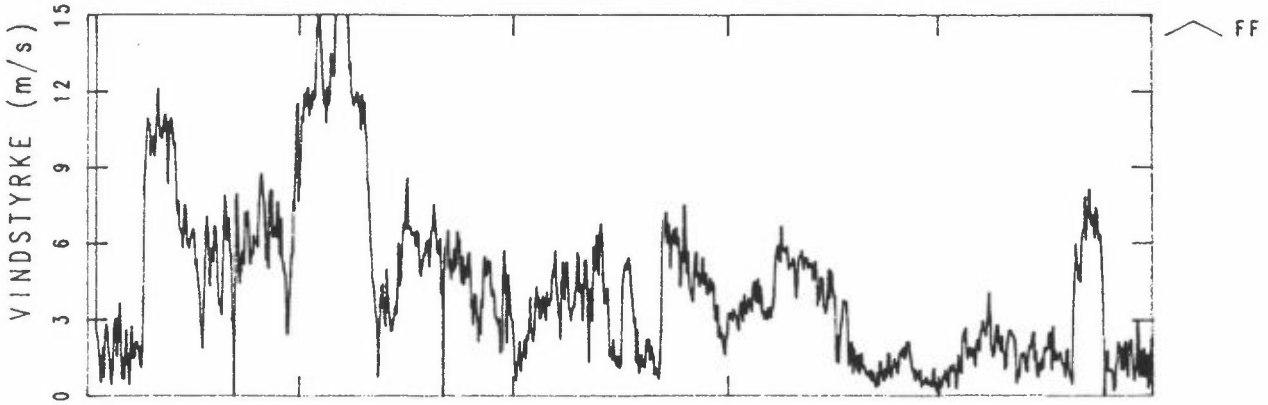
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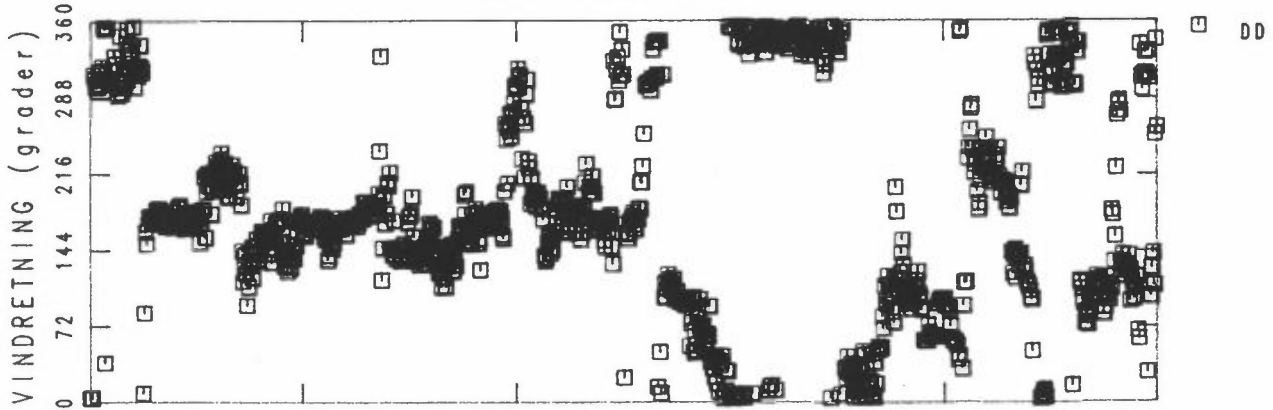
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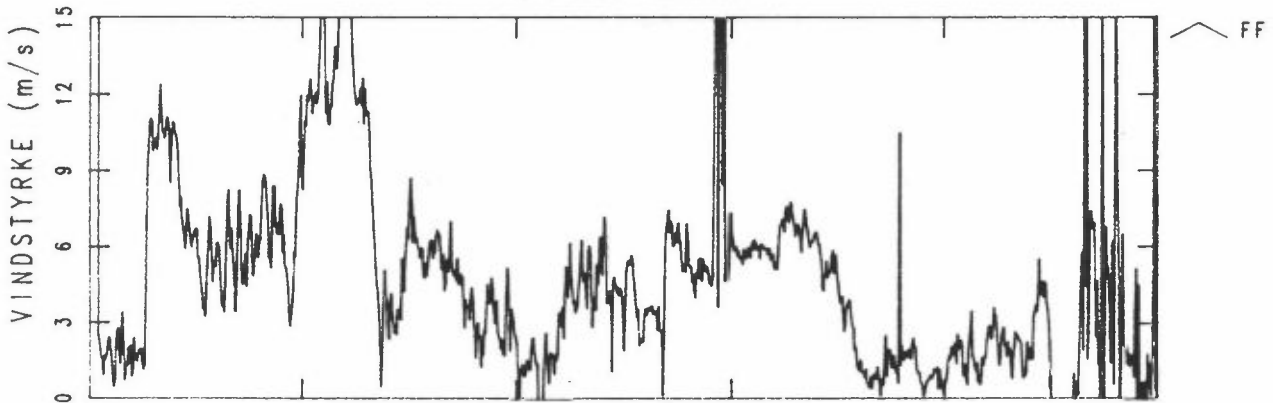
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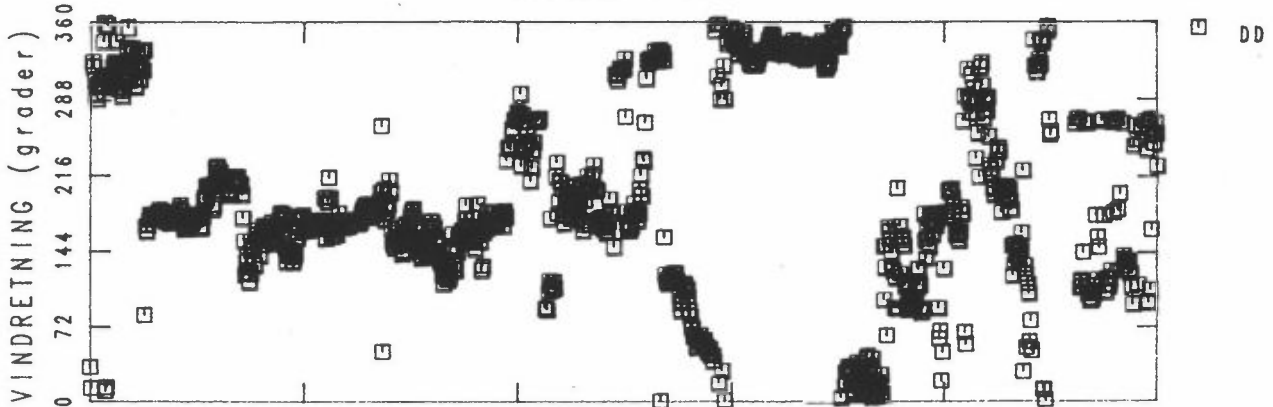
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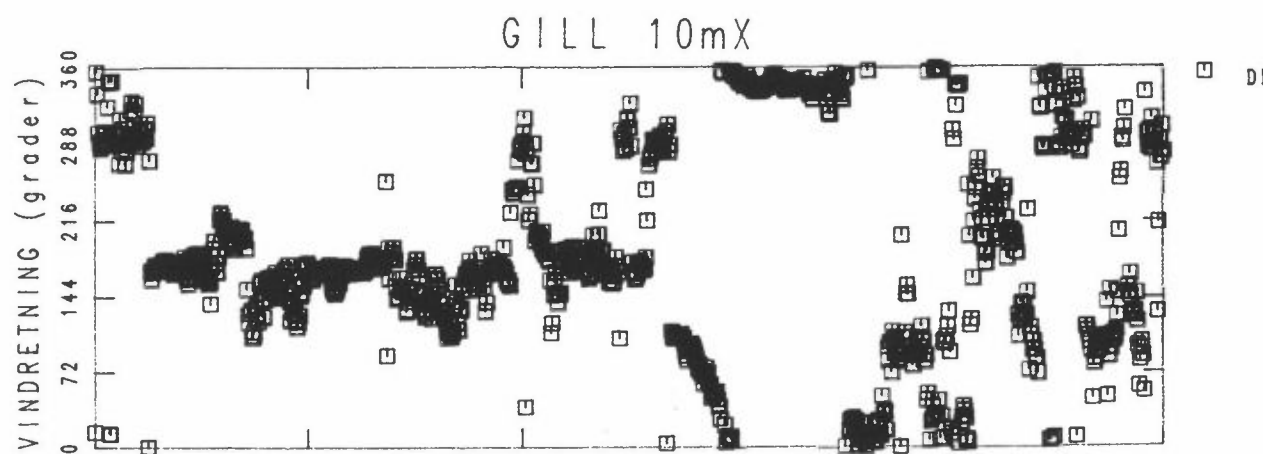
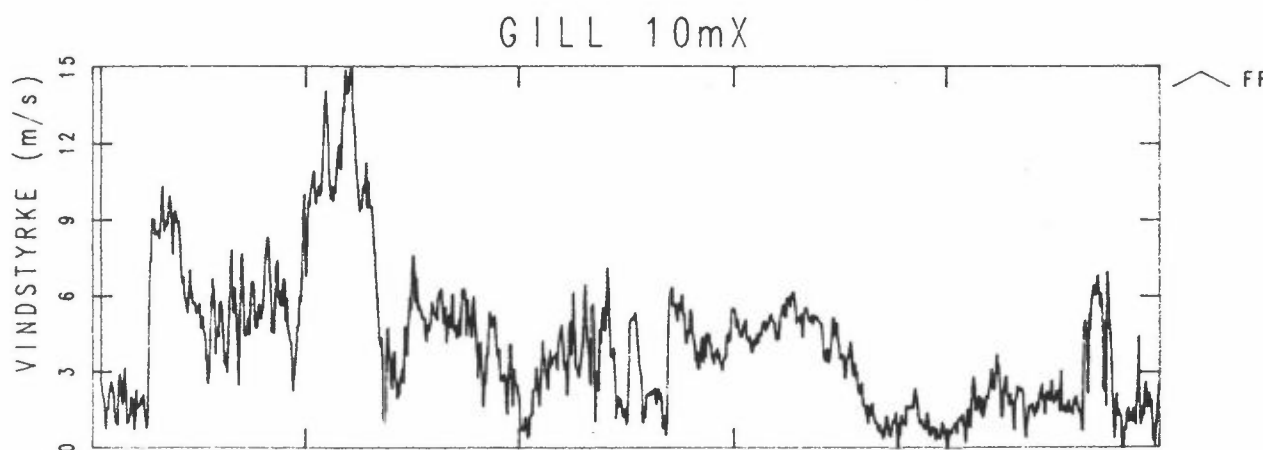
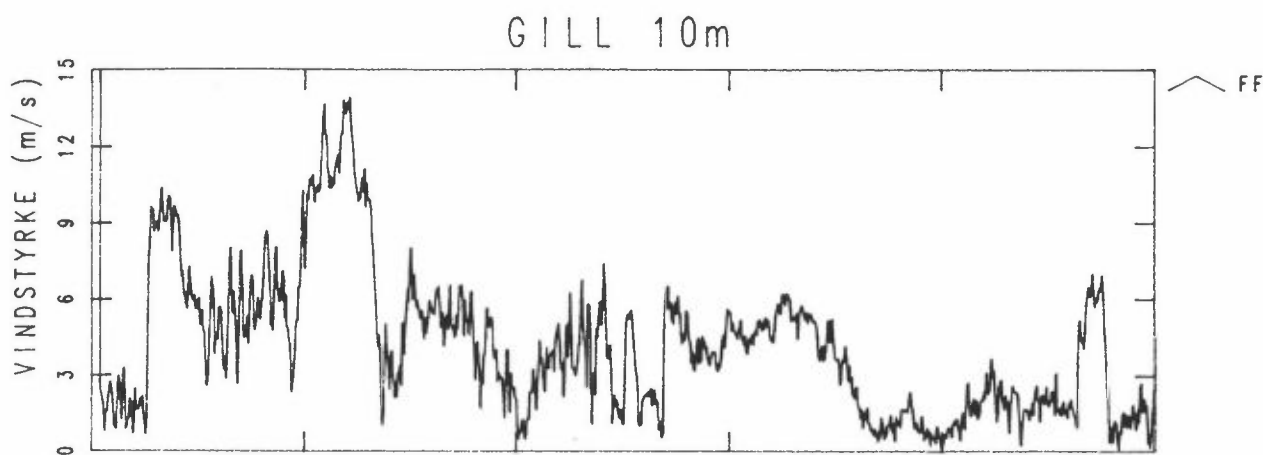
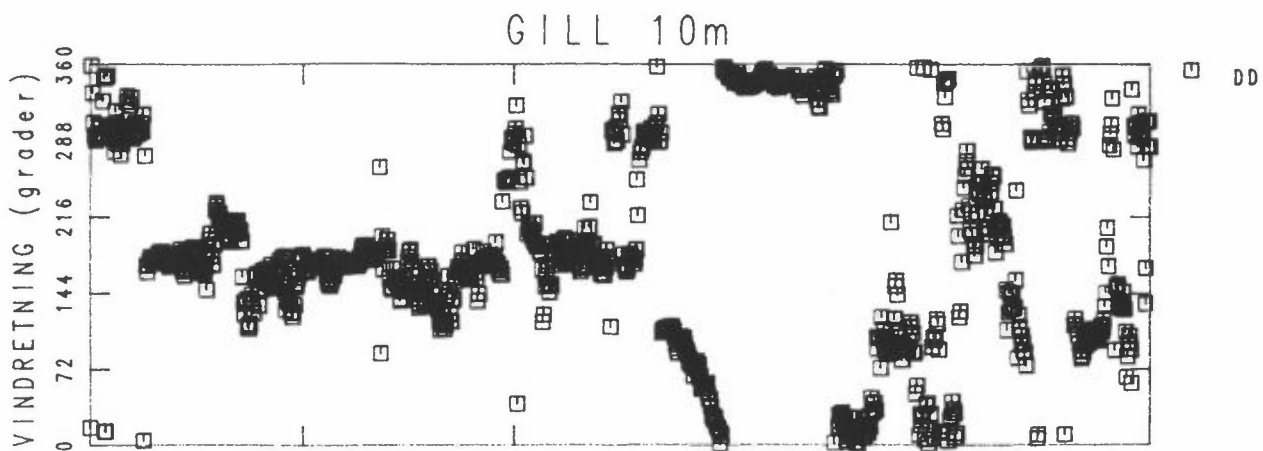


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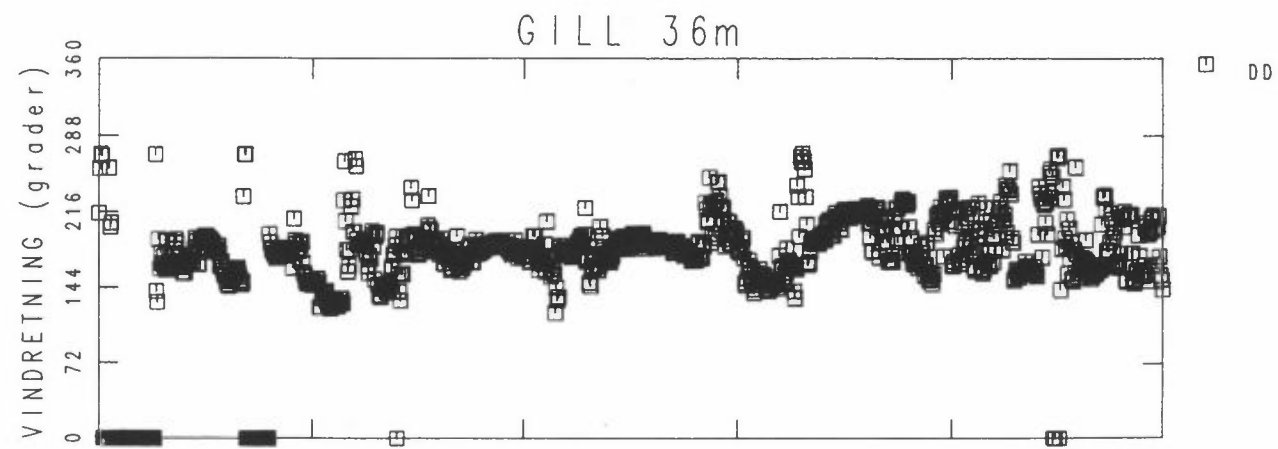
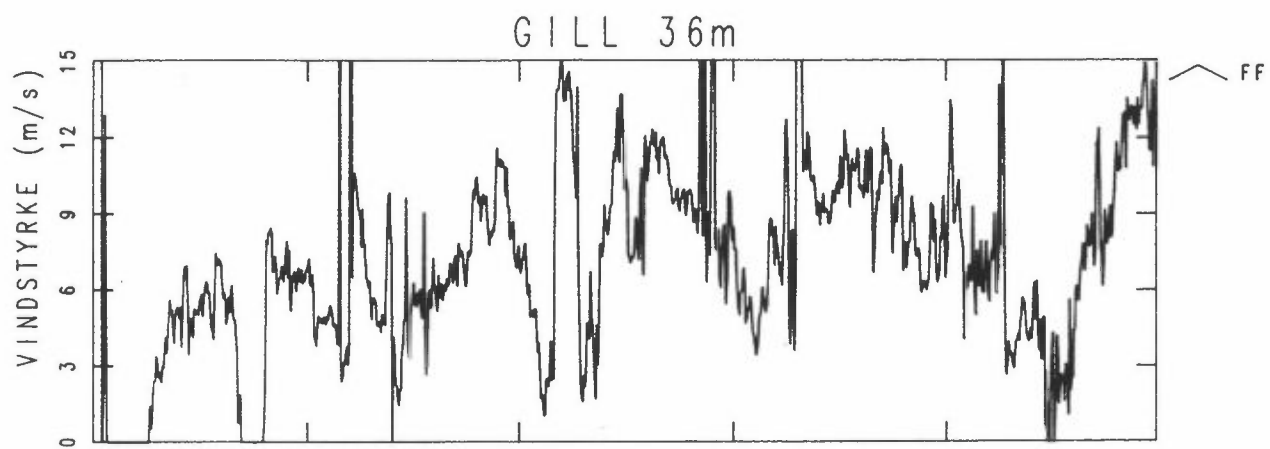
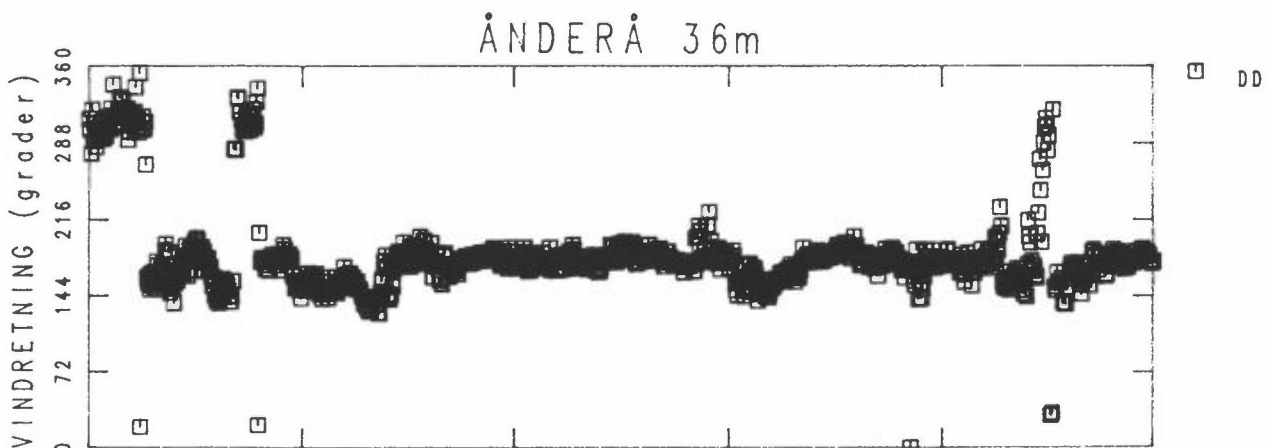
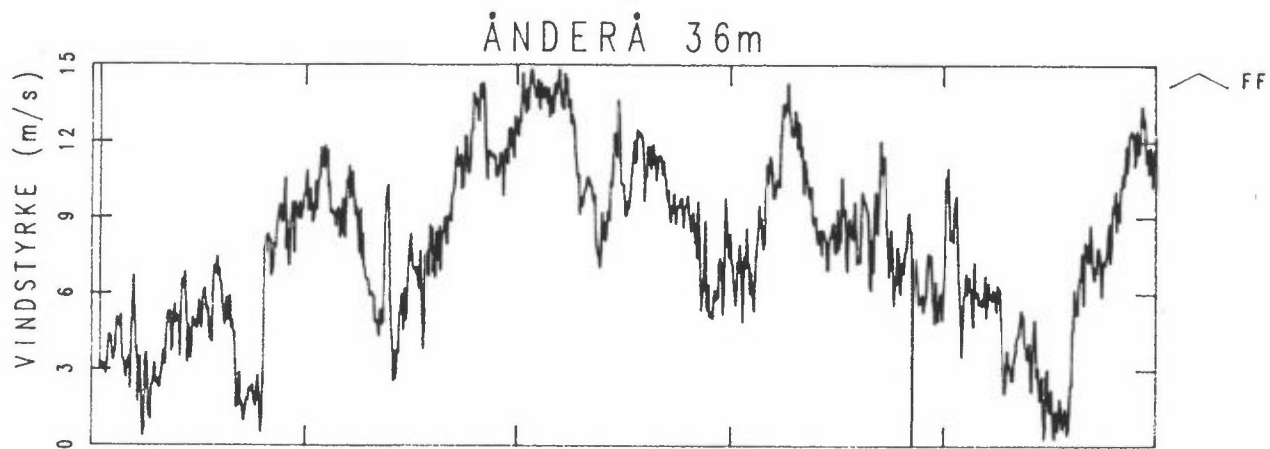


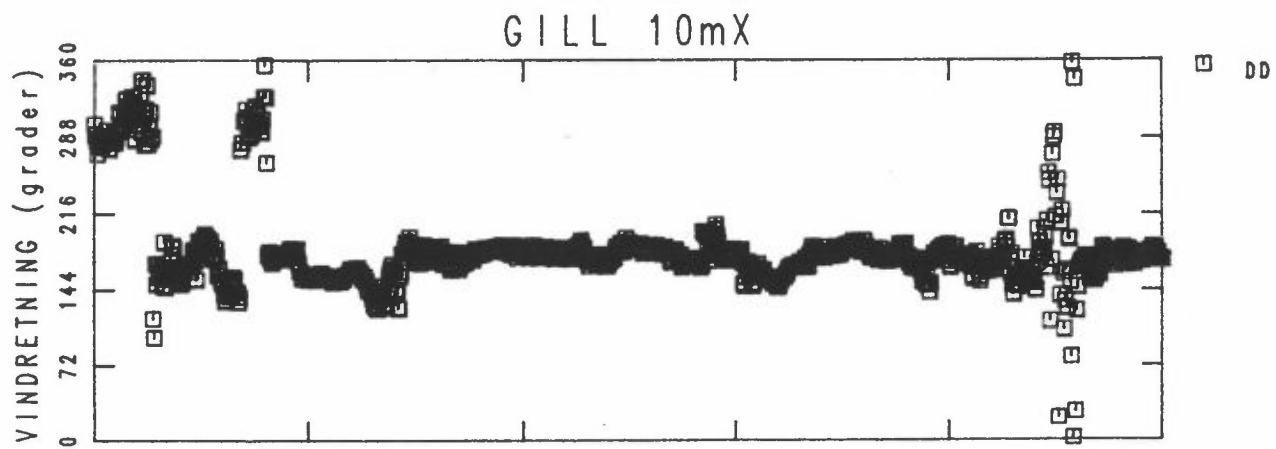
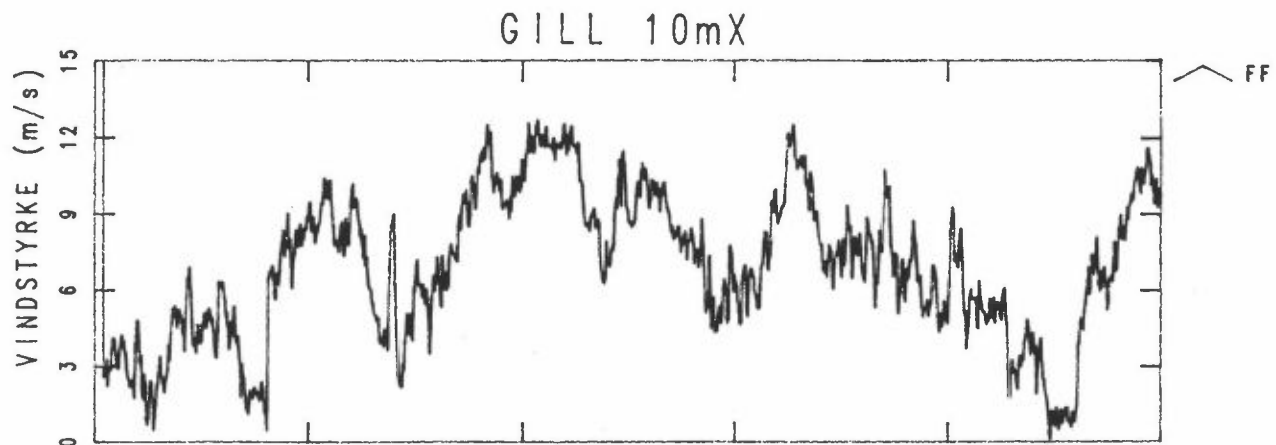
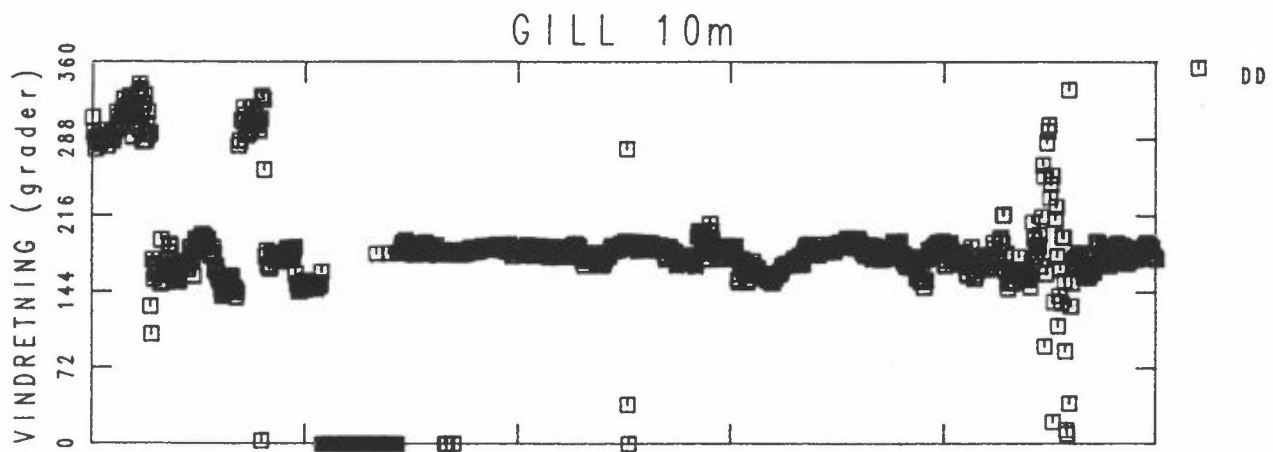
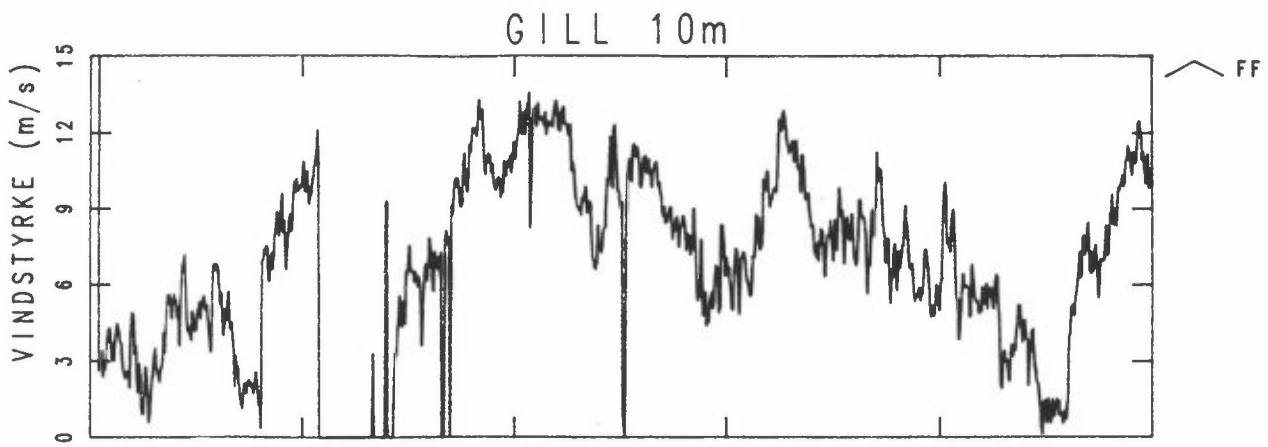
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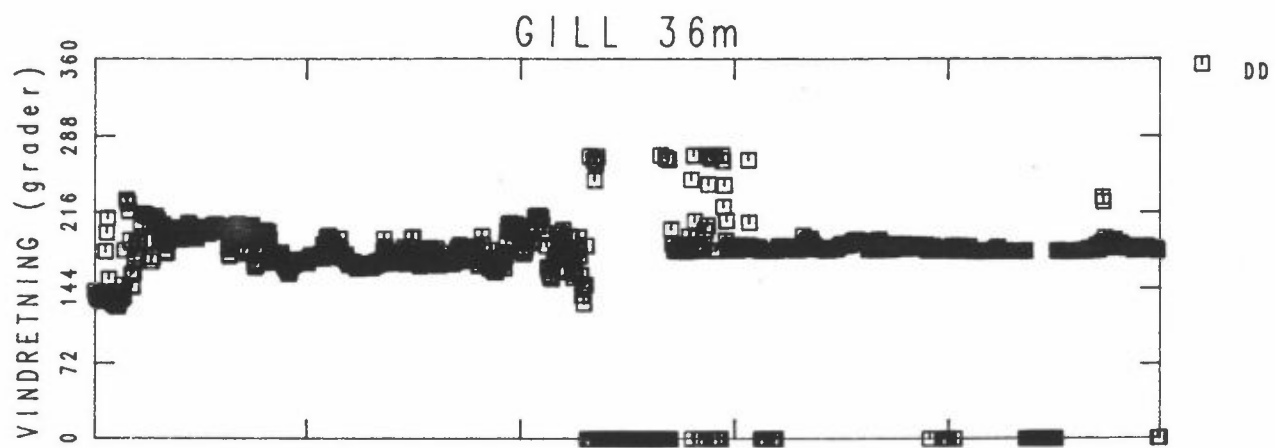
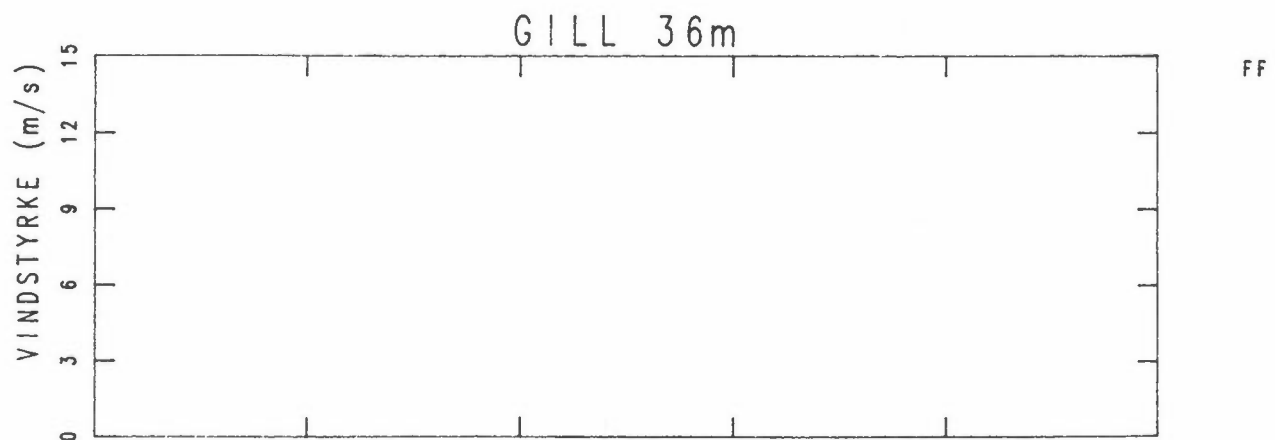
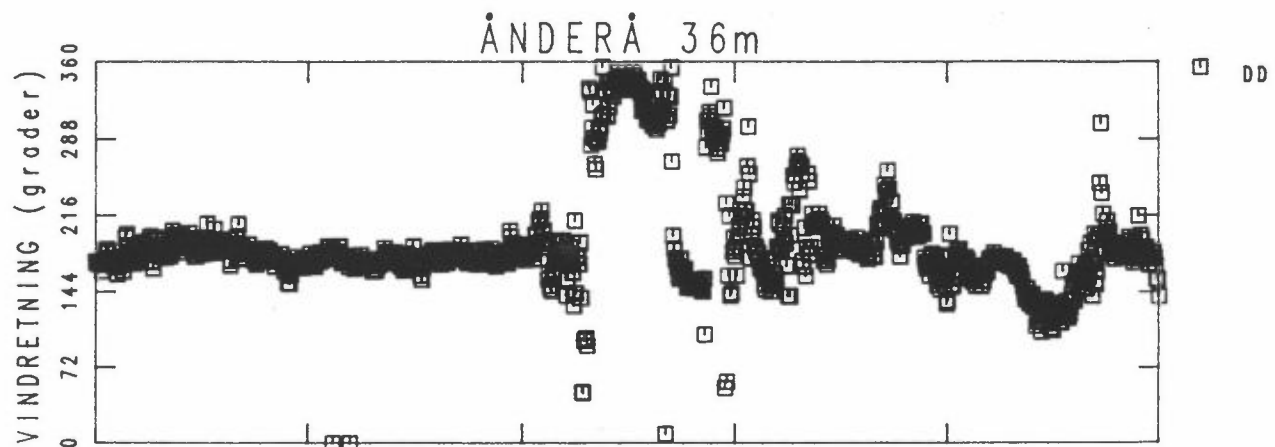
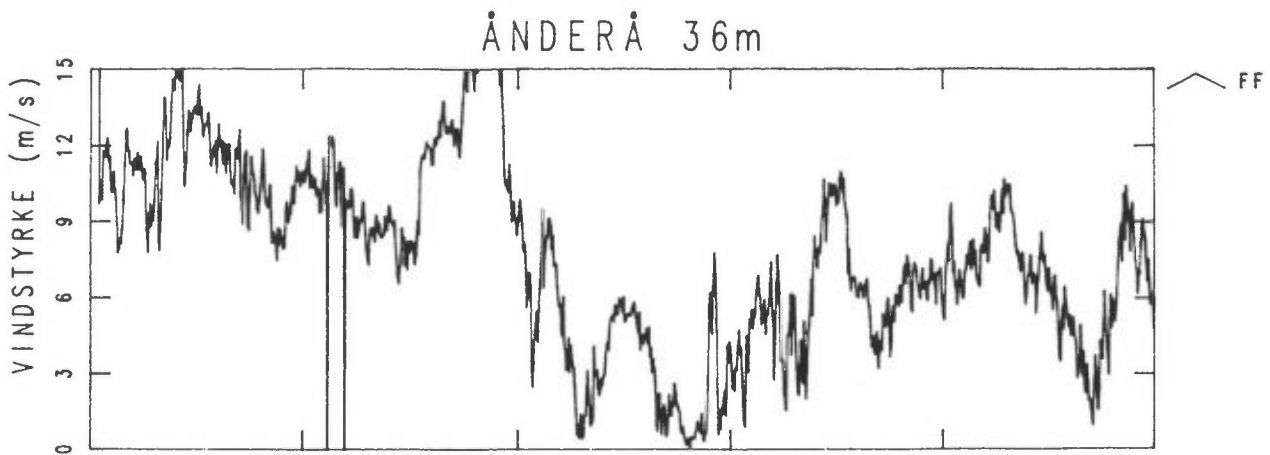


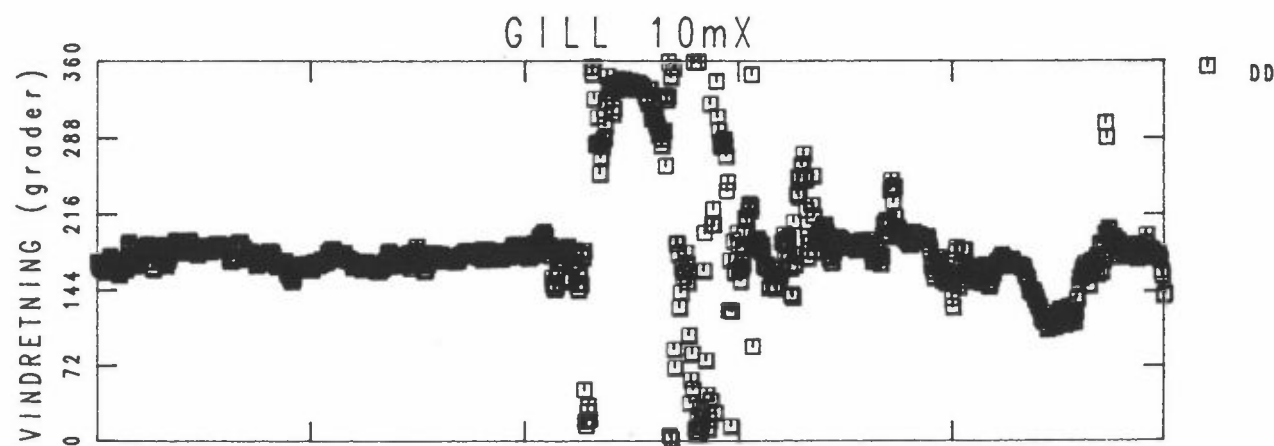
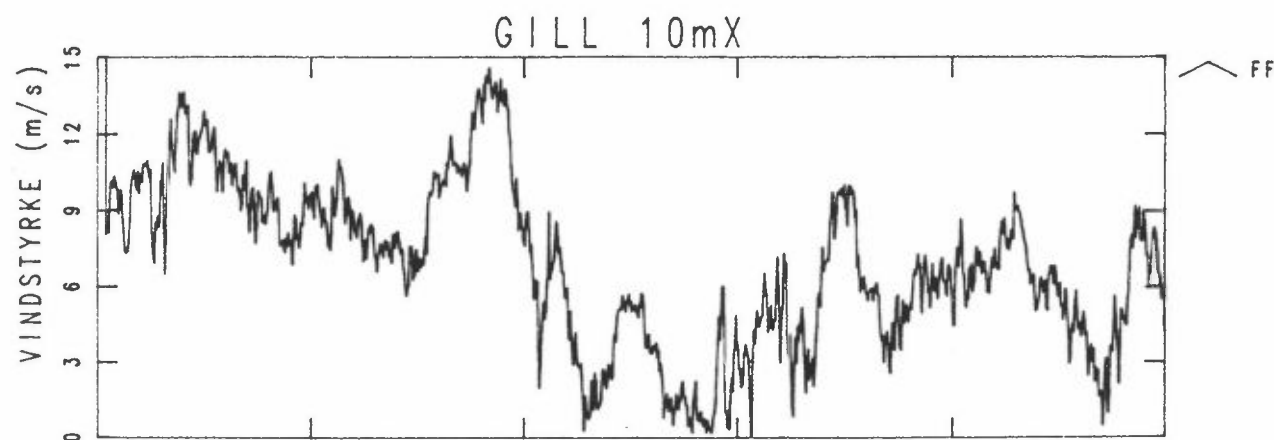
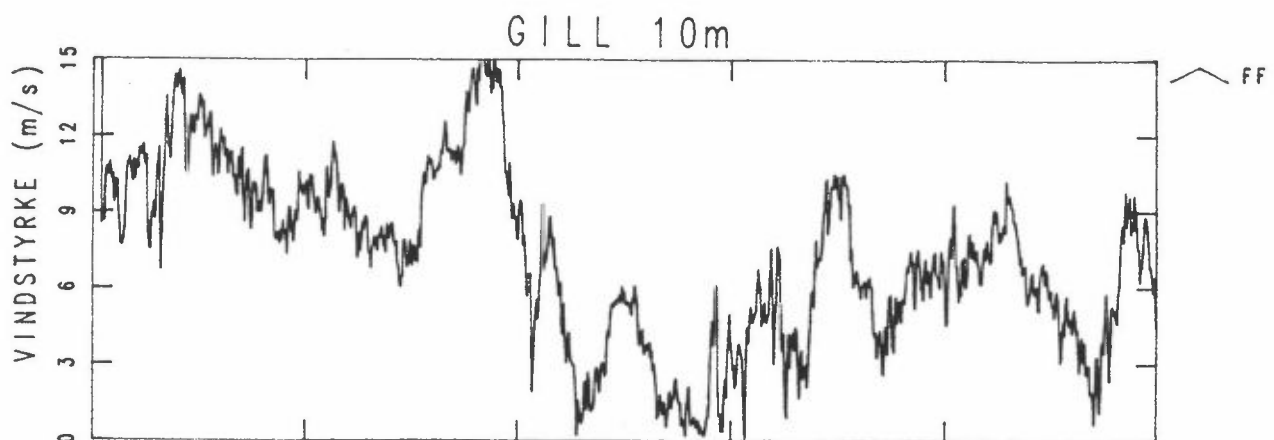
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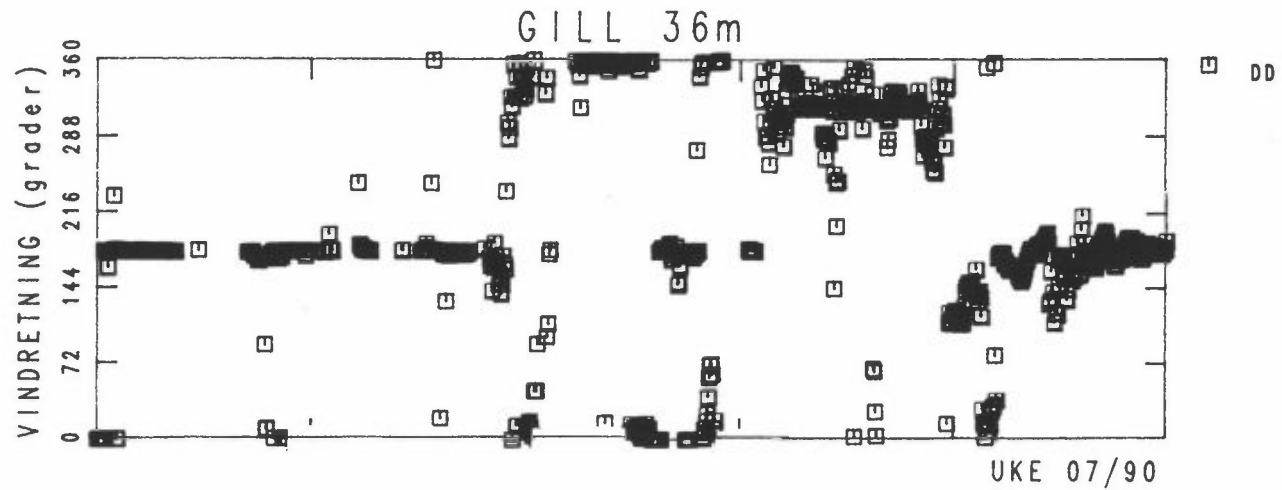
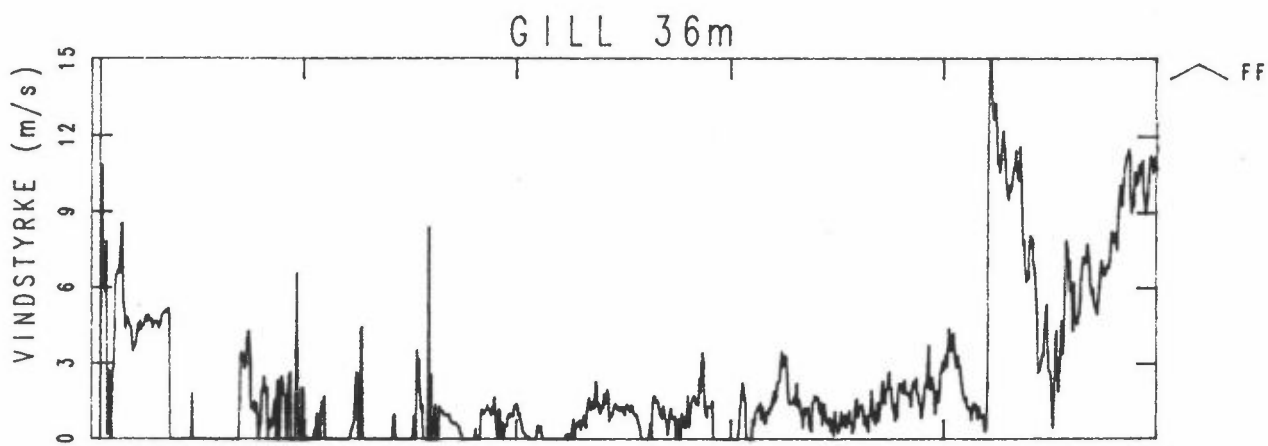
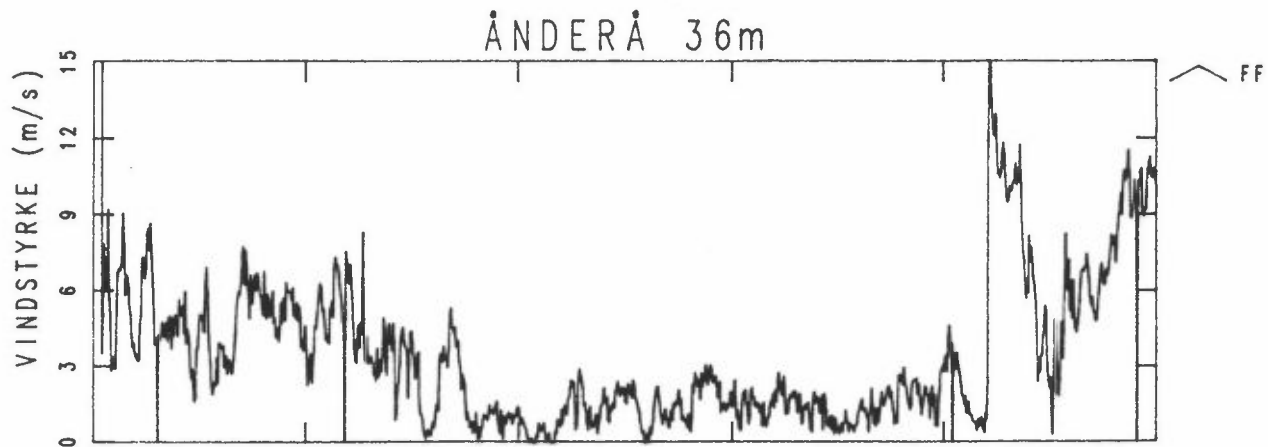
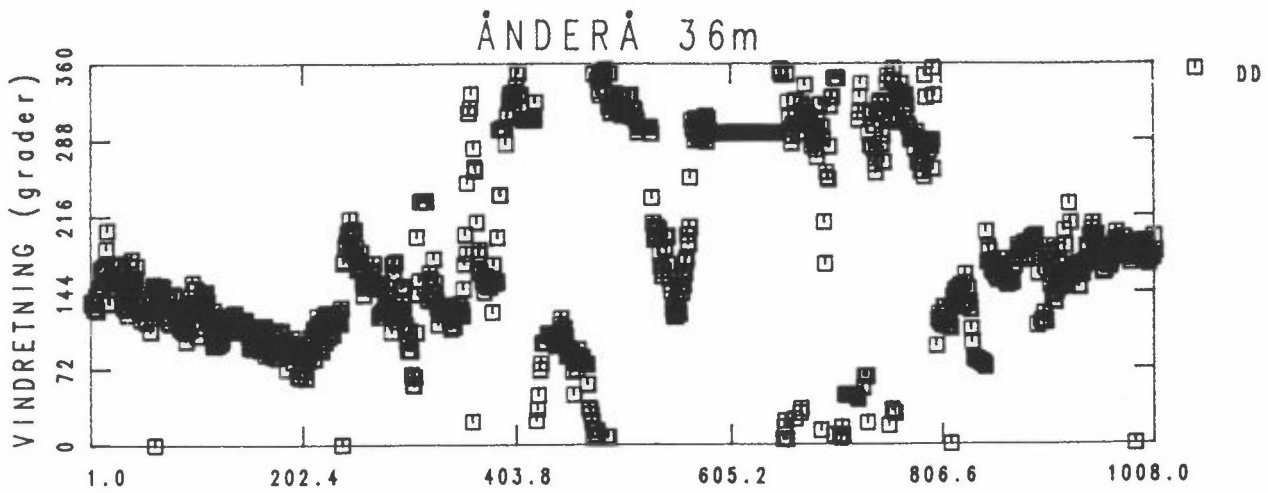


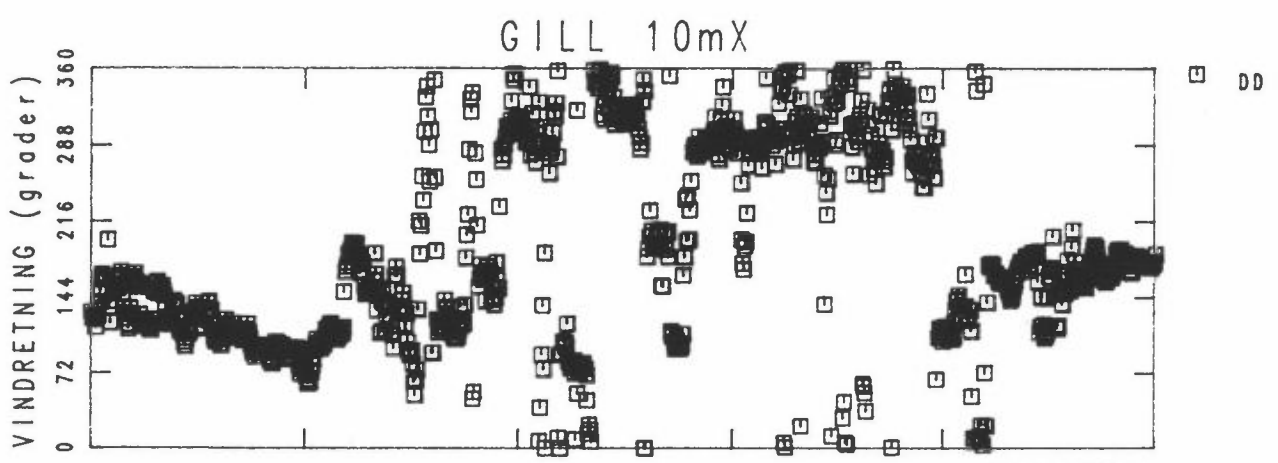
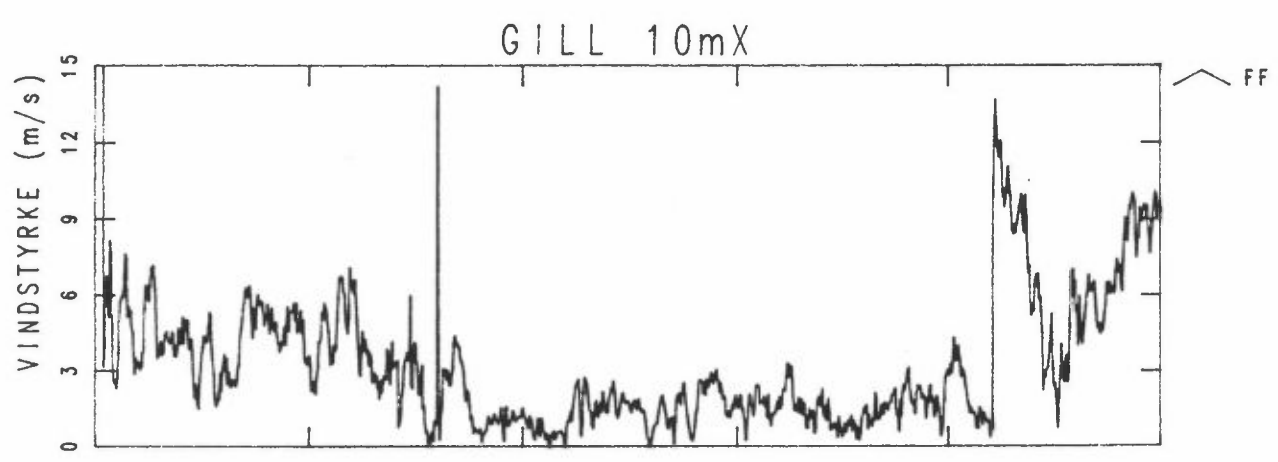
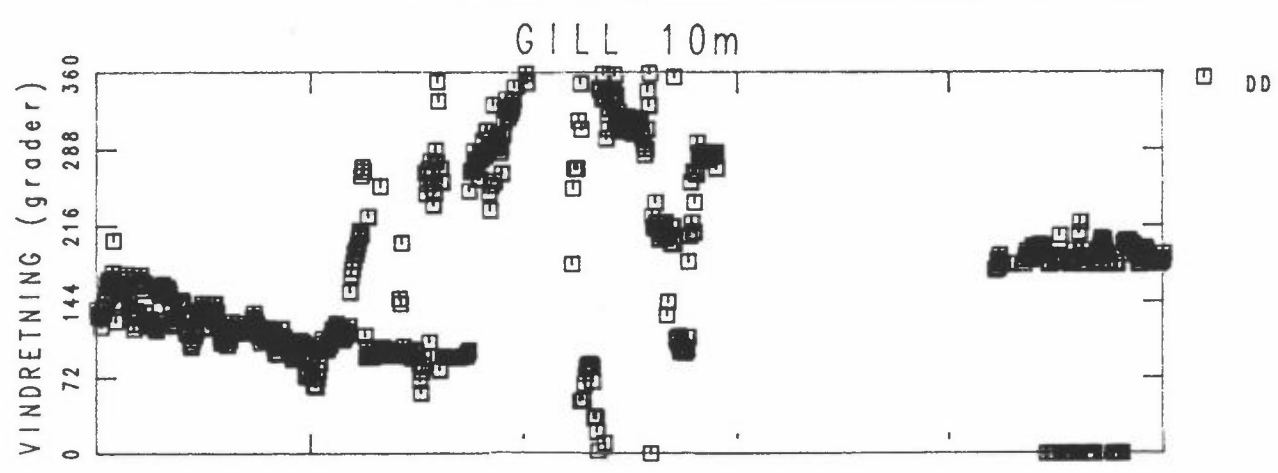
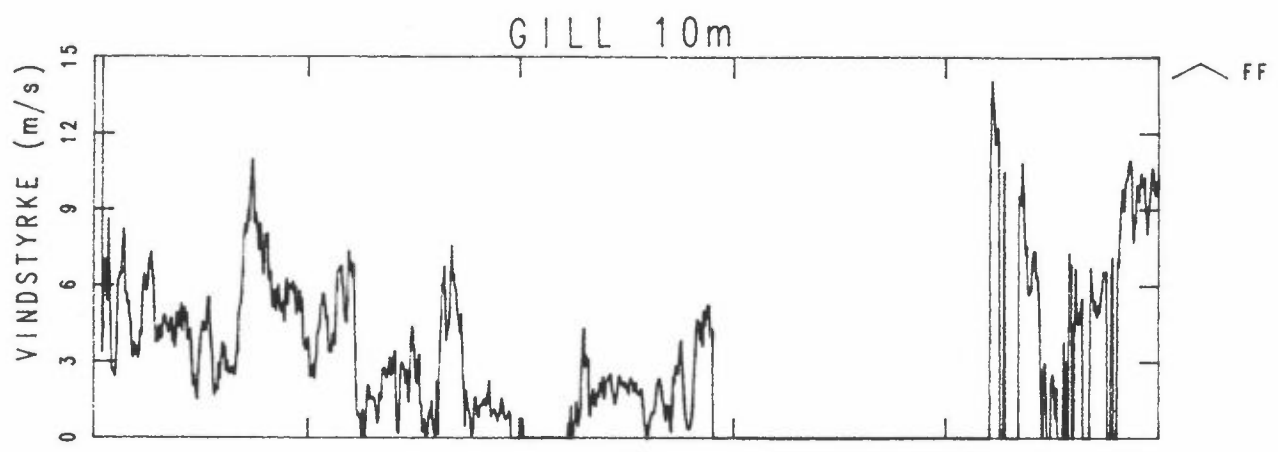


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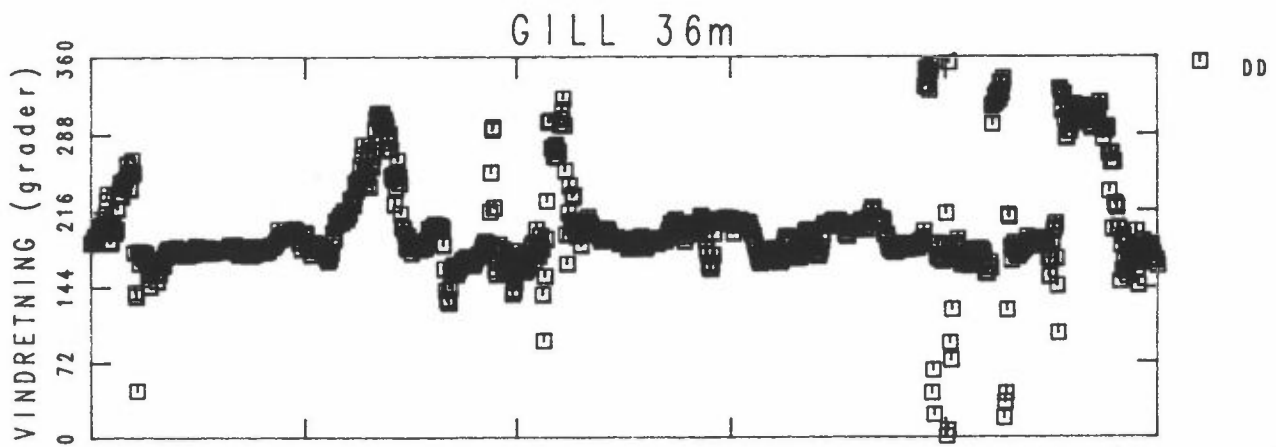
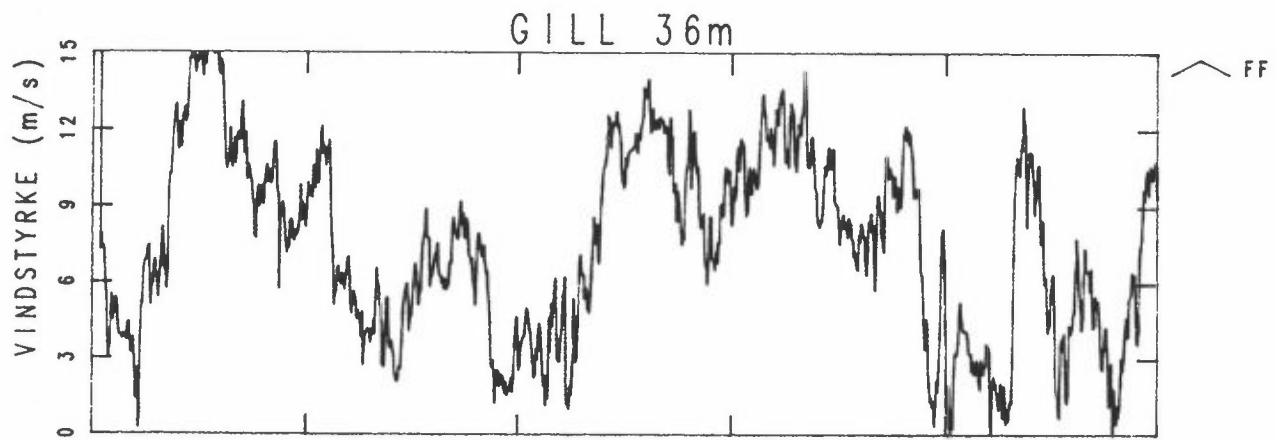
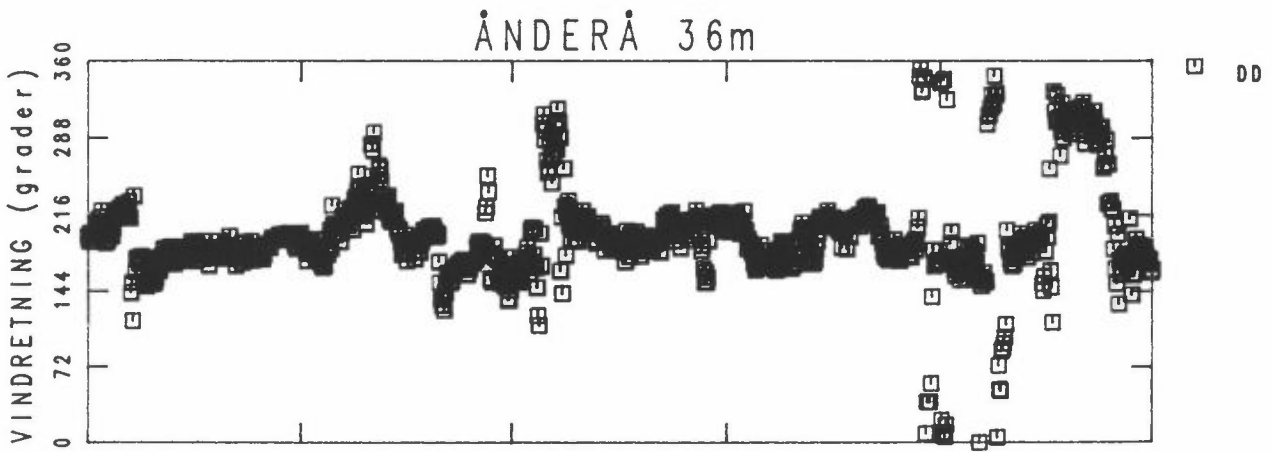
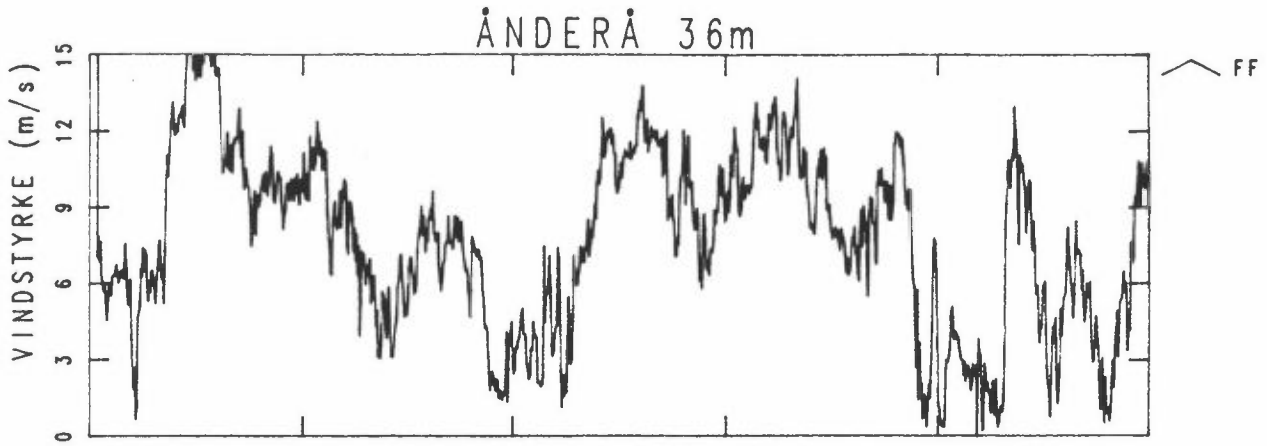


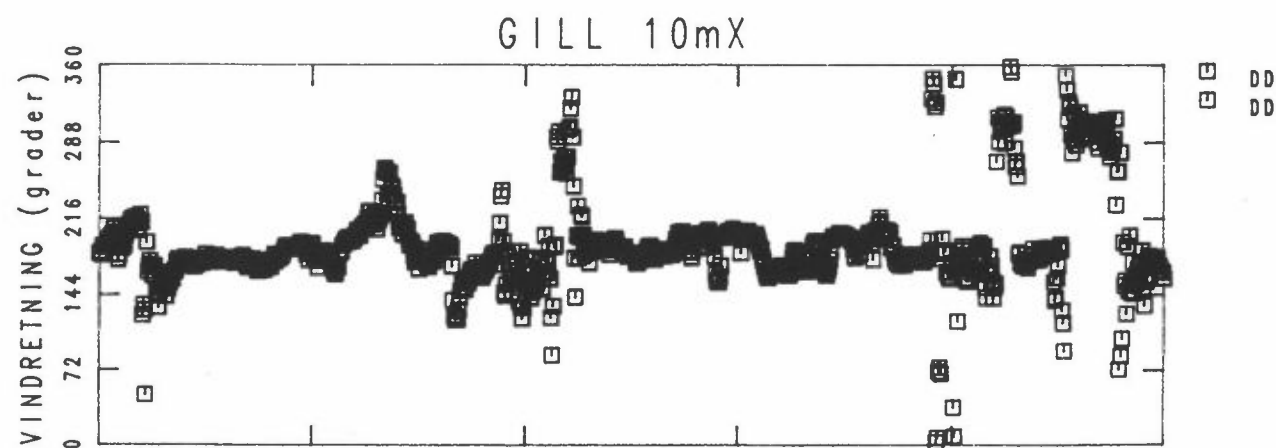
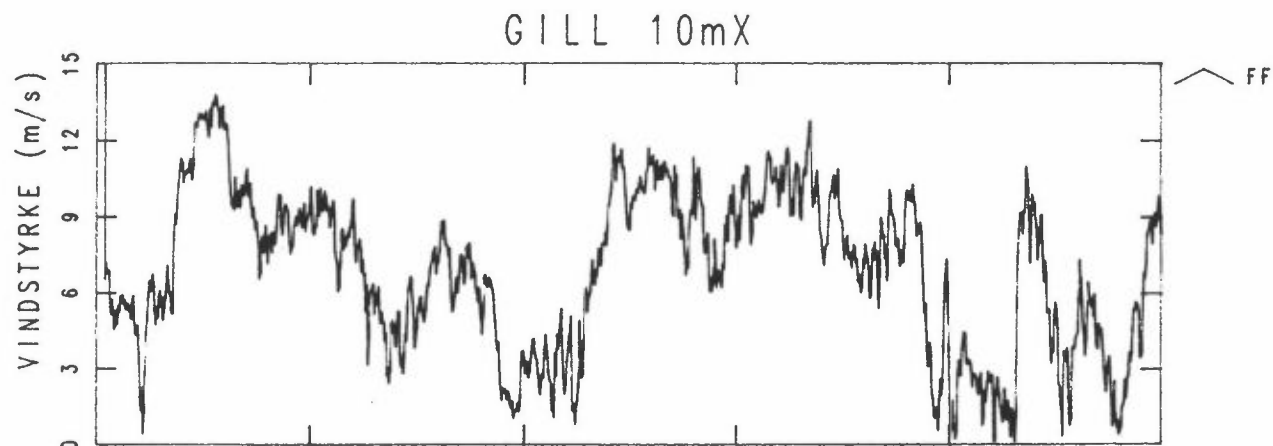
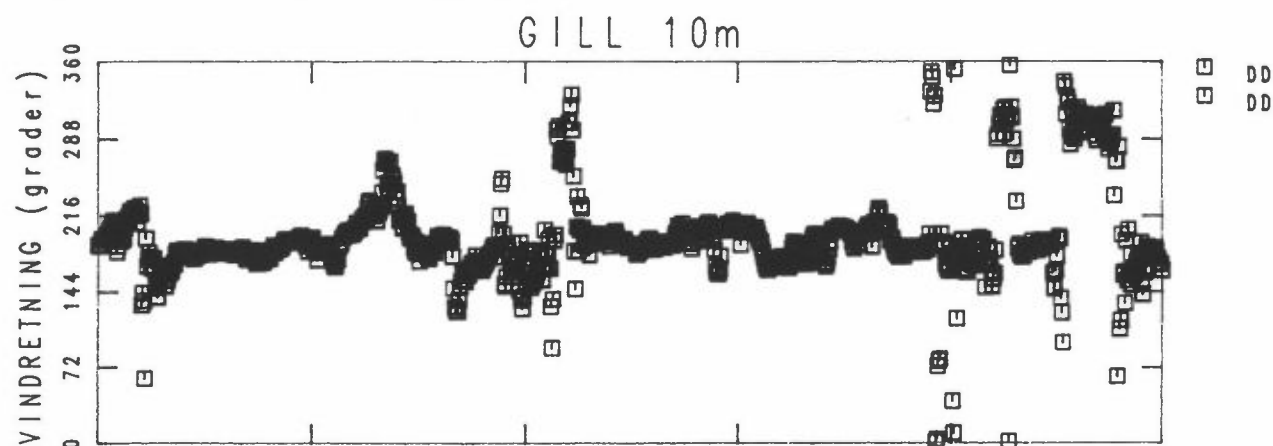
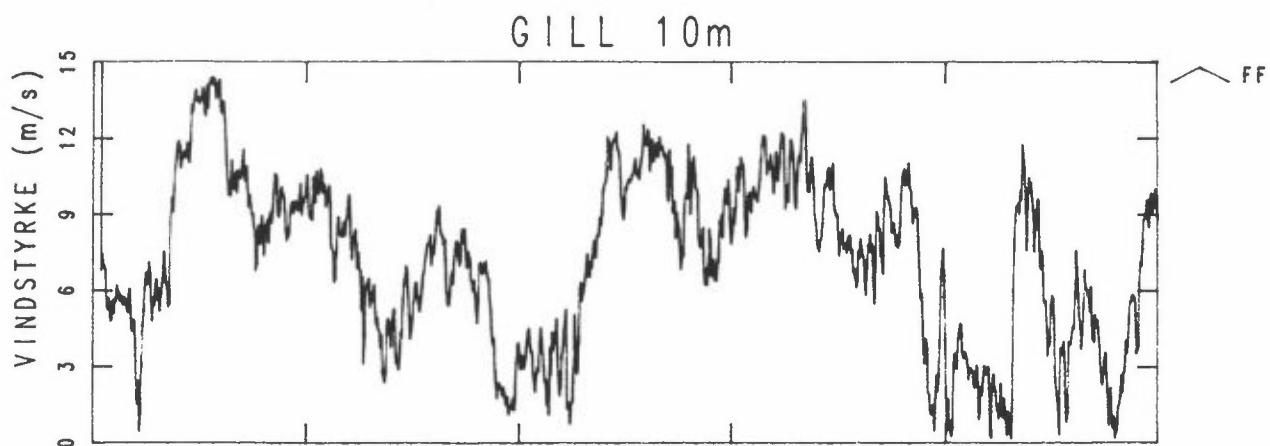






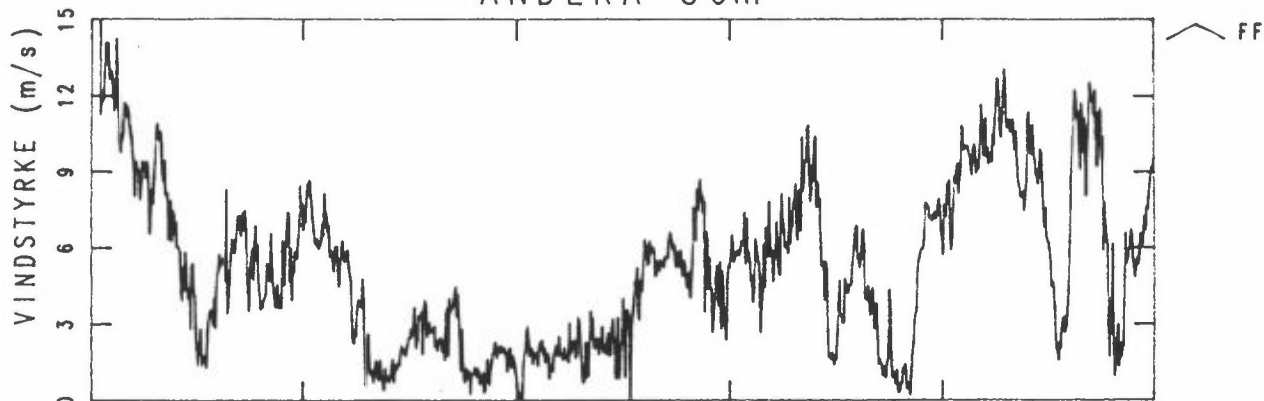
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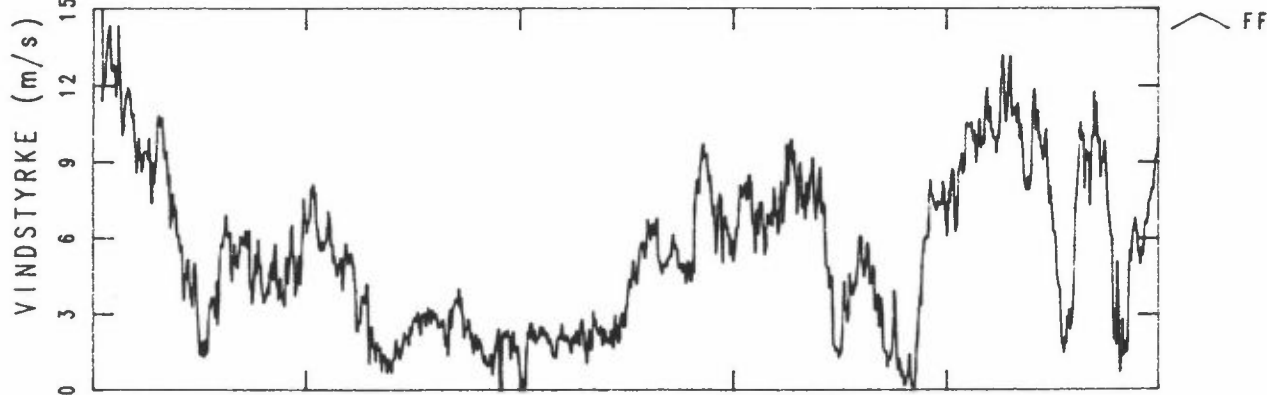
ÅNDERÅ 36m



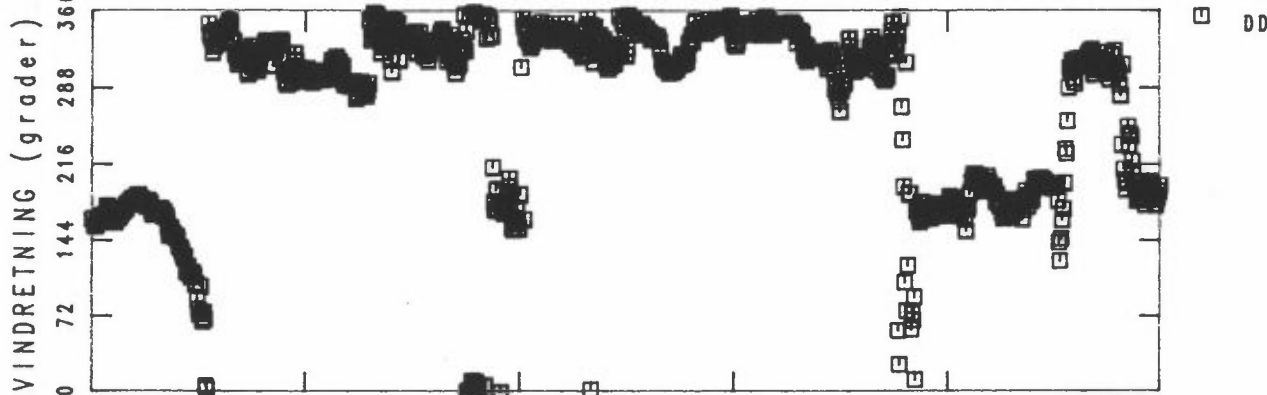
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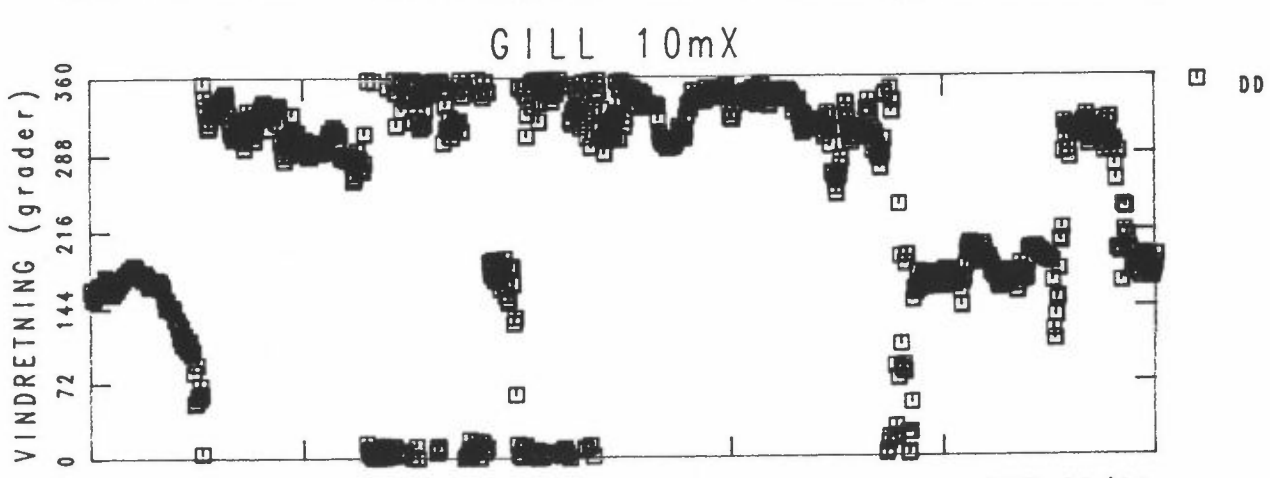
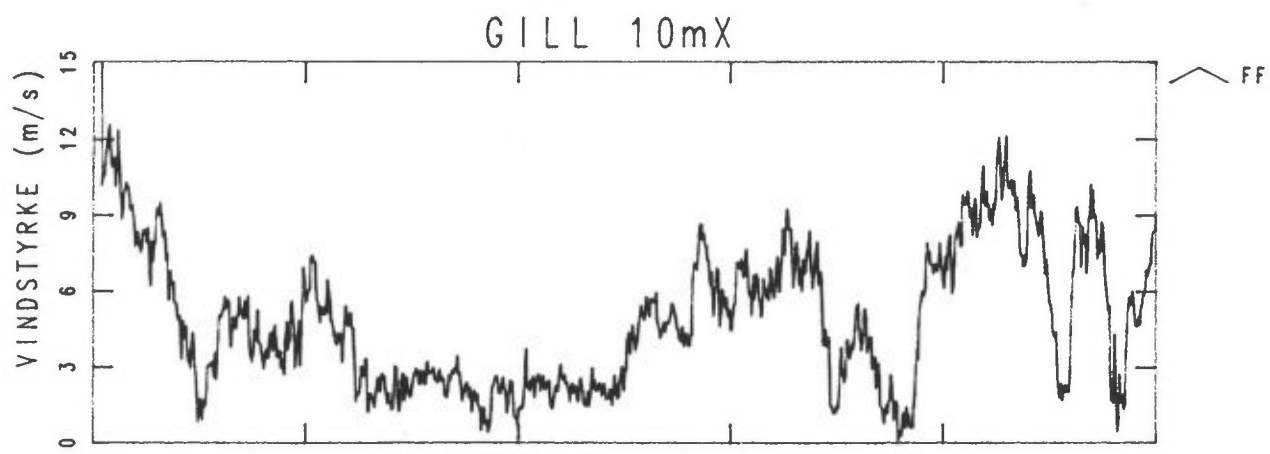
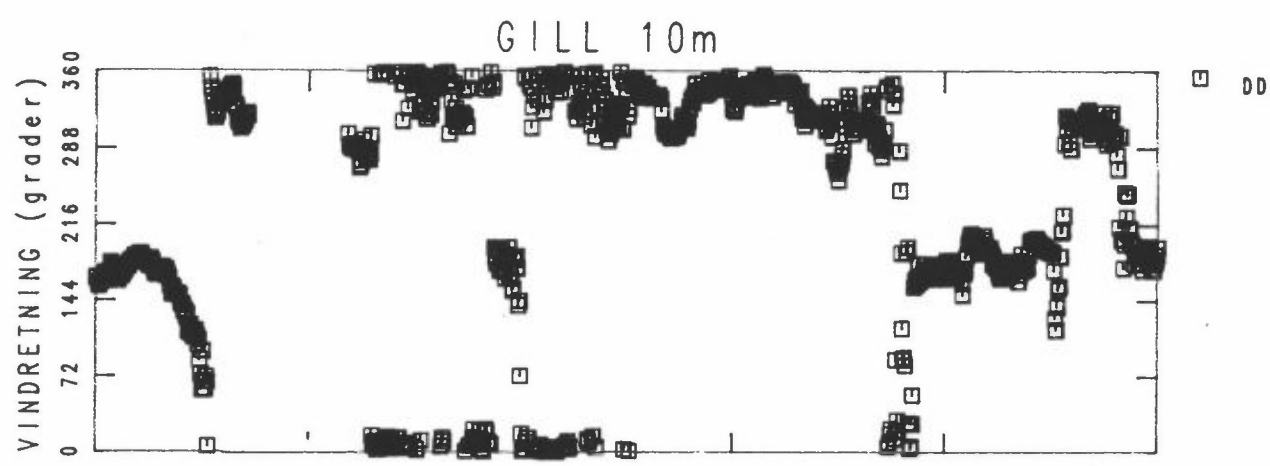
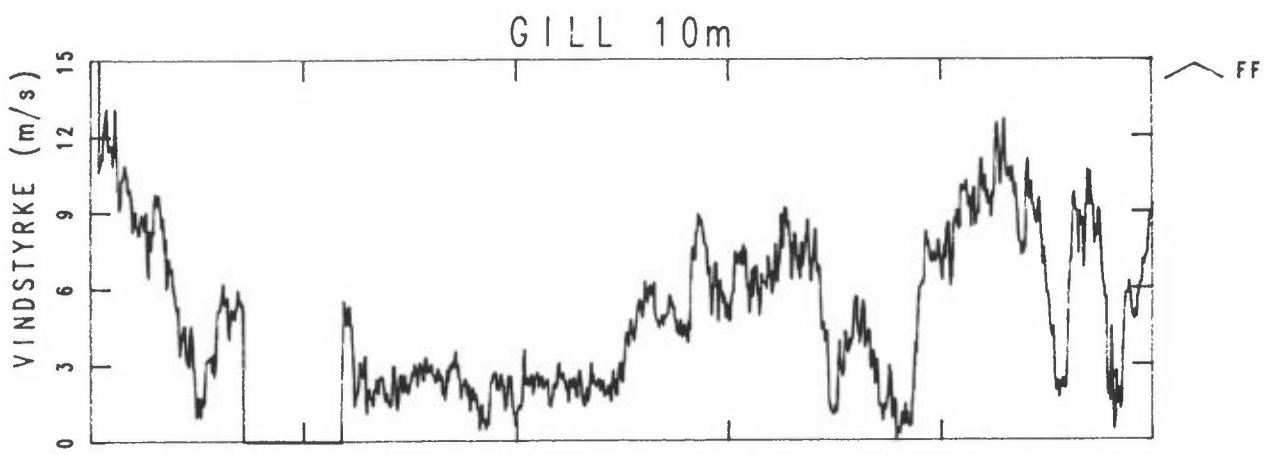


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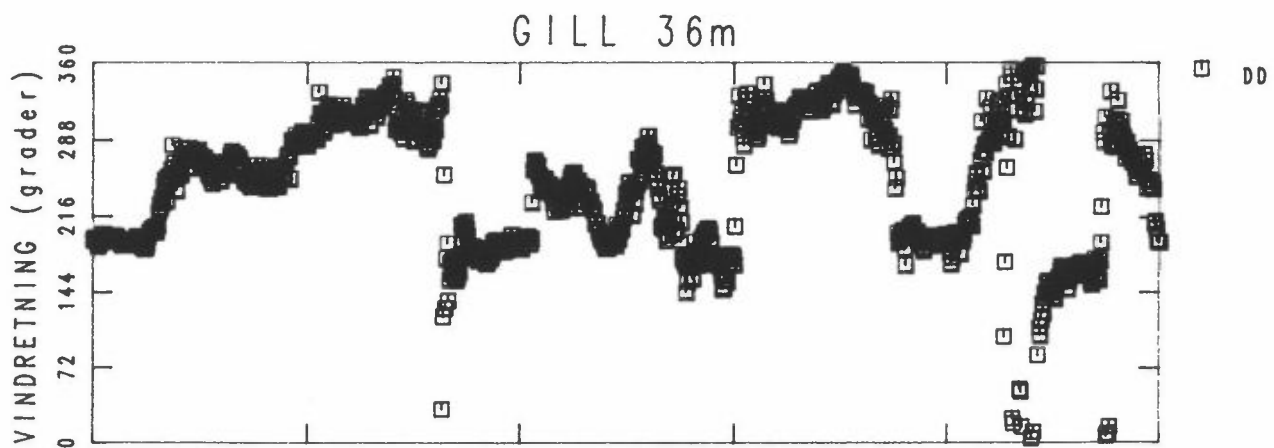
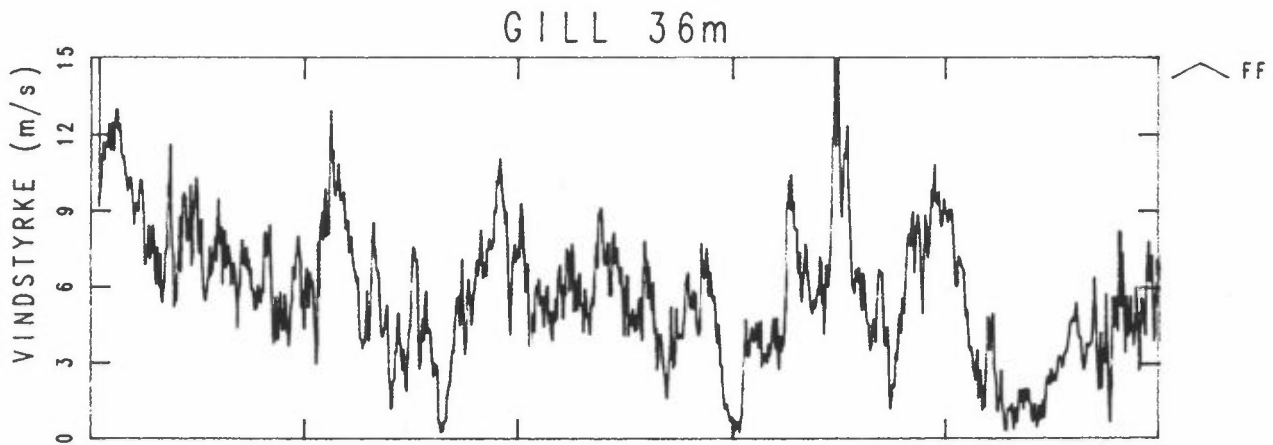
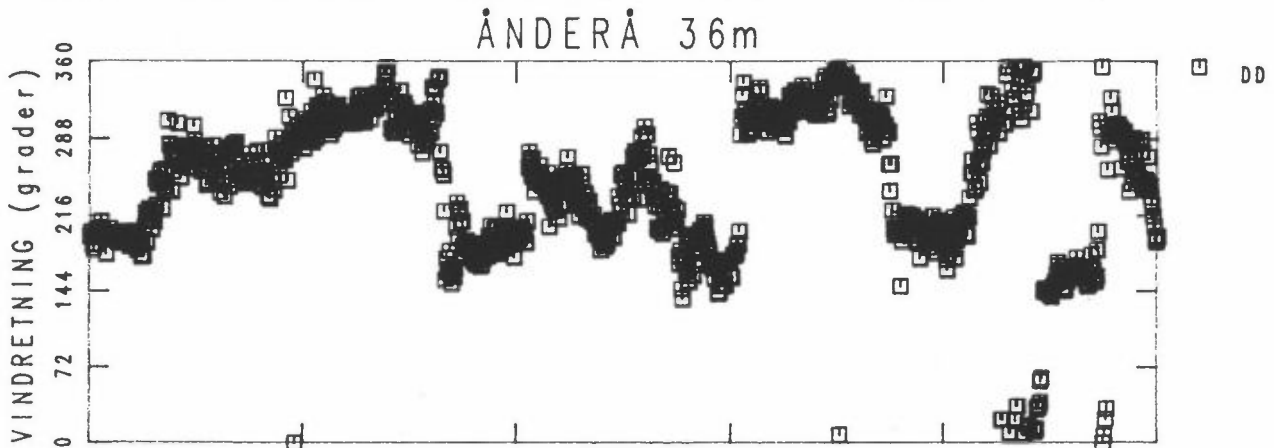
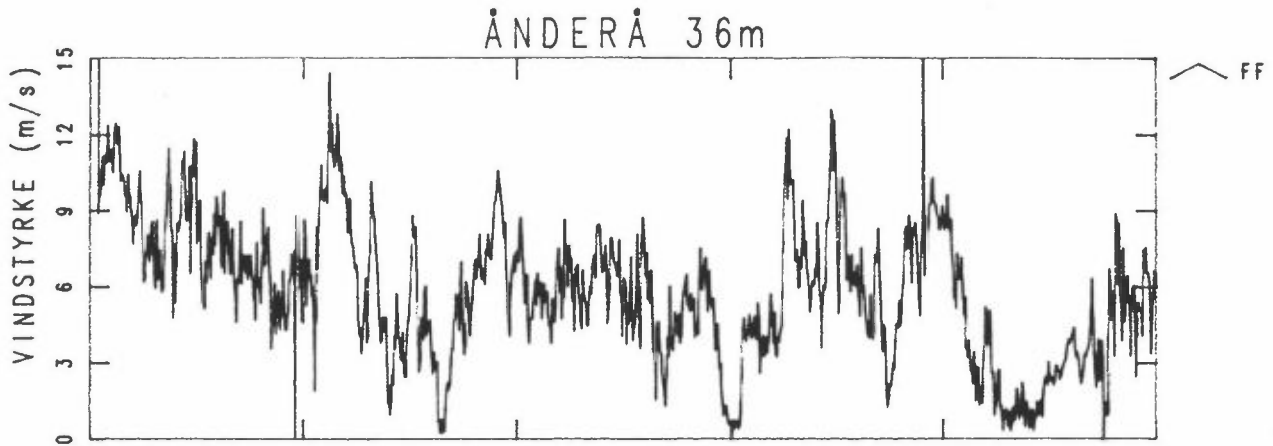


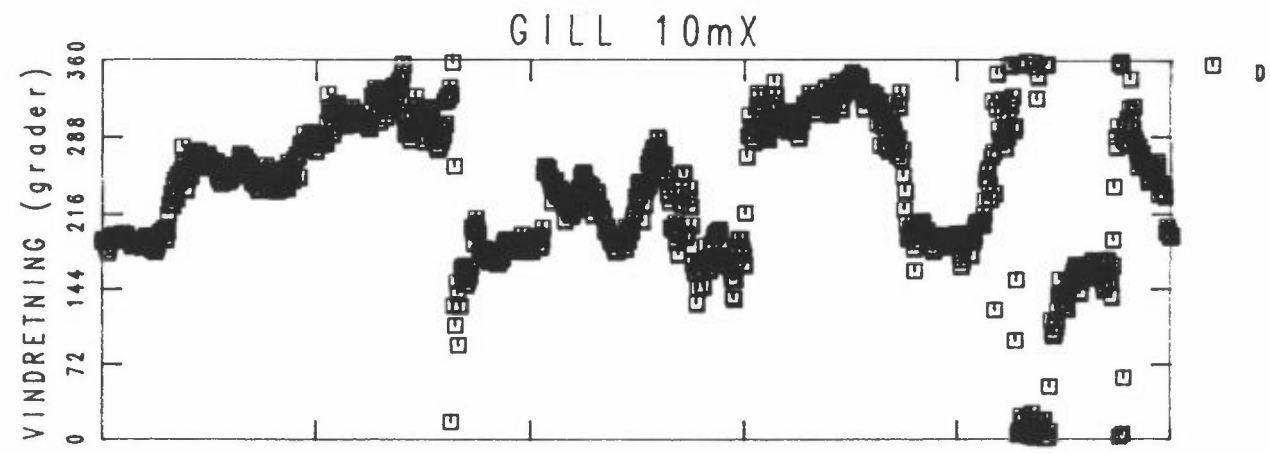
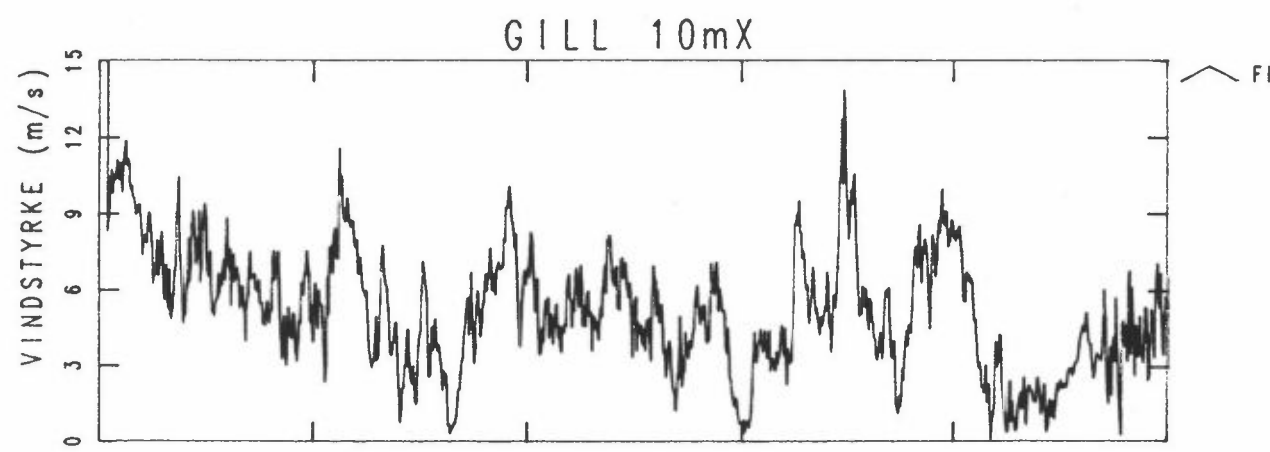
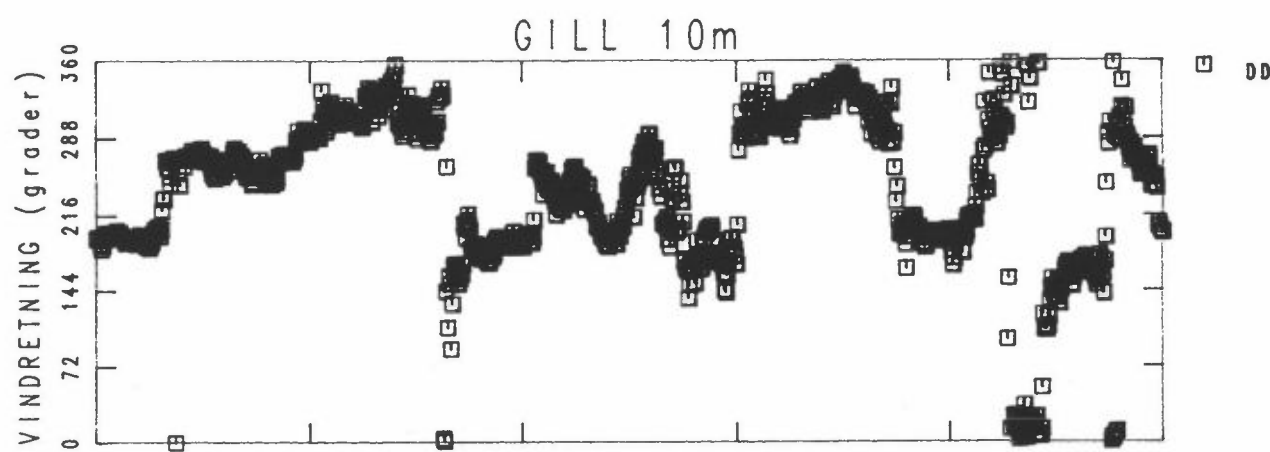
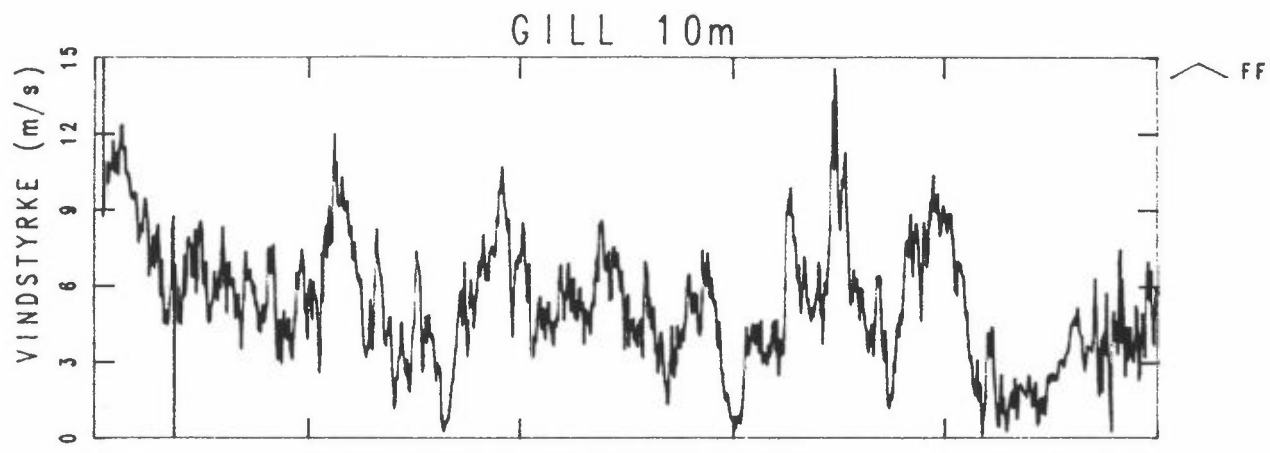
GILL 36m



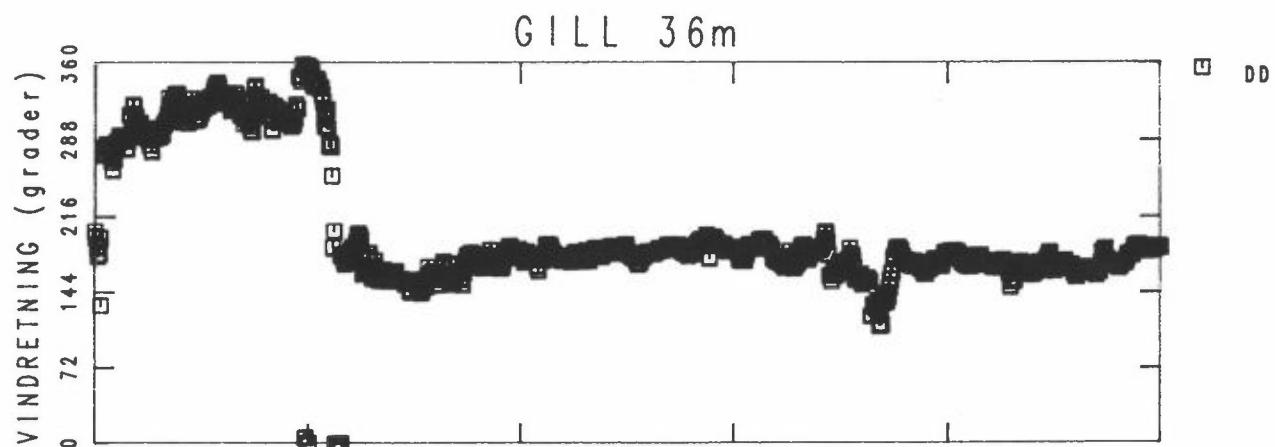
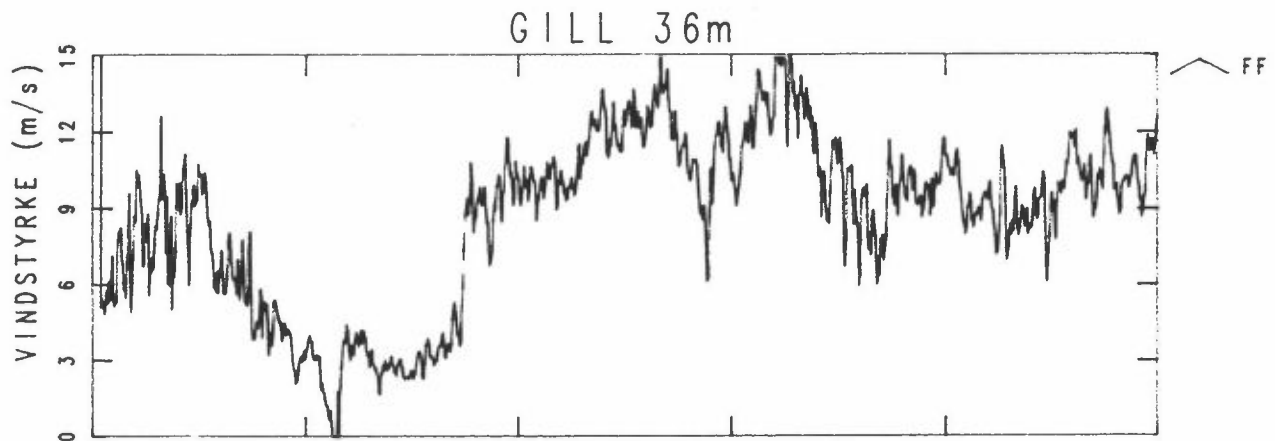
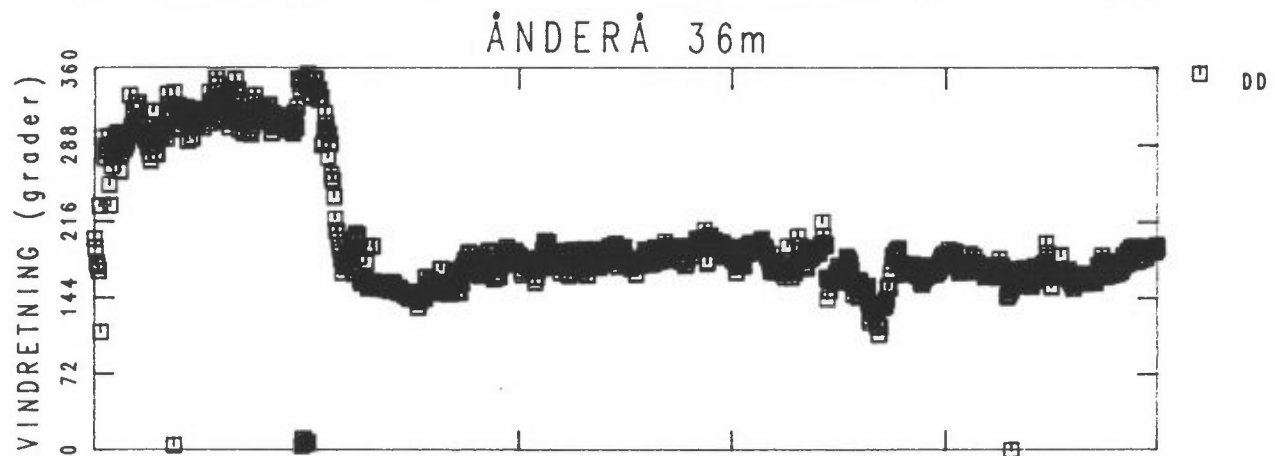
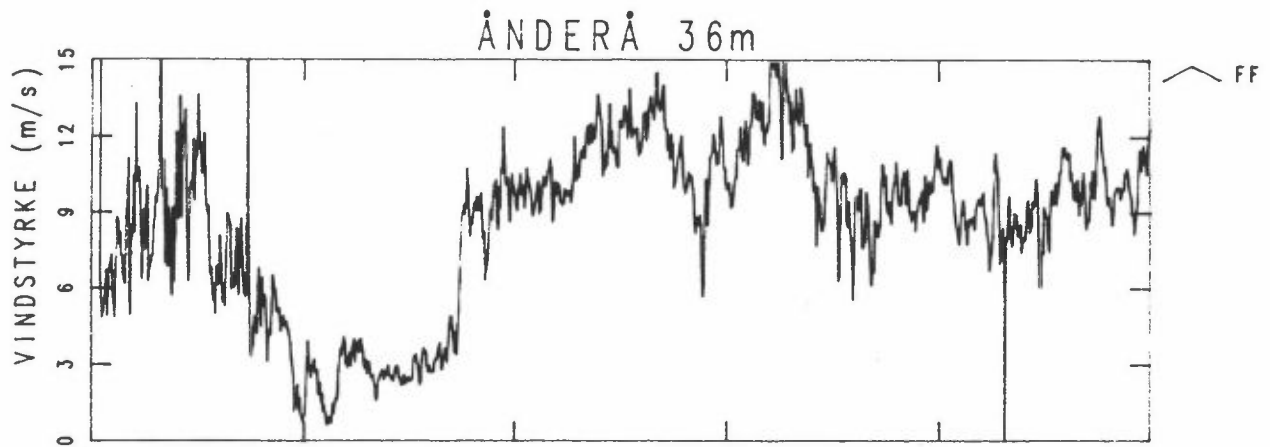


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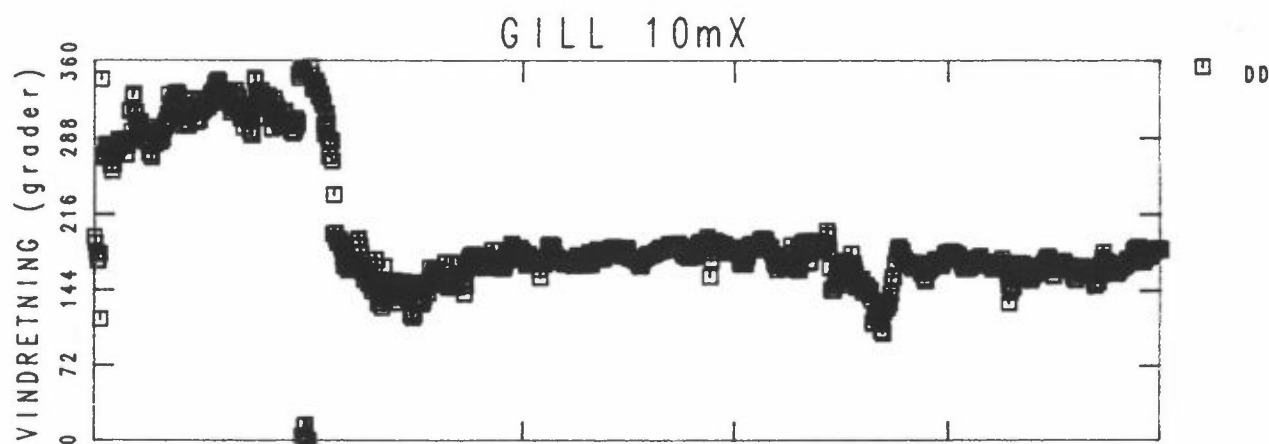
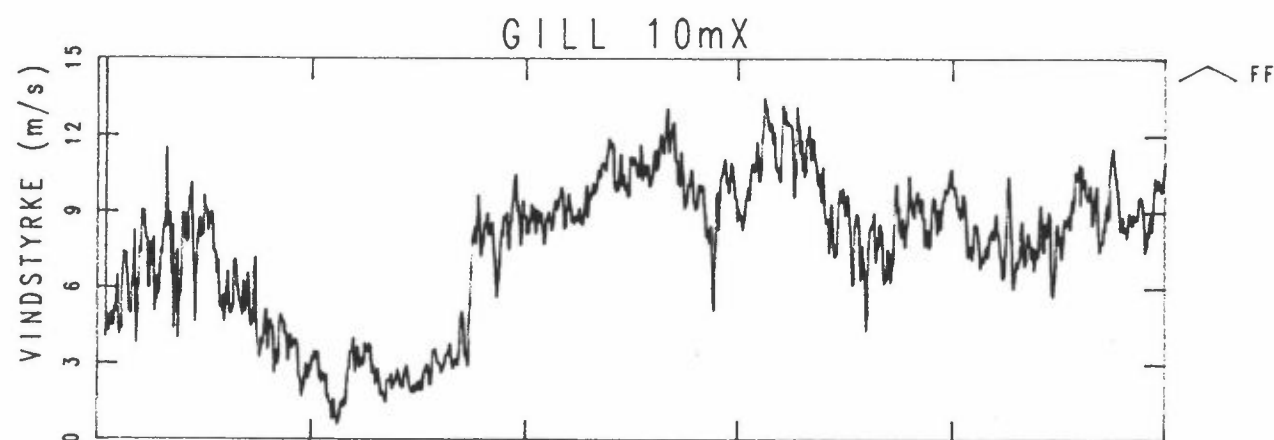
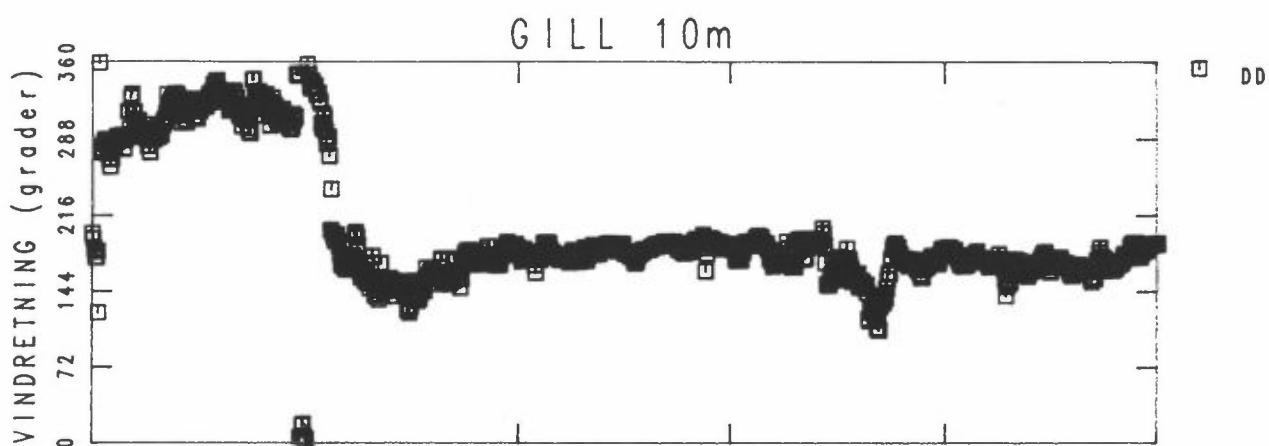
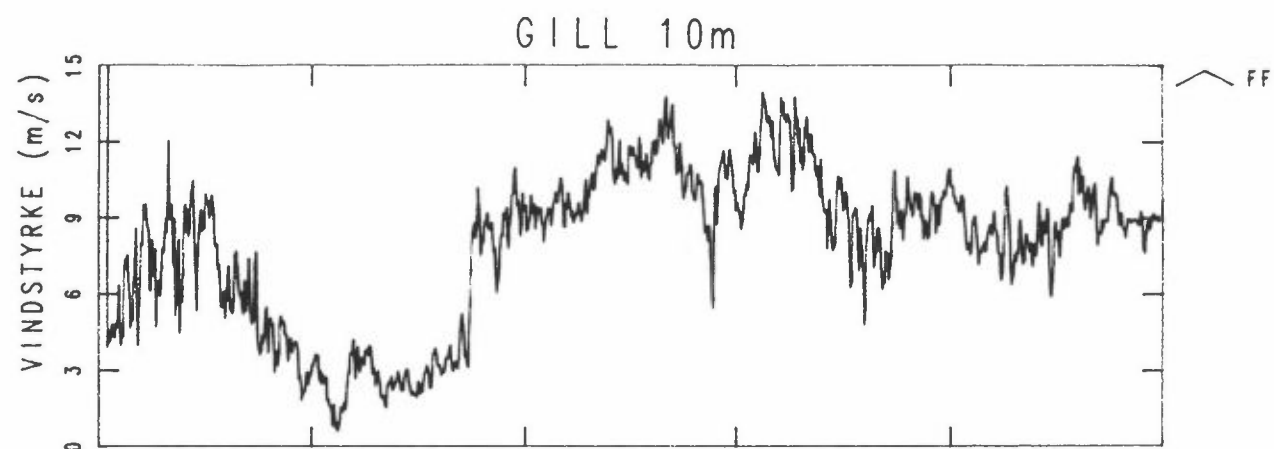




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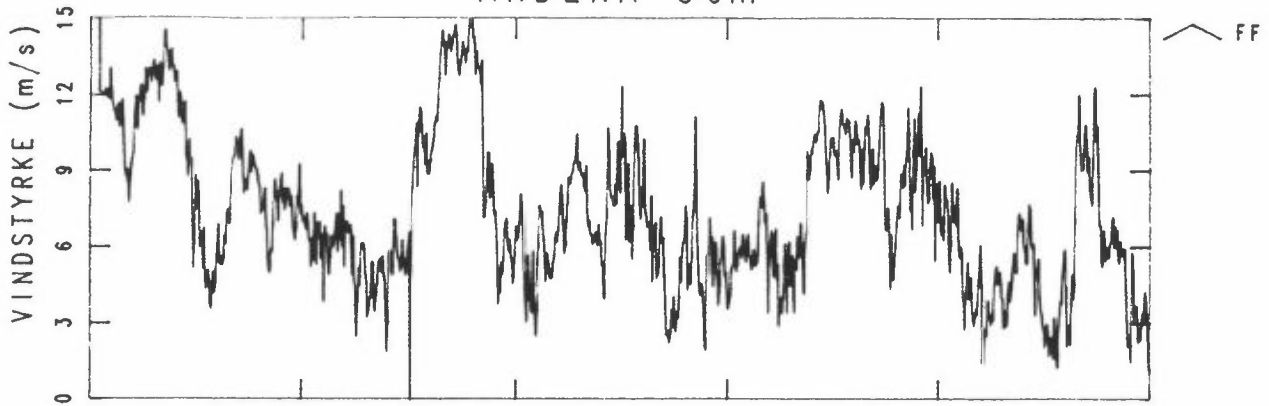


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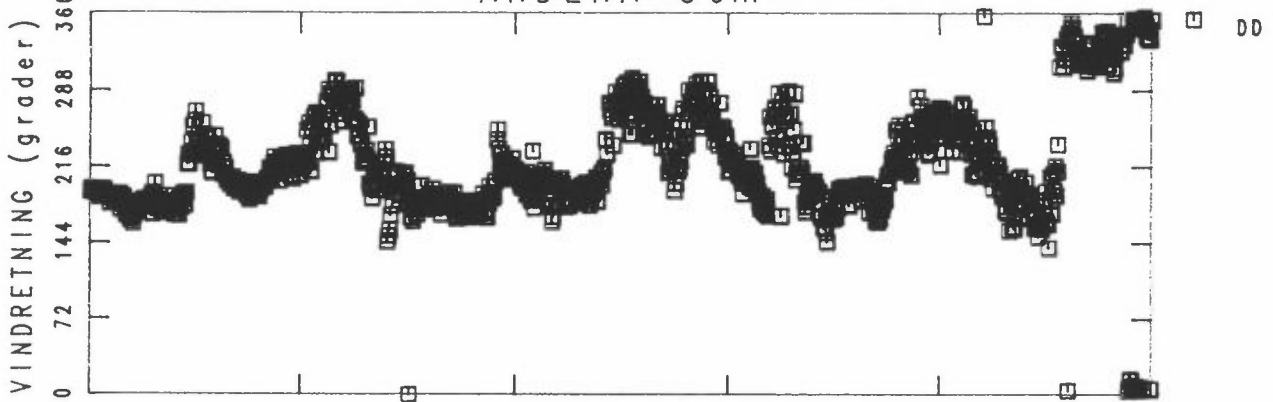


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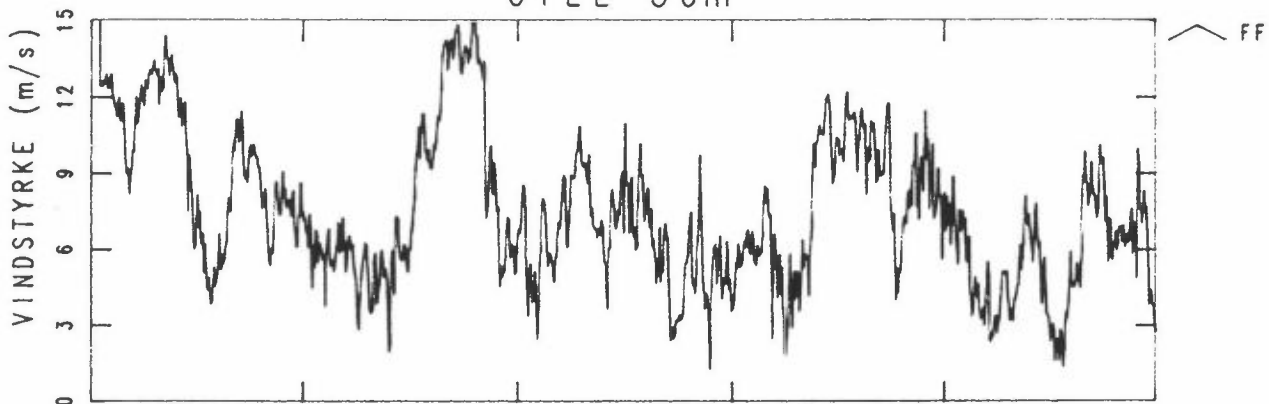
ÅNDERÅ 36m



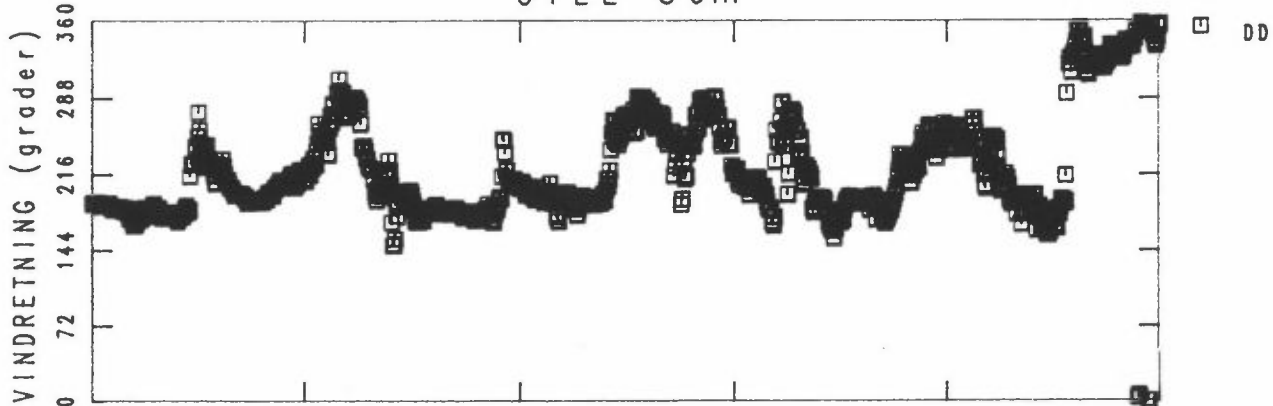
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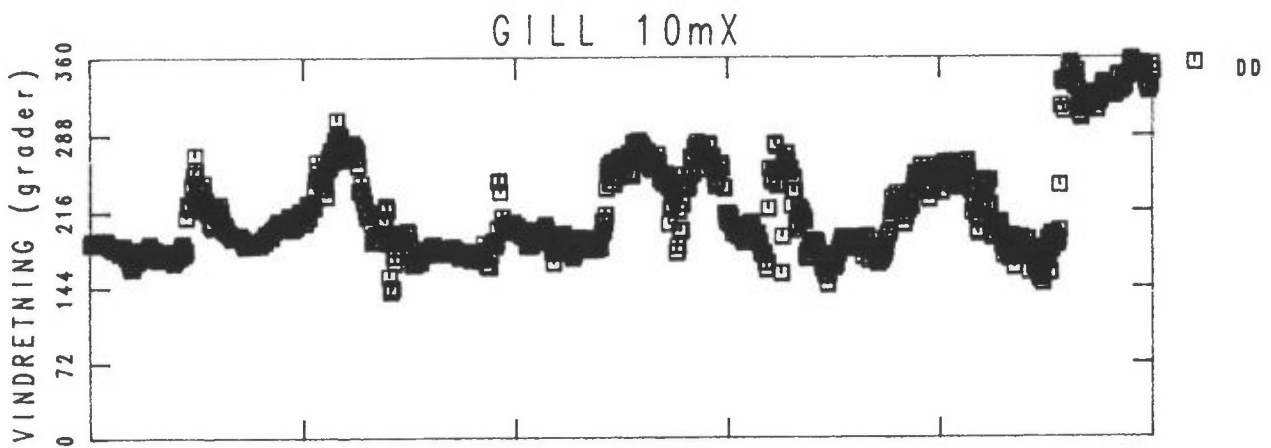
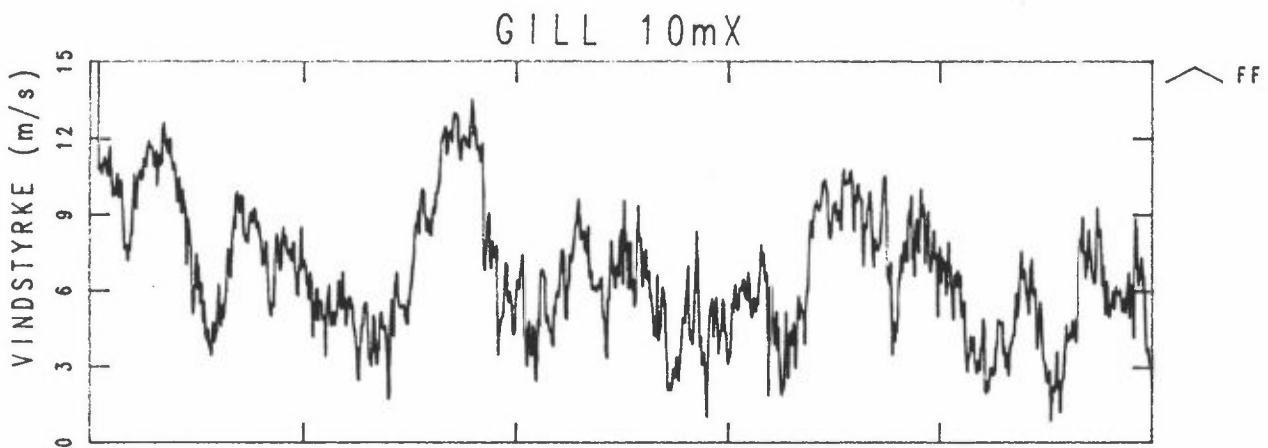
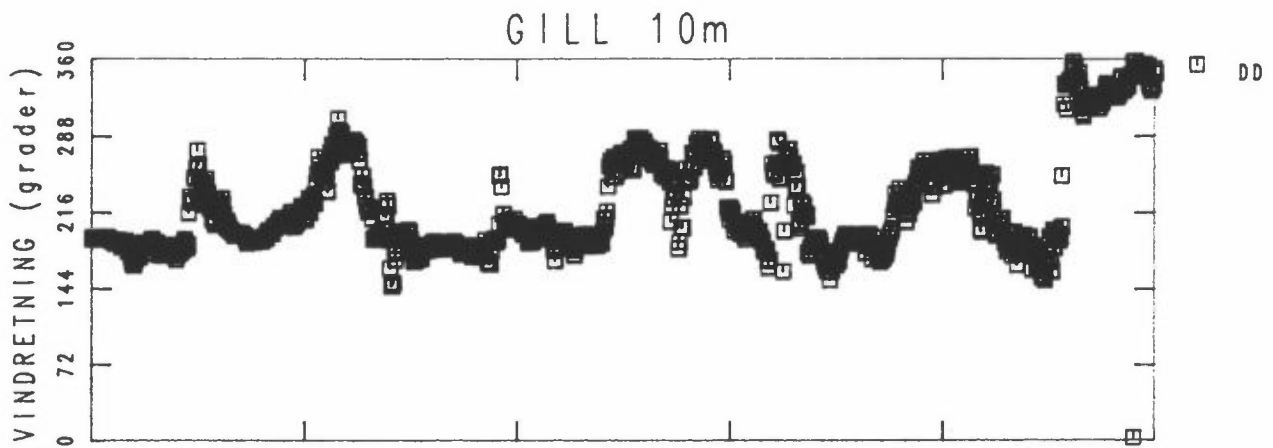
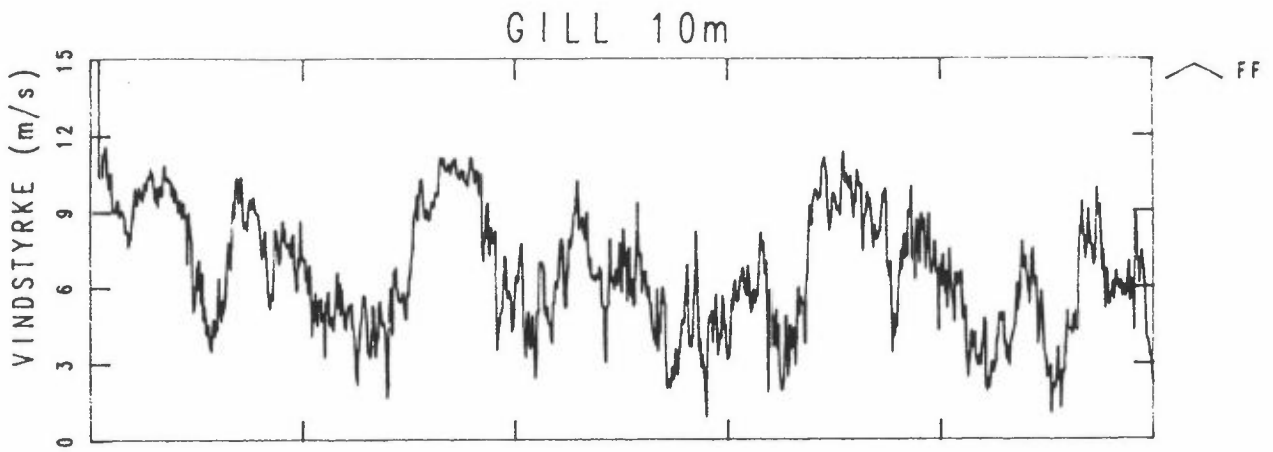


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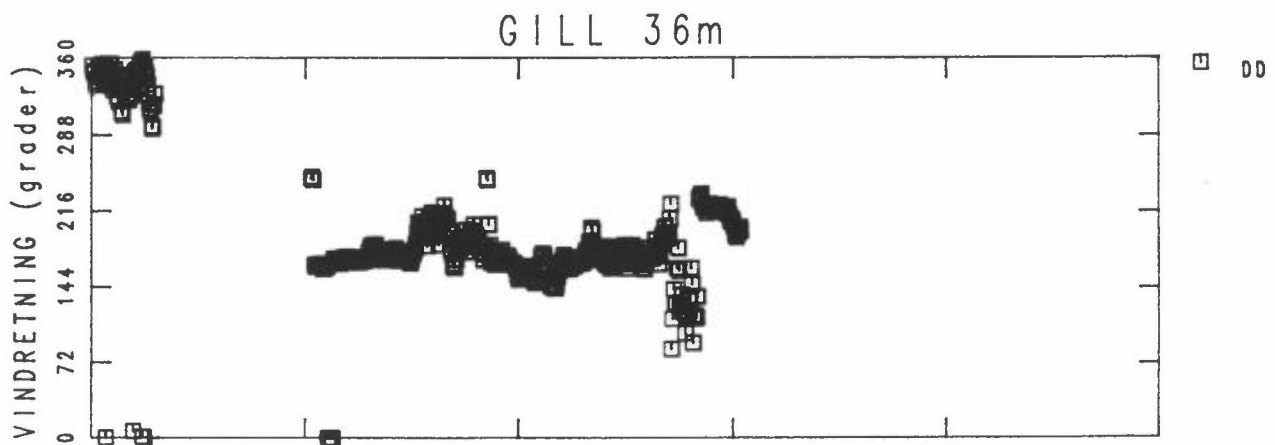
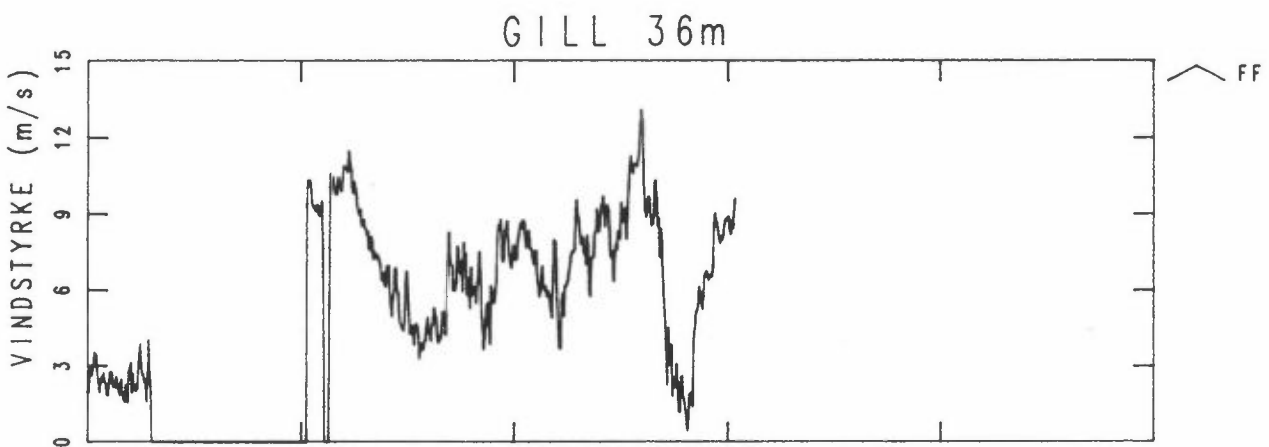
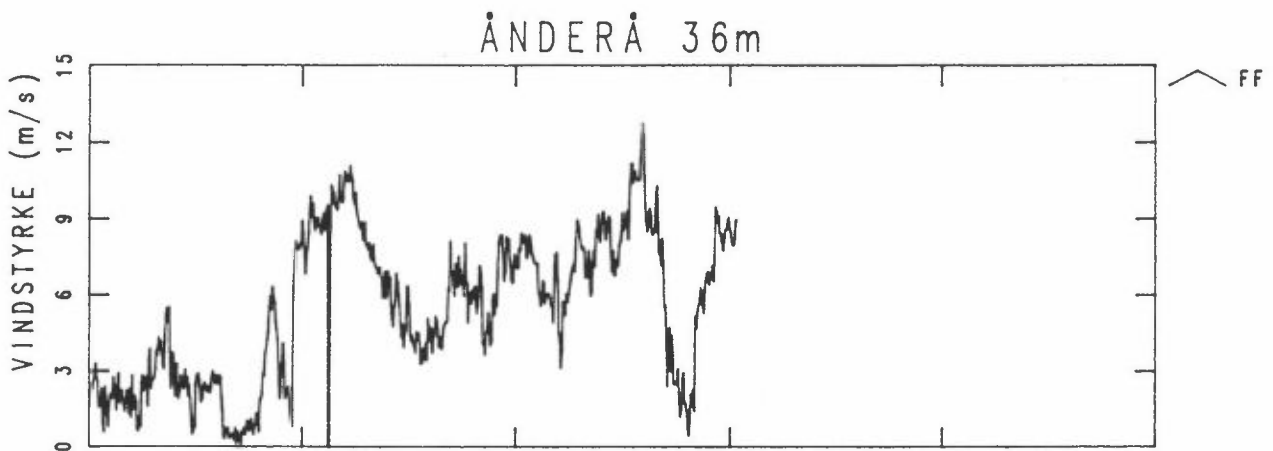
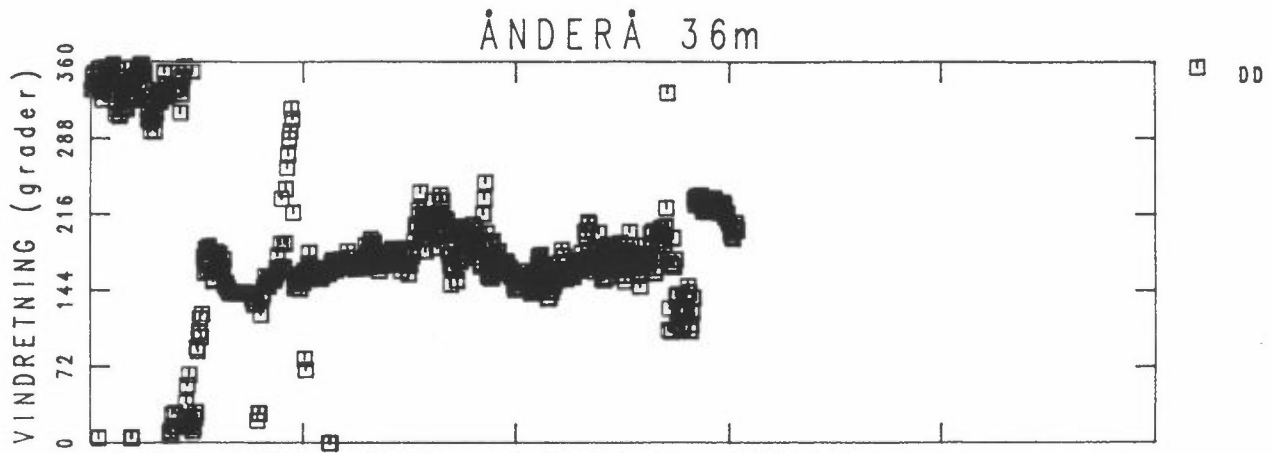


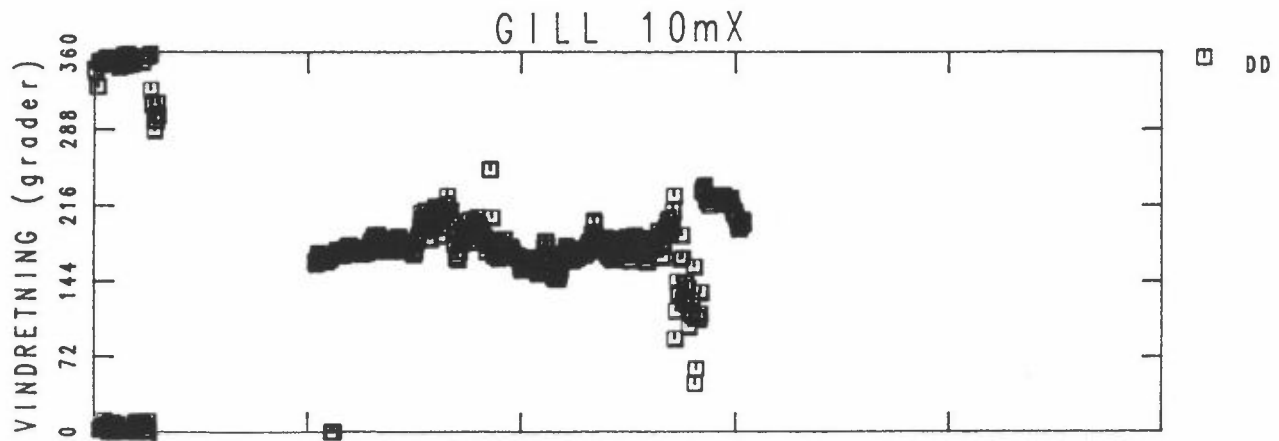
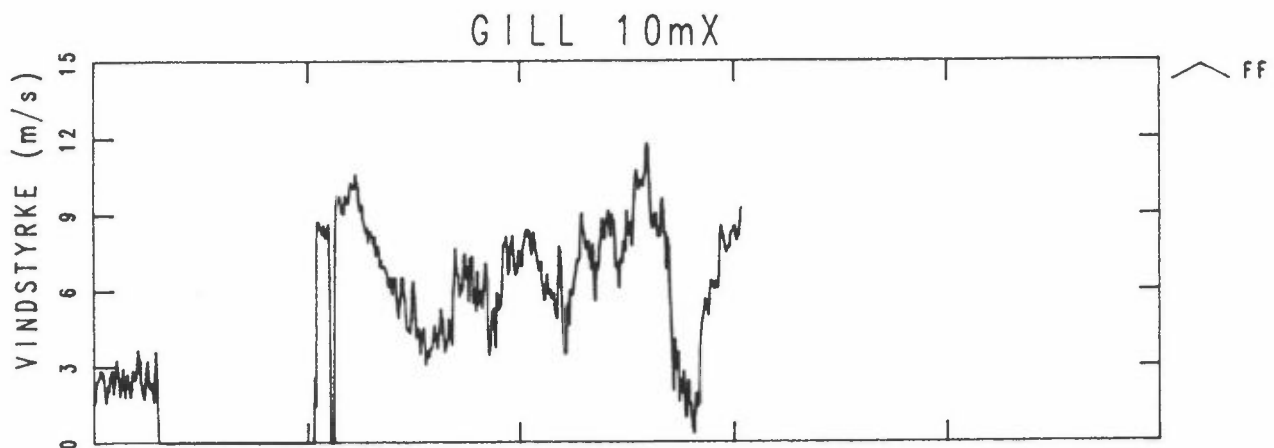
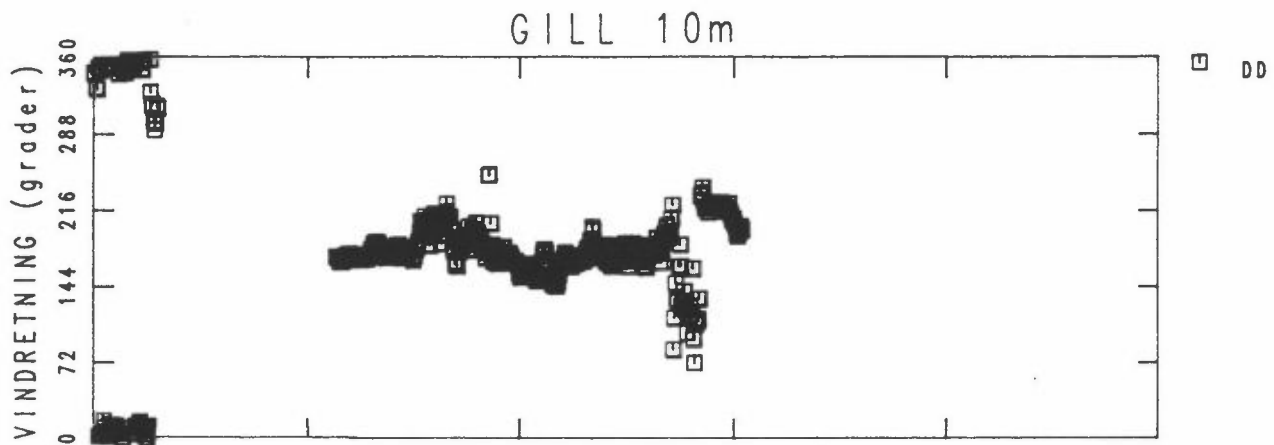
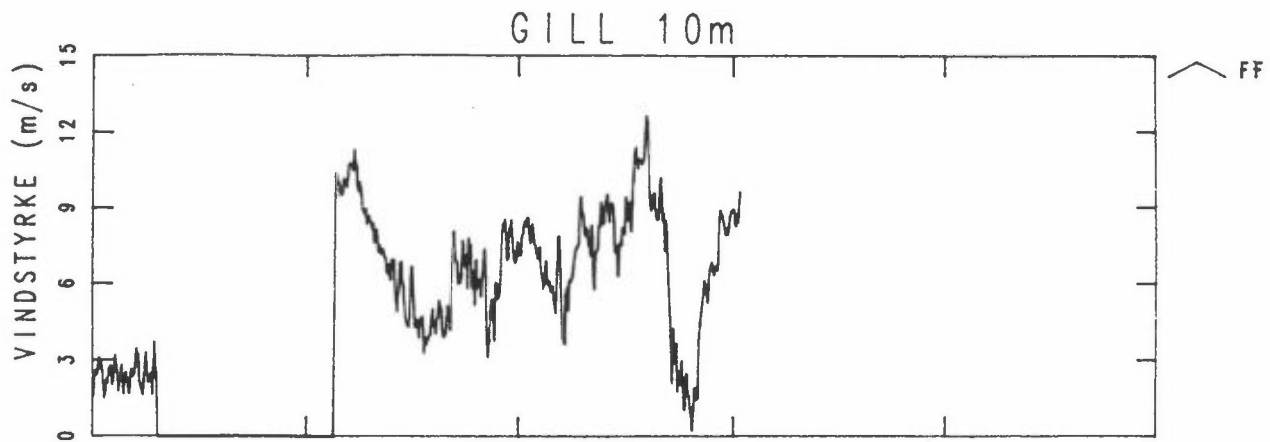
GILL 36m





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VEDLEGG B

Tabeller over vindretningsfordelte middelverdier

VEDLEGG B: Tabeller over vindretningsfordelte middelveier

Tabell B1: Prosentvis forekomst av vindstyrke og vindkast målt med Aanderaalogger 36 m høyde, fordelt på vindstyrkeklasser. Måleperiode 12.12.89-3003.90. Antall observasjoner 15491.

Klasse m/s	Forekomst av vindstyrker (%)	Forekomst av vindkast (%)
0 - 1	5,73	0,98
1 - 2	12,16	5,49
2 - 3	13,34	12,36
3 - 4	10,18	10,78
4 - 5	8,77	8,60
5 - 6	8,13	8,31
6 - 7	8,07	5,74
7 - 8	7,06	6,59
8 - 9	6,15	8,77
9 - 10	6,10	5,84
10 - 11	4,96	5,77
11 - 12	3,73	6,96
12 - 13	2,36	4,07
13 - 14	1,21	3,26
14 - 15	0,78	3,04
15 - 16	0,33	1,28
16 - 17	0,21	0,79
17 - 18	0,08	0,73
18 - 19	0,01	0,28
19 - 20	0,01	0,19
20 - 21	0,01	0,08
21 - 22	0,00	0,03
22 - 23	0,00	0,05
23 - 24	0,00	0,00
24 - 25	0,00	0,01

Tabell B2: Retningsfordelinger fra Aanderaaloggeren i 36 m høyde. Måleperiode 12.12.89 - 30.3.90. Turbulensdata fra Gillmåler i 36 m høyde.

Vindretnings- klasse (dekagrader)	Retningsfordeling (%)			Midlere vind- styrke	Midlere vindkast	Midlere vertikal hastigh.	Midlere vertikal vindkast	σ_L	σ_T	σ_W
	(1)	(2)	(3)					U	U	U
1	2,04	1,27	1,40	1,7	3,3	0,19	1,82	0,25	0,26	0,15
2	1,34	0,75	0,81	1,7	3,0	0,10	1,16	0,48	0,40	0,18
3	1,07	0,74	0,84	2,0	3,1	0,13	1,37	0,41	0,41	0,21
4	0,88	0,61	0,68	2,2	3,3	0,12	1,26	0,25	0,22	0,16
5	0,74	0,73	0,84	1,9	2,9	0,11	1,23	0,45	0,37	0,24
6	0,63	0,65	0,75	1,8	2,8	0,07	1,13	0,48	0,32	0,20
7	0,38	0,39	0,43	2,5	3,8	0,08	1,47	0,40	0,34	0,19
8	0,53	0,46	0,53	2,3	3,4	0,10	1,18	0,45	0,63	0,30
9	0,75	0,65	0,71	3,0	4,5	0,10	1,32	0,40	0,34	0,16
10	0,91	0,78	0,82	3,0	4,5	0,08	1,48	0,78	0,75	0,21
11	1,14	0,96	0,99	3,6	5,0	0,10	1,08	0,34	0,27	0,11
12	1,32	1,08	1,12	3,6	5,1	0,11	1,14	0,30	0,25	0,11
13	1,41	1,20	1,18	3,9	5,4	0,15	1,26	0,24	0,25	0,10
14	2,20	2,20	2,11	4,1	5,4	0,18	1,28	0,22	0,21	0,11
15	4,20	4,79	4,27	4,7	6,0	0,21	1,35	0,21	0,18	0,09
16	5,79	6,61	6,06	6,2	7,5	0,29	1,59	0,13	0,11	0,07
17	11,53	13,48	11,65	8,3	9,8	0,34	1,76	0,10	0,10	0,05
18	11,09	12,89	10,67	8,9	10,5	0,36	1,90	0,11	0,12	0,05
19	7,66	8,78	8,28	8,4	10,0	0,29	1,87	0,10	0,10	0,06
20	4,91	5,95	6,53	6,9	8,7	0,24	2,03	0,13	0,11	0,07
21	3,02	3,65	4,13	6,3	8,4	0,18	2,10	0,15	0,13	0,09
22	1,74	2,10	2,36	5,3	7,6	0,16	2,12	0,20	0,20	0,12
23	1,27	1,46	1,67	4,7	7,2	0,11	2,40	0,31	0,30	0,15
24	1,03	1,27	1,46	5,5	8,6	0,10	2,89	0,28	0,27	0,15
25	1,26	1,56	1,78	5,3	8,5	0,12	3,05	0,30	0,25	0,15
26	1,09	1,32	1,45	4,8	7,7	0,11	2,89	0,32	0,30	0,16
27	1,08	1,26	1,43	5,1	8,0	0,10	2,90	0,30	0,28	0,15
28	1,78	1,71	1,90	4,6	6,9	0,13	2,74	0,31	0,31	0,14
29	3,49	2,25	2,58	3,6	5,1	0,14	2,03	0,22	0,20	0,12
30	4,78	3,07	3,45	3,8	5,1	0,18	2,11	0,20	0,19	0,11
31	4,59	3,89	4,23	4,4	5,7	0,23	2,18	0,23	0,21	0,11
32	3,23	2,98	3,38	4,2	5,8	0,23	2,13	0,21	0,21	0,11
33	2,85	2,51	2,80	3,4	5,0	0,17	1,98	0,20	0,17	0,10
34	3,14	2,40	2,69	3,5	5,2	0,19	1,76	0,20	0,16	0,10
35	2,93	2,29	2,55	3,1	4,9	0,19	1,69	0,22	0,19	0,11
36	2,21	1,30	1,47	1,9	3,7	0,20	1,82	0,19	0,19	0,13

- (1) Retningsfordeling med alle data.
- (2) Retningsfordeling der det foreligger horisontale turbulensdata fra Gill 1.
- (3) Retningsfordeling der det foreligger vertikale data fra Gill 1.

Tabell B3: Retningsfordeling fra Gillmåler i 36 m høyde. Måleperiode 12.12.89 - 30.3.90. Antall observasjoner - horisontale parametre 11418, vertikale parametre 10228.

Vindretnings- klasse (dekagrader)	Retningsfordeling (%)		Midlere vind- styrke	Midlere vindkast	Midlere vertikal hastigh.	Midlere vertikal vindkast	σ_L	σ_T	σ_W
	(1)	(2)					U	U	U
1	1,16	1,28	2,4	3,6	0,11	1,12	0,25	0,22	0,14
2	0,54	0,61	2,0	3,4	0,13	1,08	0,30	0,25	0,16
3	0,58	0,66	2,1	5,5	0,11	1,11	0,55	0,43	0,22
4	0,45	0,52	2,2	3,4	0,10	1,24	0,27	0,27	0,19
5	0,56	0,62	2,3	4,9	0,08	1,47	0,41	0,42	0,20
6	0,59	0,68	2,2	6,8	0,10	1,40	0,41	0,45	0,20
7	0,34	0,38	2,1	4,4	0,11	1,29	0,39	0,38	0,17
8	0,38	0,43	2,1	4,3	0,14	1,16	0,31	0,30	0,16
9	0,45	0,49	2,3	4,4	0,12	1,19	0,40	0,41	0,19
10	0,55	0,54	2,8	5,2	0,09	1,22	0,31	0,26	0,15
11	1,02	1,10	3,0	6,1	0,10	1,27	0,23	0,20	0,12
12	0,96	1,03	3,4	5,1	0,13	1,11	0,22	0,20	0,10
13	1,02	0,90	3,3	7,2	0,12	1,20	0,37	0,40	0,11
14	1,47	1,42	3,5	5,9	0,14	1,21	0,24	0,23	0,11
15	2,51	2,28	4,8	6,8	0,25	1,54	0,19	0,17	0,09
16	6,16	5,52	5,8	7,7	0,26	1,71	0,17	0,14	0,08
17	12,91	12,08	7,8	9,9	0,33	1,64	0,11	0,10	0,05
18	16,14	14,63	8,5	10,8	0,34	1,81	0,11	0,10	0,05
19	10,69	10,21	8,4	10,6	0,27	1,89	0,11	0,11	0,06
20	6,55	6,40	7,6	10,4	0,21	2,02	0,14	0,14	0,08
21	3,07	2,94	6,5	10,0	0,18	2,18	0,18	0,19	0,10
22	1,66	1,62	5,7	10,2	0,16	2,29	0,25	0,25	0,13
23	1,14	1,16	4,6	8,9	0,12	2,42	0,49	0,49	0,23
24	1,19	1,33	4,8	10,5	0,12	2,59	0,39	0,34	0,16
25	1,79	2,02	5,9	10,9	0,12	2,94	0,32	0,30	0,16
26	1,51	1,63	6,0	12,1	0,10	3,22	0,40	0,30	0,17
27	1,69	1,74	5,5	13,3	0,11	2,92	0,42	0,32	0,17
28	1,36	1,52	4,4	8,0	0,10	2,72	0,27	0,27	0,13
29	2,15	2,46	4,6	7,3	0,15	2,27	0,21	0,20	0,11
30	2,58	2,88	4,5	6,7	0,22	2,08	0,21	0,19	0,10
31	3,48	3,97	4,4	6,3	0,22	2,04	0,19	0,19	0,10
32	3,63	4,07	4,3	6,3	0,20	2,03	0,23	0,23	0,12
33	3,18	3,56	3,9	5,9	0,18	2,00	0,20	0,19	0,11
34	3,07	3,47	4,3	6,3	0,20	1,99	0,20	0,18	0,12
35	2,12	2,35	4,3	6,3	0,20	1,80	0,20	0,19	0,11
36	1,37	1,50	2,9	4,3	0,14	1,49	0,29	0,35	0,18

(1) Retningsfordeling basert på 11418 observasjoner

(2) Retningsfordeling basert på 10228 observasjoner

Tabell B4: Retningsfordeling fra Gillmåler i 10 m høyde i 36 m mast. Måleperiode 12.12.89 - 30.3.90. Antall observasjoner - horisontale parametre 14605, vertikale parametre 14540.

Vindretnings- klasse (dekagrader)	Retningsfordeling (%)		Midlere vind- styrke	Midlere vindkast	Midlere vertikal hastigh.	Midlere vertikal vindkast	σ_L	σ_T	σ_W
	(1)	(2)					U	U	U
1	2,59	2,59	2,4	3,6	0,14	0,86	0,21	0,18	0,09
2	1,34	1,32	2,2	3,4	0,12	0,83	0,27	0,23	0,11
3	0,81	0,81	2,0	3,2	0,11	0,90	0,31	0,28	0,14
4	0,47	0,47	1,8	3,1	0,11	0,95	0,37	0,35	0,16
5	0,51	0,51	1,8	3,1	0,11	0,93	0,37	0,37	0,17
6	0,45	0,45	1,9	3,4	0,12	0,94	0,39	0,35	0,16
7	0,43	0,43	1,9	3,5	0,14	1,12	0,45	0,44	0,19
8	0,55	0,55	2,5	4,3	0,27	1,78	0,31	0,27	0,15
9	0,90	0,90	2,6	4,1	0,16	1,33	0,35	0,28	0,20
10	1,18	1,18	3,2	5,1	0,22	1,21	0,20	0,17	0,11
11	1,10	1,10	3,7	5,8	0,29	1,24	0,23	0,19	0,09
12	1,27	1,27	3,8	5,8	0,32	1,23	0,22	0,20	0,10
13	1,05	1,05	3,5	5,1	0,28	1,09	0,29	0,29	0,12
14	1,20	1,20	3,7	5,4	0,27	1,06	0,24	0,24	0,09
15	2,58	2,59	5,0	6,7	0,36	1,17	0,15	0,13	0,06
16	4,77	4,79	5,7	7,3	0,33	1,11	0,13	0,11	0,05
17	10,24	10,19	7,4	9,3	0,39	1,25	0,10	0,08	0,04
18	13,89	13,85	8,3	10,6	0,39	1,43	0,11	0,09	0,04
19	11,45	11,46	7,9	10,1	0,29	1,44	0,11	0,08	0,05
20	5,22	5,23	6,5	8,9	0,18	1,44	0,13	0,11	0,06
21	2,01	2,00	5,3	7,8	0,07	1,43	0,20	0,19	0,08
22	1,21	1,21	4,7	7,4	0,04	1,57	0,24	0,23	0,10
23	0,80	0,80	3,9	7,0	0,02	1,51	0,33	0,33	0,12
24	0,63	0,63	3,5	6,6	0,02	1,60	0,38	0,37	0,14
25	1,36	1,36	4,7	8,5	0,02	1,94	0,32	0,29	0,12
26	1,35	1,35	4,5	8,9	0,01	2,21	0,31	0,25	0,13
27	1,66	1,66	4,0	8,0	0,04	1,93	0,32	0,25	0,14
28	2,33	2,33	3,3	5,4	0,06	1,13	0,23	0,17	0,09
29	4,68	2,69	3,4	4,9	0,06	0,95	0,18	0,15	0,08
30	3,68	3,69	3,5	5,0	0,09	0,96	0,18	0,16	0,08
31	2,84	2,85	4,0	5,8	0,17	1,13	0,20	0,19	0,08
32	2,49	2,50	4,2	6,3	0,22	1,27	0,21	0,21	0,09
33	2,57	2,57	3,7	5,5	0,18	1,14	0,22	0,21	0,09
34	3,90	3,89	4,2	6,1	0,19	1,15	0,17	0,16	0,08
35	3,27	3,27	3,6	5,1	0,19	1,04	0,19	0,17	0,08
36	3,25	3,25	2,7	3,8	0,13	0,92	0,20	0,19	0,10

(1) Retningsfordeling basert på 14605 observasjoner.

(2) Retningsfordeling basert på 14540 observasjoner

Tabell B5: Retningsfordeling fra Gillmåler i 10 m mast. Måleperiode 12.12.89 - 30.3.90. Antall observasjoner - horisontale parametre 15330, vertikale parametre 14813.

Vindretnings- klasse (dekagrader)	Retningsfordeling (%)		Midlere vind- styrke	Midlere vindkast	Midlere vertikal hastigh.	Midlere vertikal vindkast	σ_L	σ_T	σ_W
	(1)	(2)					U	U	U
1	2,93	2,99	2,6	3,6	0,13	0,73	0,20	0,16	0,08
2	1,40	1,62	2,2	3,3	0,12	0,72	0,27	0,22	0,10
3	0,93	0,95	2,1	3,3	0,11	0,80	0,30	0,28	0,12
4	0,67	0,69	1,9	3,1	0,10	0,83	0,35	0,34	0,14
5	0,64	0,67	1,8	3,3	0,10	1,08	0,40	0,40	0,18
6	0,51	0,52	1,9	3,4	0,09	0,91	0,39	0,36	0,15
7	0,44	0,45	2,2	3,8	0,11	0,91	0,41	0,32	0,13
8	0,57	0,59	2,4	3,8	0,10	0,93	0,31	0,27	0,12
9	0,95	0,98	3,0	4,7	0,11	1,54	0,33	0,29	0,17
10	1,49	1,52	3,1	4,5	0,09	1,22	0,20	0,15	0,10
11	1,43	1,47	3,5	5,3	0,11	1,06	0,20	0,17	0,09
12	1,26	1,28	3,3	5,0	0,10	1,39	0,25	0,22	0,11
13	1,22	1,23	3,3	4,9	0,09	0,97	0,24	0,24	0,09
14	1,56	1,60	3,7	5,2	0,09	0,99	0,21	0,20	0,08
15	3,15	3,25	4,8	6,5	0,10	1,08	0,18	0,17	0,10
16	5,69	5,85	6,1	7,8	0,12	0,97	0,13	0,10	0,04
17	12,29	12,65	7,5	9,4	0,13	1,02	0,10	0,08	0,04
18	13,29	13,32	8,2	10,3	0,10	1,07	0,10	0,09	0,04
19	8,81	8,81	7,0	9,2	0,07	1,04	0,12	0,09	0,04
20	3,87	3,96	6,1	8,5	0,04	1,26	0,15	0,13	0,06
21	1,56	1,60	4,5	7,1	0,03	1,38	0,28	0,28	0,16
22	1,10	1,14	4,3	7,3	0,02	1,48	0,27	0,27	0,10
23	0,73	0,73	3,7	6,5	0,03	1,38	0,31	0,31	0,11
24	1,09	1,11	4,6	8,3	0,03	1,73	0,31	0,29	0,11
25	1,31	1,35	4,8	9,1	0,03	2,03	0,30	0,28	0,12
26	1,35	1,37	4,4	8,5	0,05	2,23	0,34	0,31	0,17
27	1,34	1,36	4,0	7,0	0,05	1,52	0,31	0,31	0,13
28	2,06	1,99	3,3	5,3	0,06	0,98	0,21	0,18	0,08
29	3,84	3,71	3,2	4,7	0,08	0,81	0,18	0,16	0,08
30	4,46	4,37	3,3	4,6	0,10	0,81	0,18	0,16	0,07
31	3,32	3,30	3,7	5,3	0,15	0,98	0,20	0,20	0,08
32	2,41	2,32	3,7	5,5	0,18	1,02	0,21	0,21	0,08
33	2,39	2,17	3,5	5,3	0,17	1,17	0,21	0,20	0,08
34	3,56	3,09	4,1	5,9	0,19	1,15	0,18	0,16	0,08
35	3,04	2,85	3,4	4,9	0,17	0,90	0,22	0,20	0,08
36	3,15	3,15	2,5	3,7	0,12	0,76	0,21	0,19	0,08

(1) Retningsfordeling basert på 15338 observasjoner

(2) Retningsfordeling basert på 14813 observasjoner

VEDLEGG C

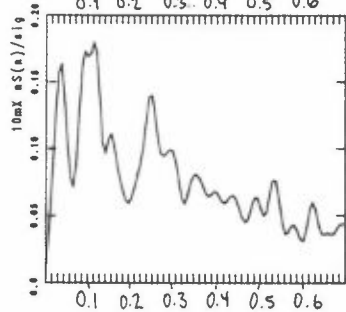
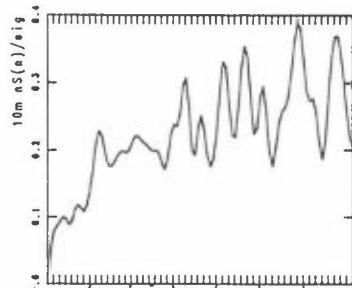
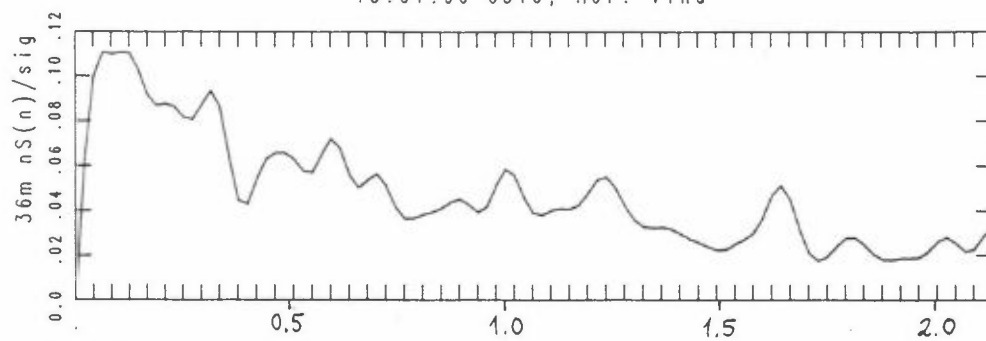
Plott av autospektra

Plottene viser $\frac{n}{\sigma_u^2} S\left(\frac{nz}{U}\right)$ der

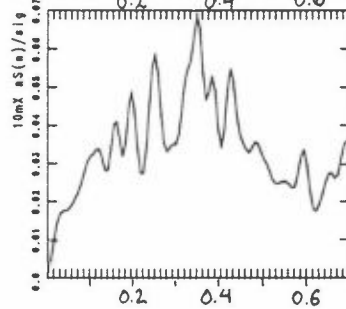
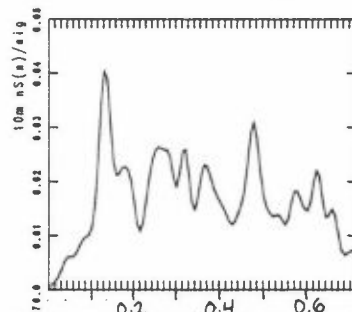
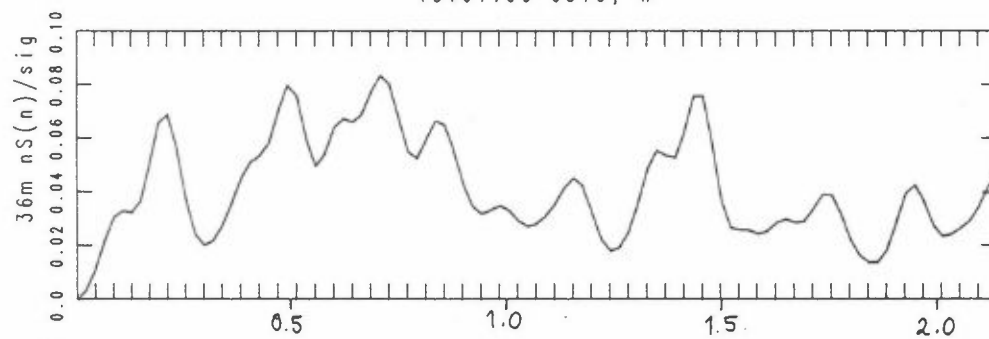
$$S(n) = 4 \sigma_u^2 \int_0^{\infty} R(\tau) \cos 2\pi \tau \, d\tau$$

- n : frekvens
- σ_u : Standardavvik av vindstyrke
- $R(\tau)$: Autokorrelasjon av vindstyrken for tidsforskjell τ
- U : Vindstyrke
- z : Målehøyde
- S : Spektraltetthetsfunksjonen

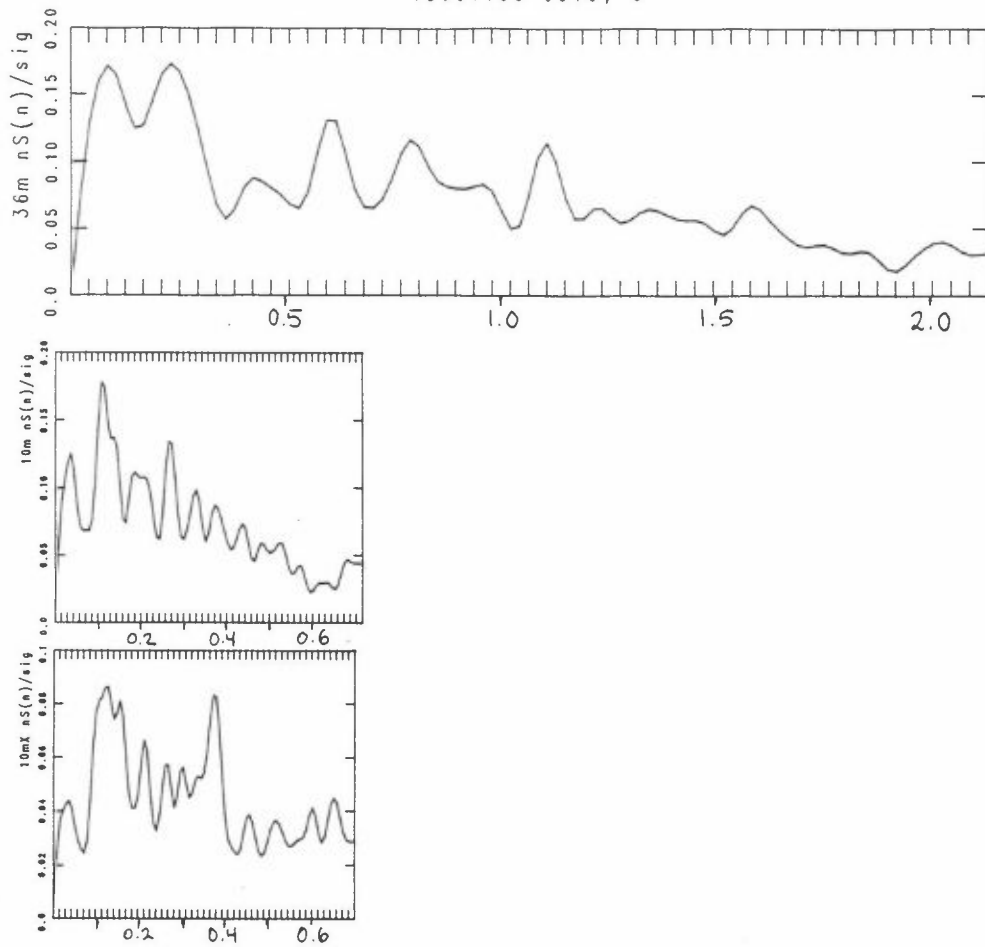
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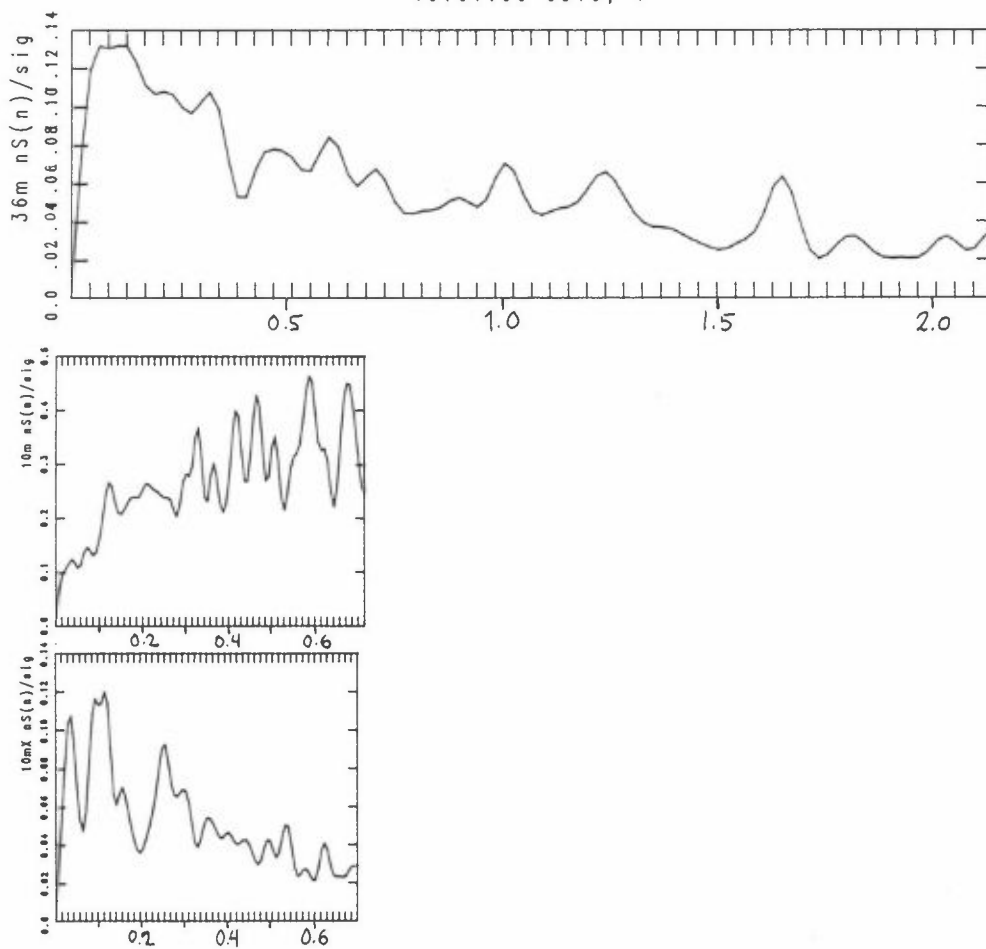
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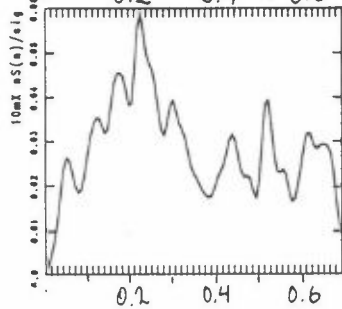
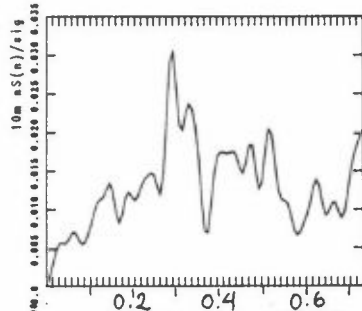
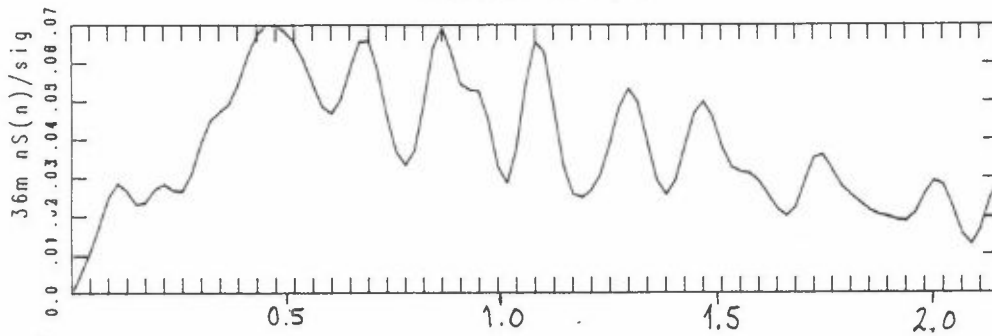
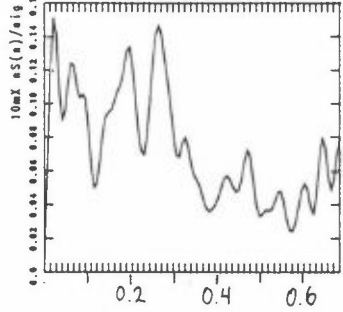
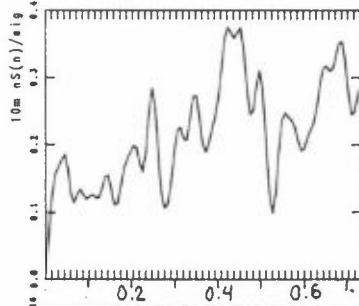
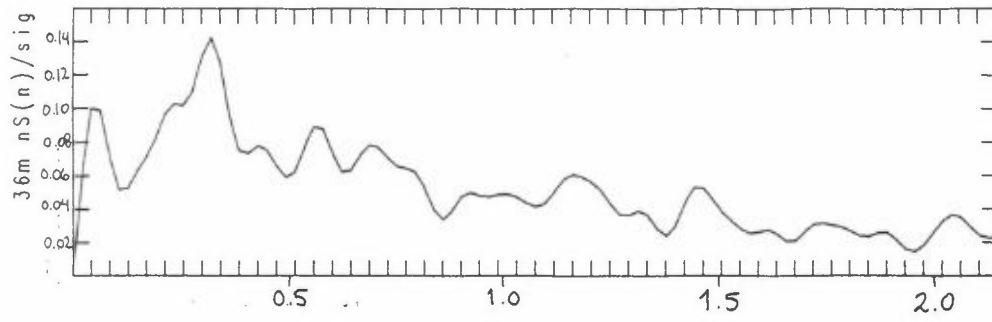


15.01.90 0510, U

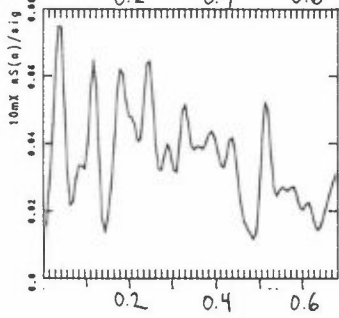
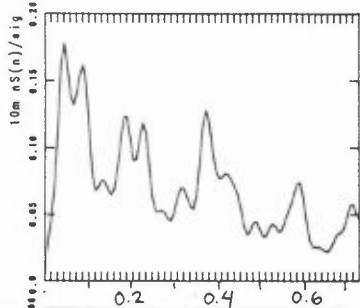
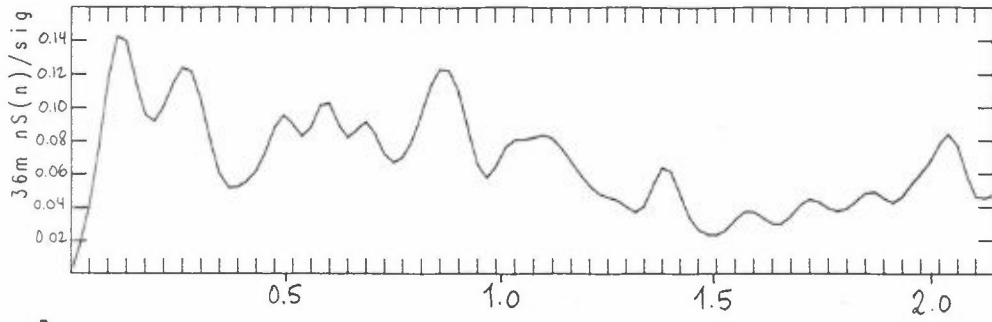


15.01.90 0510, V

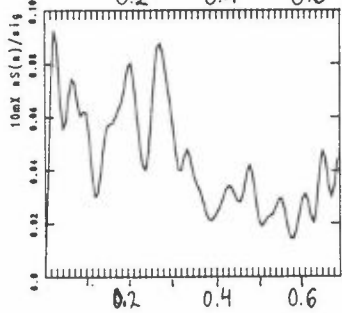
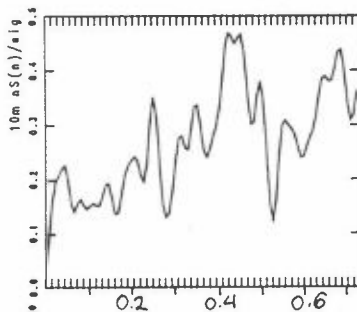
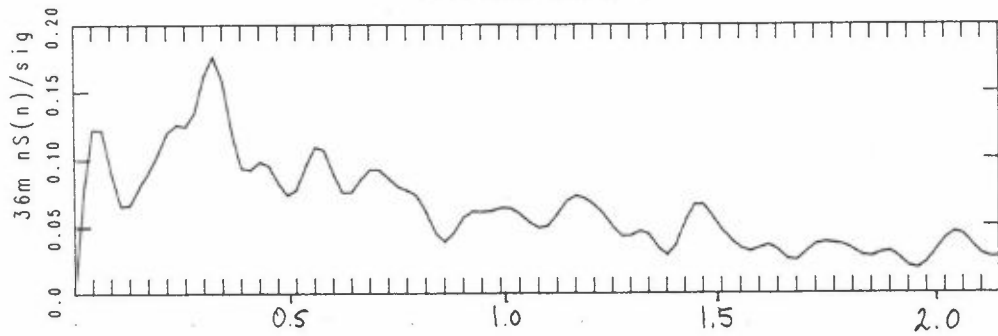


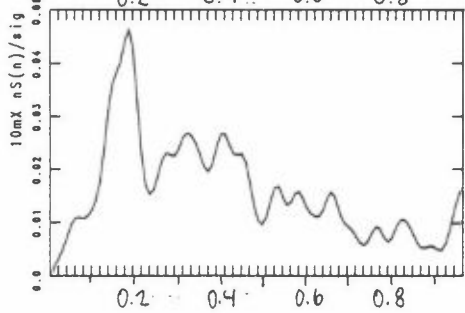
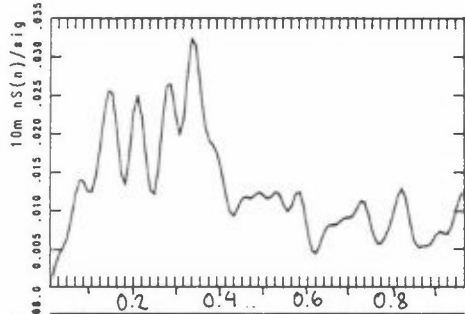
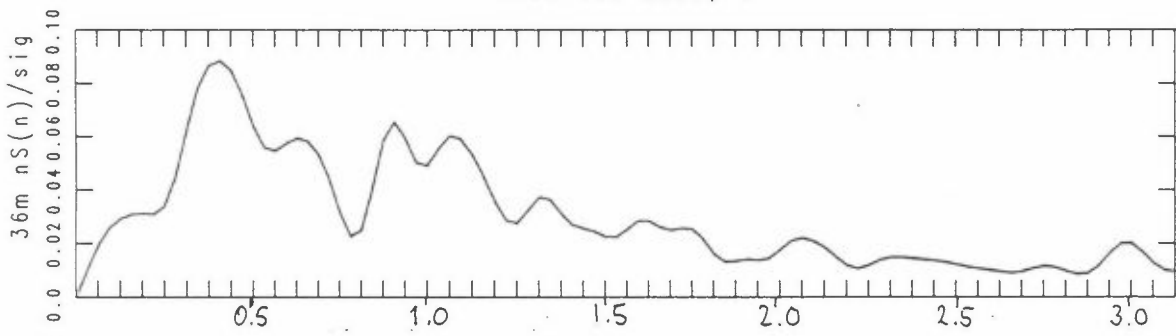
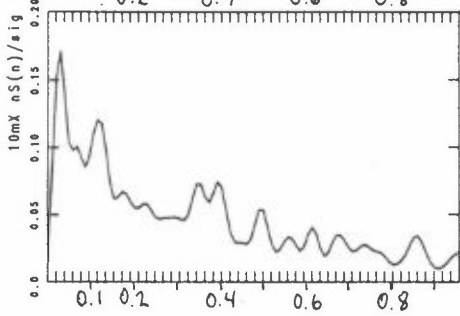
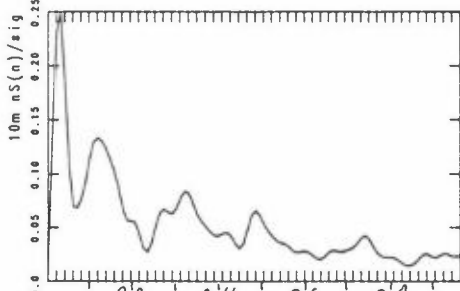
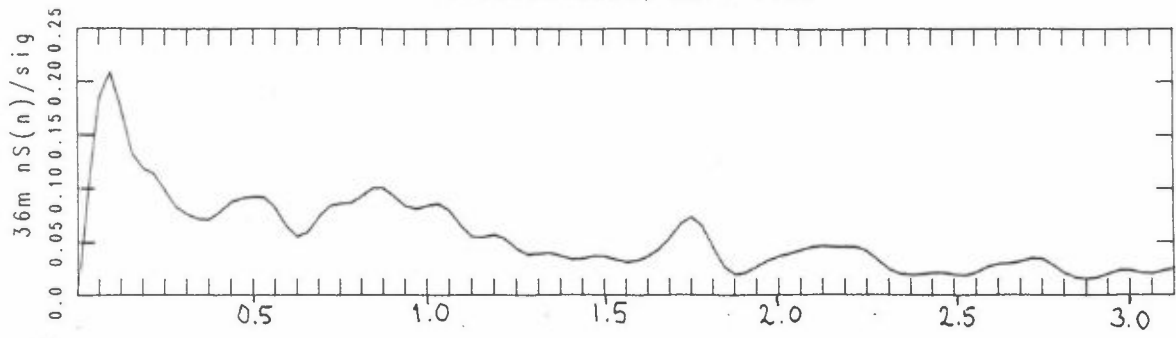


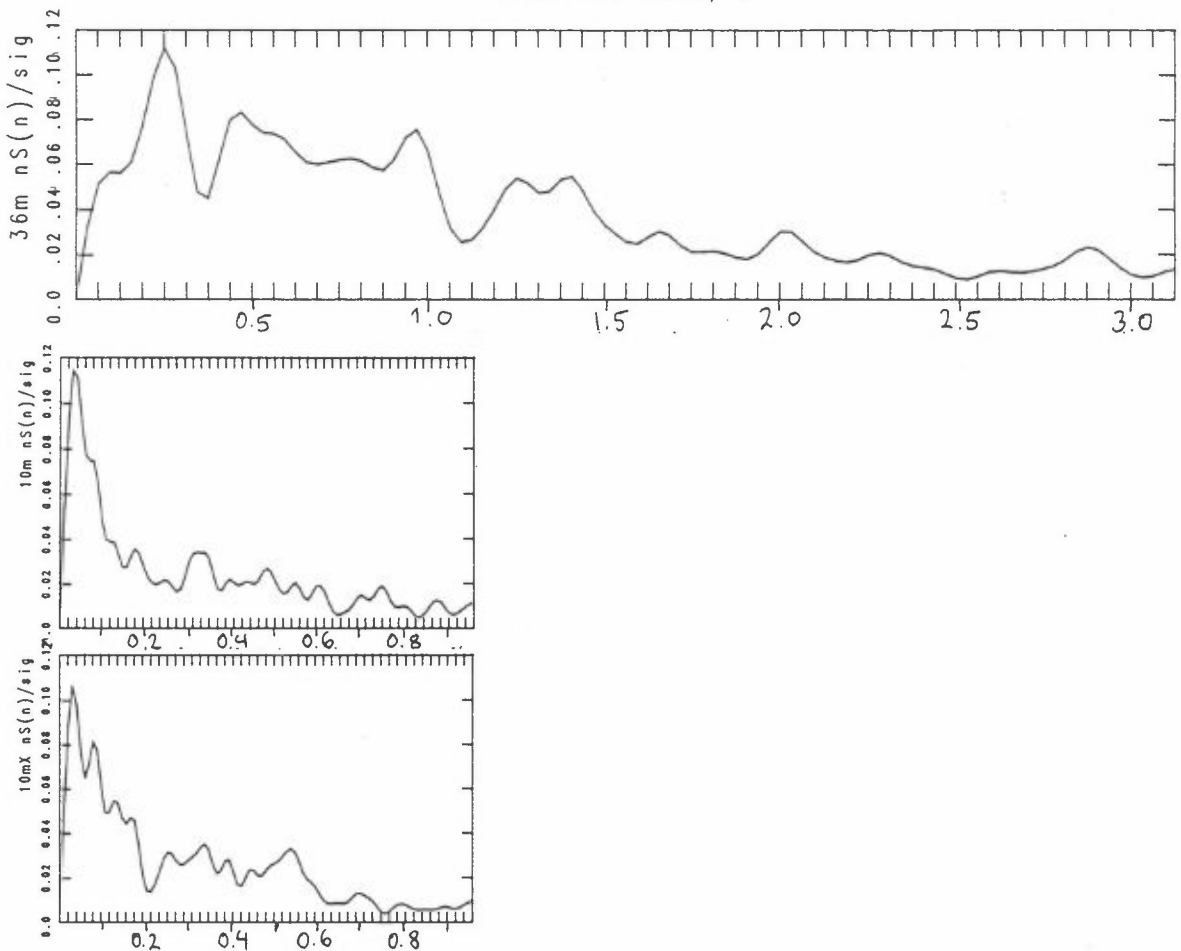
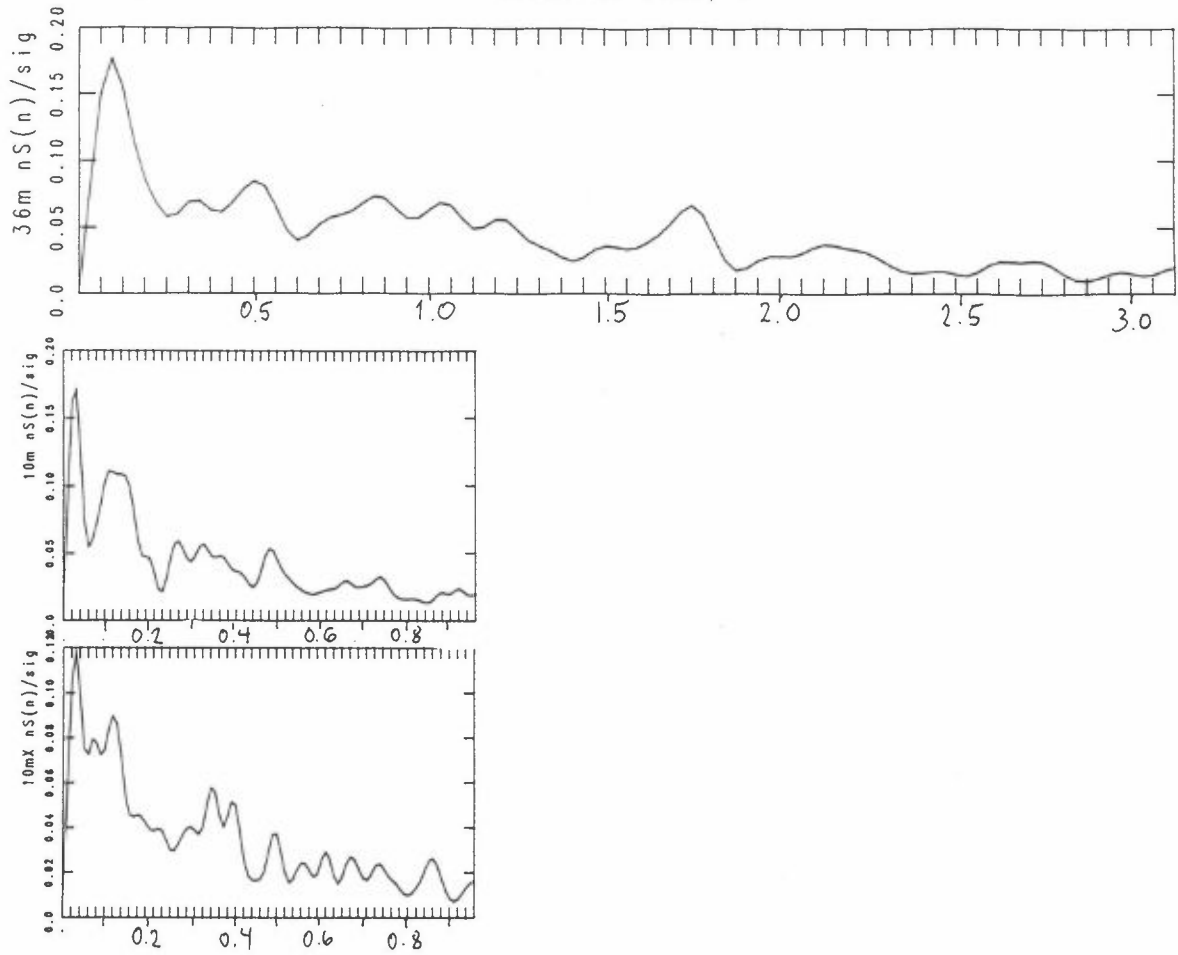
15.01.90 0520, U



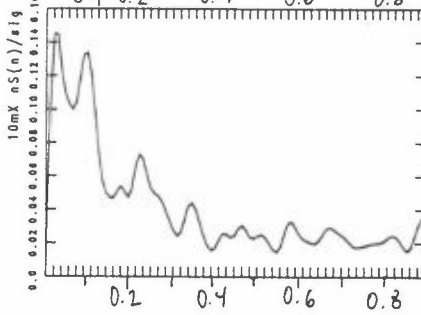
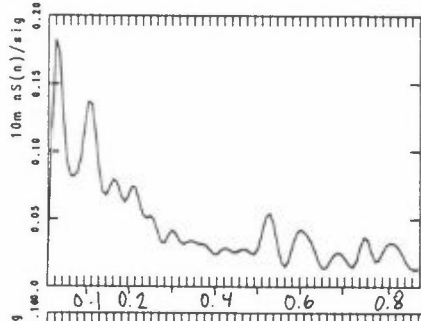
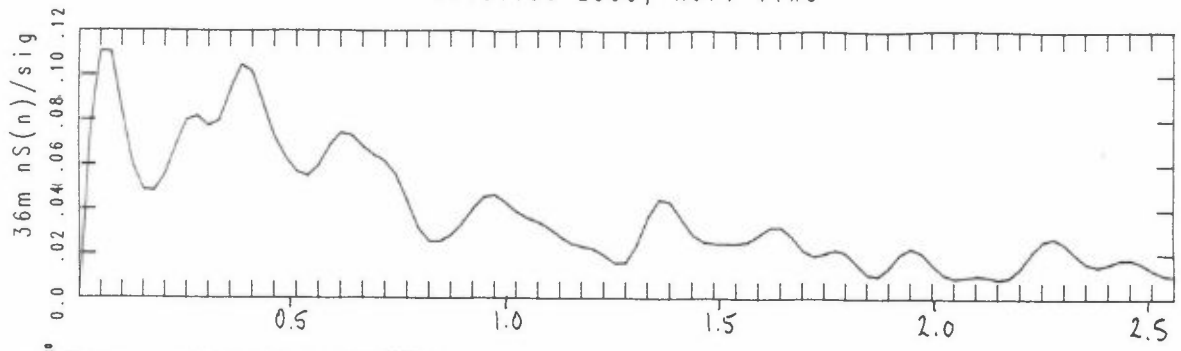
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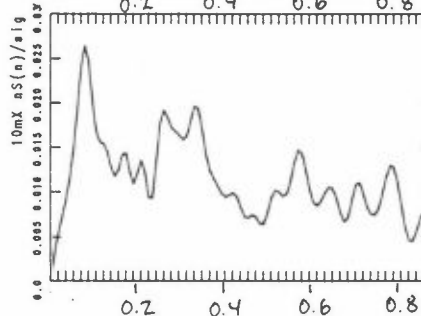
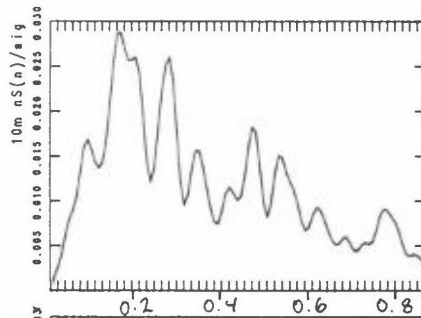
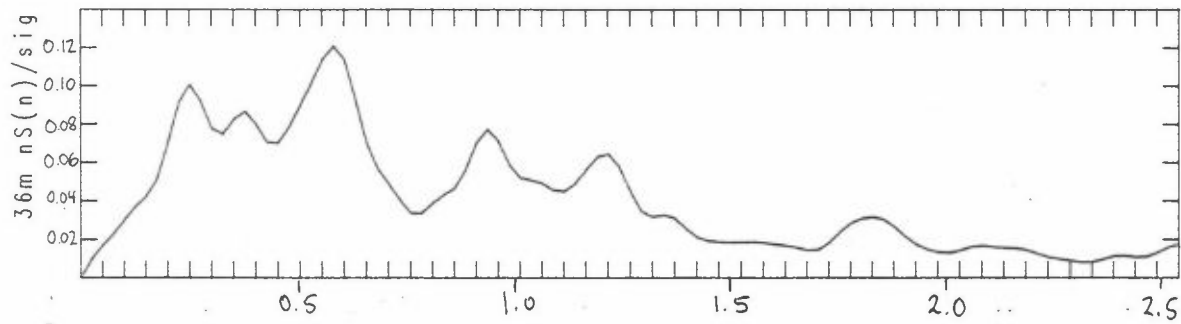


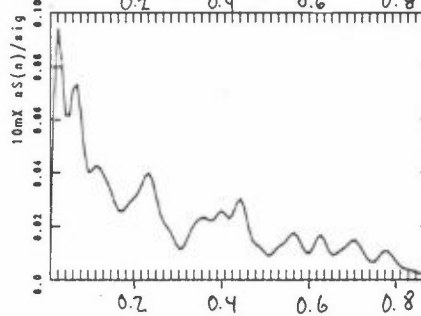
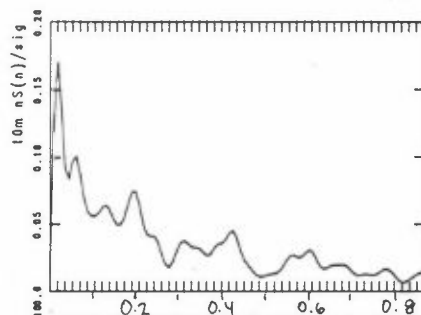
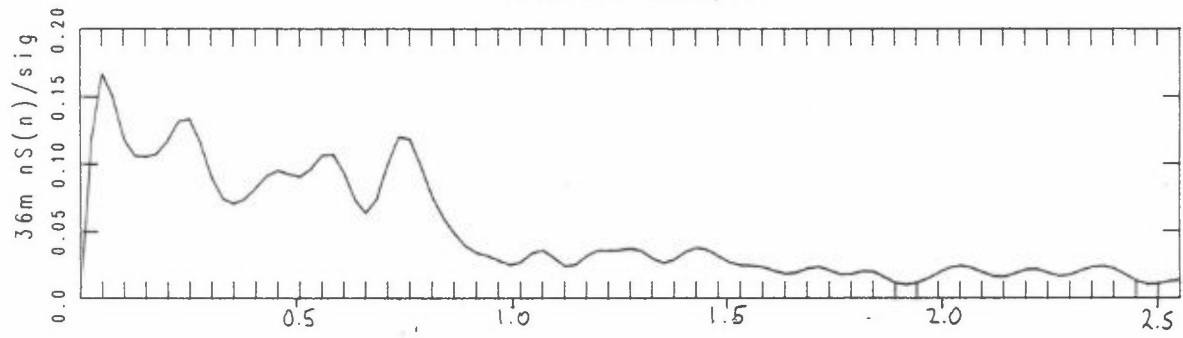
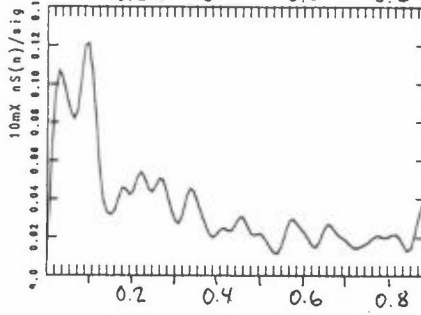
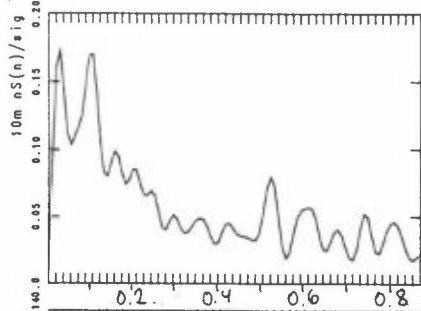
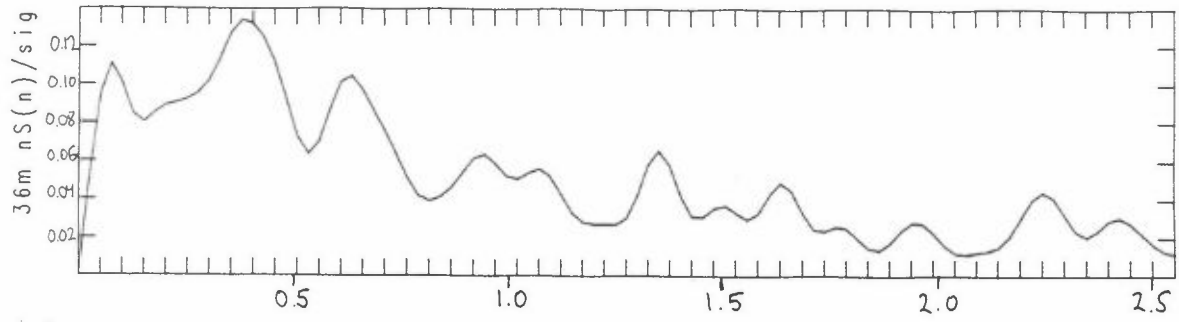


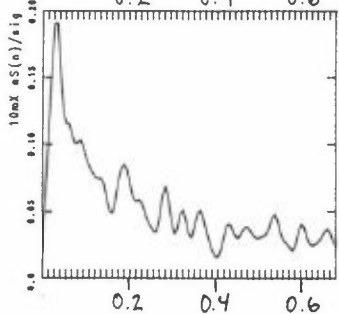
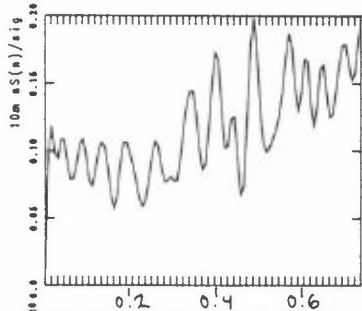
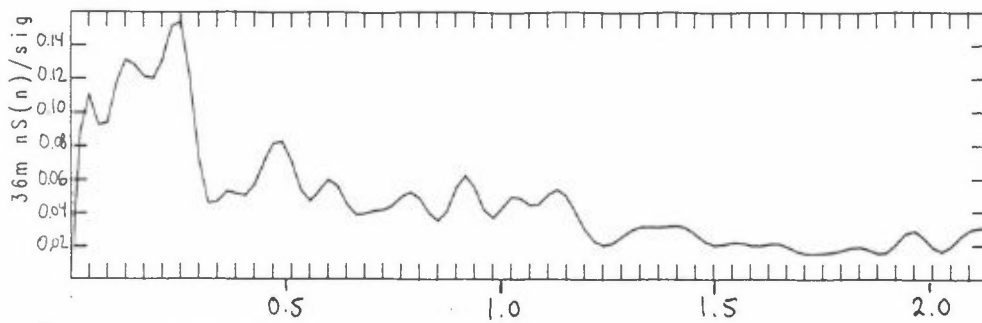
17.01.90 2300, Hor. vind



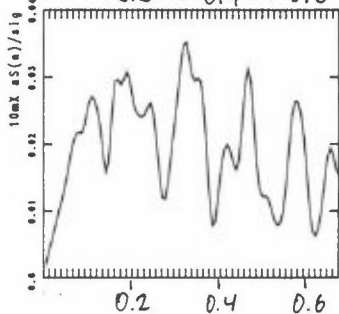
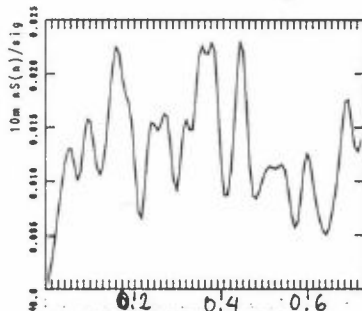
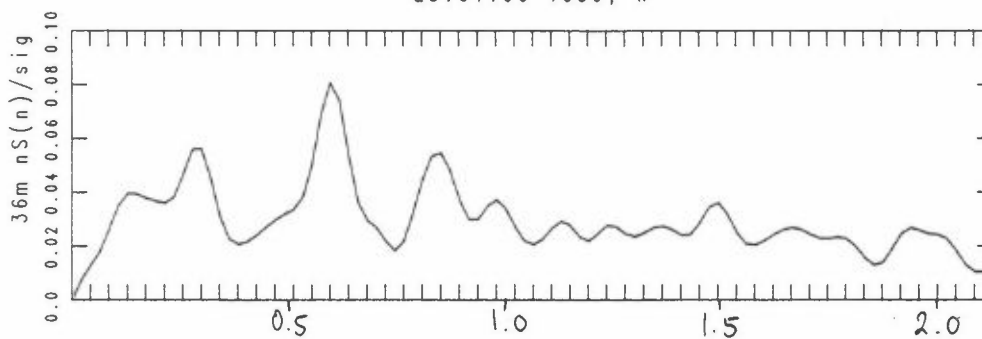
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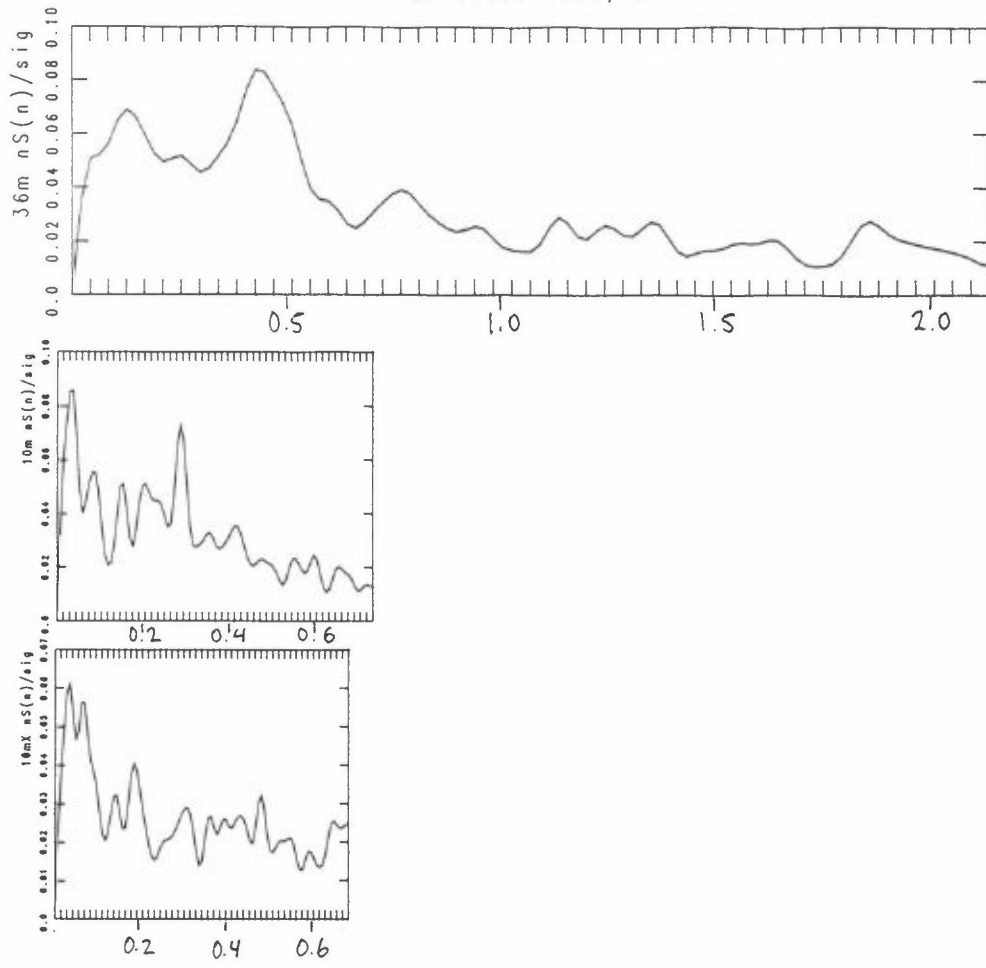




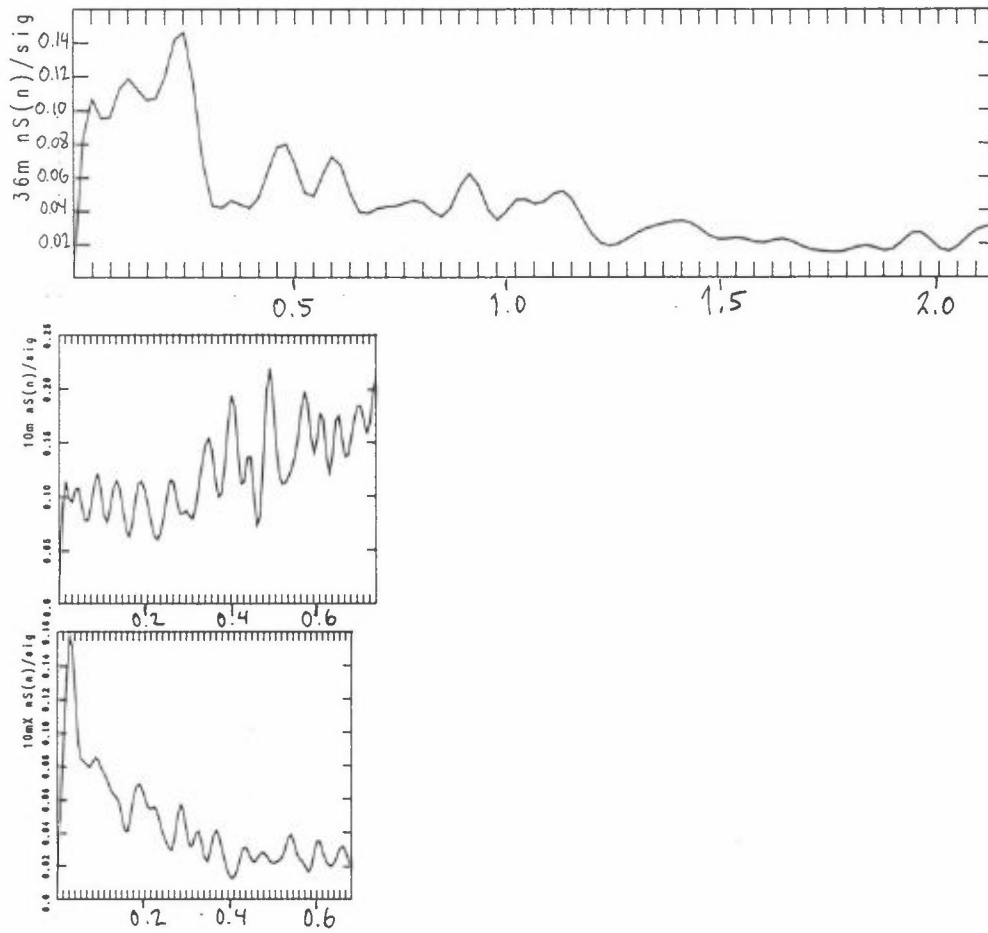
23.01.90 1550, W



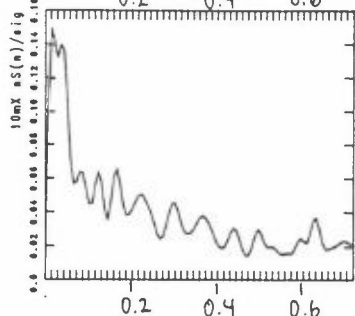
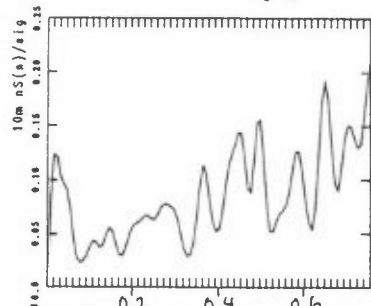
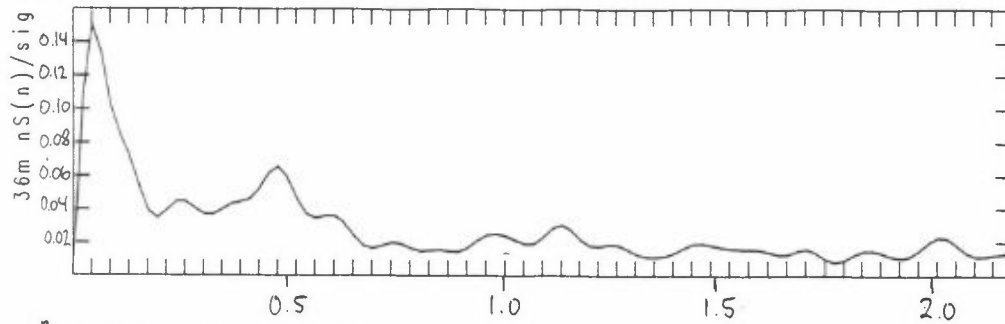
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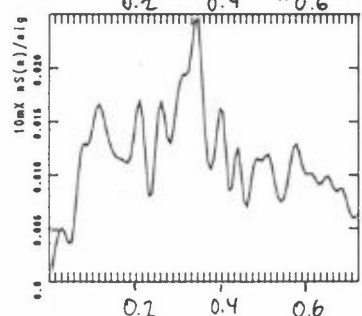
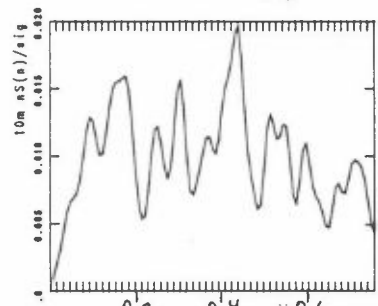
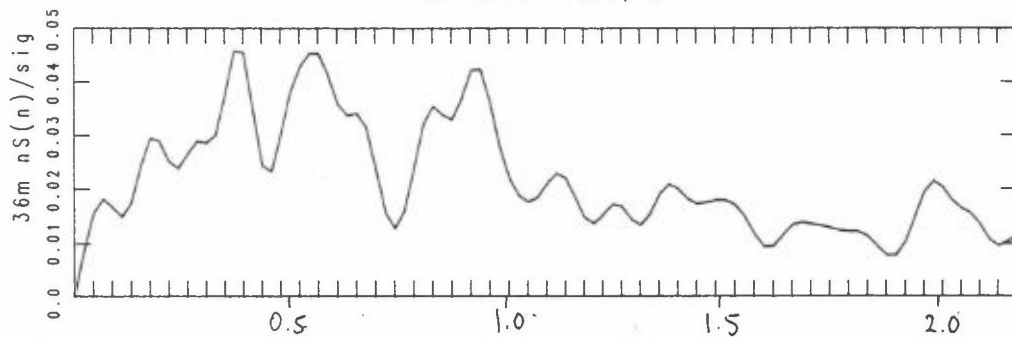
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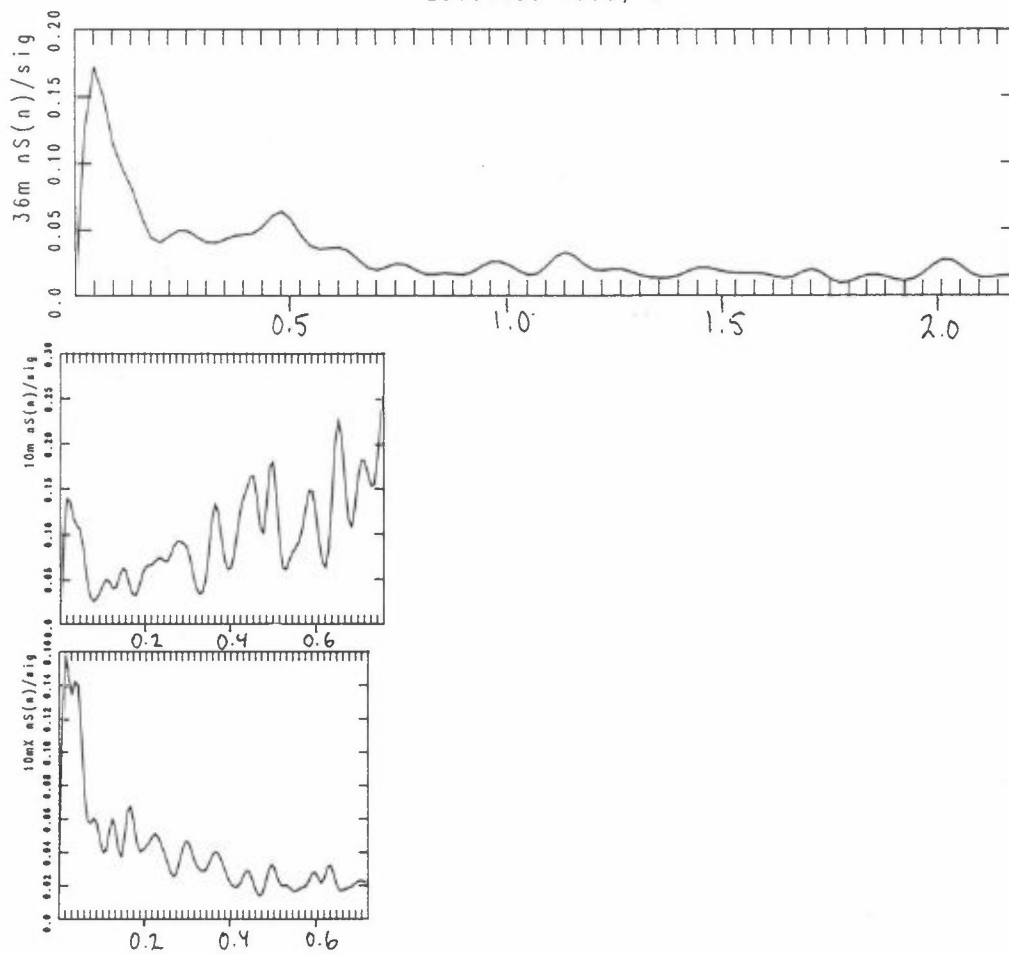
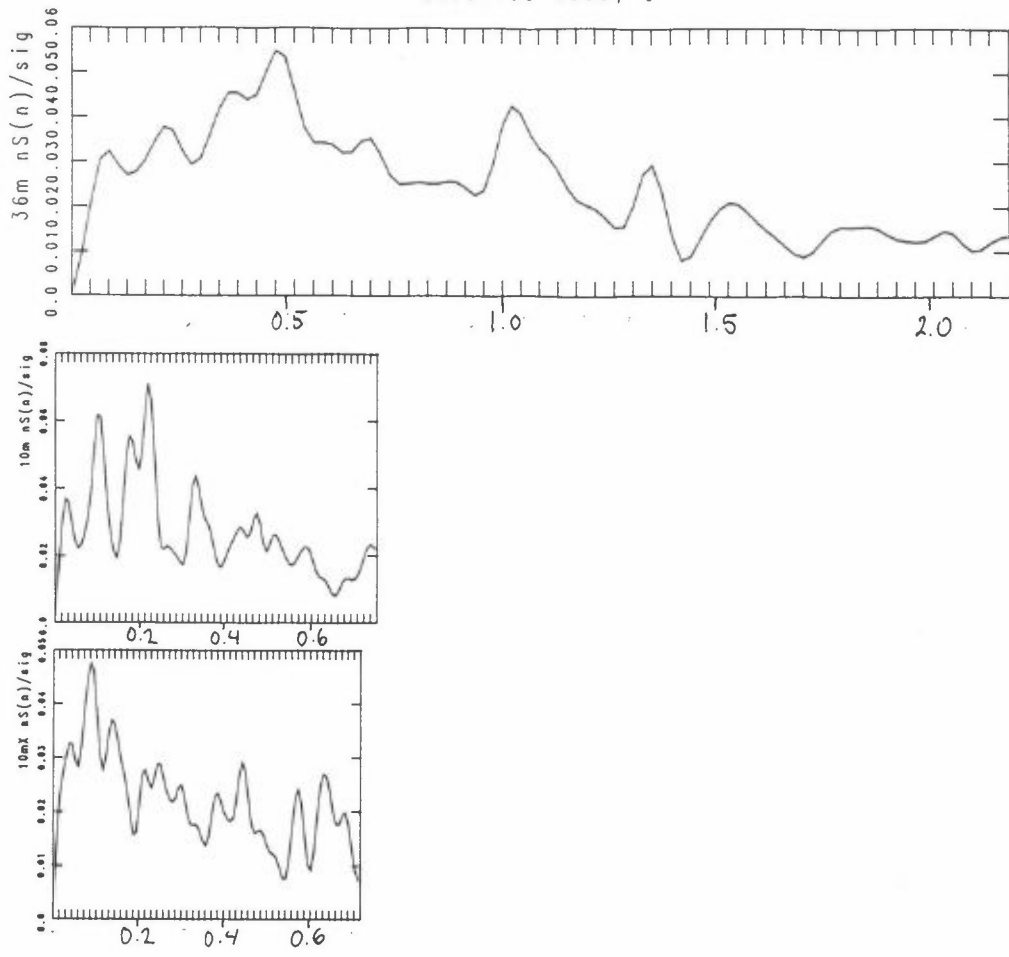


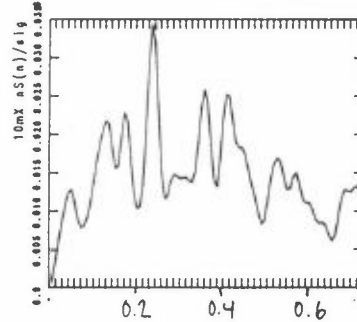
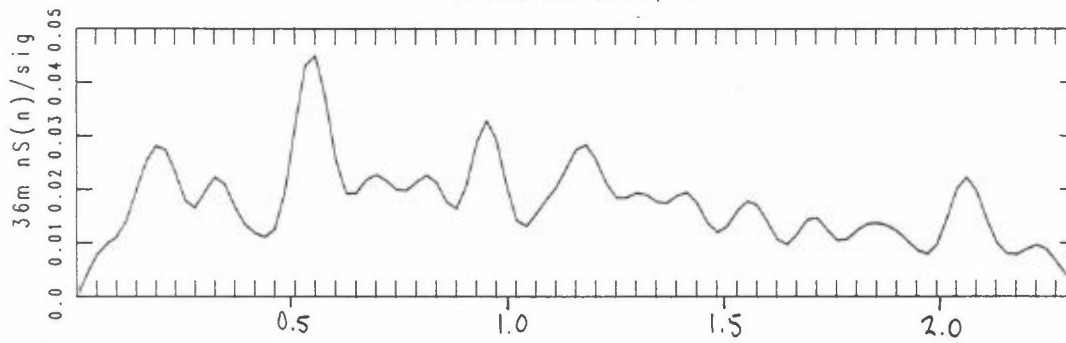
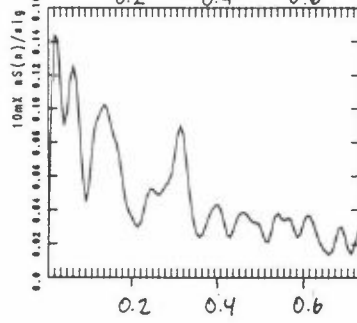
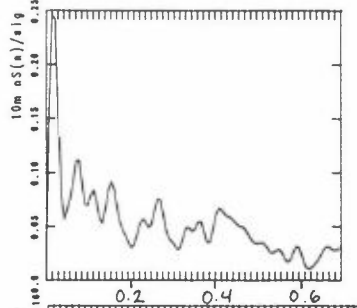
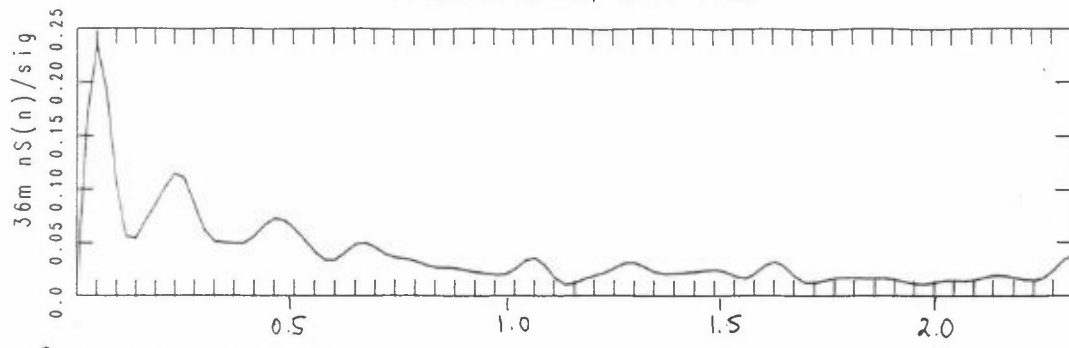
23.01.90 1600, Hor. vind

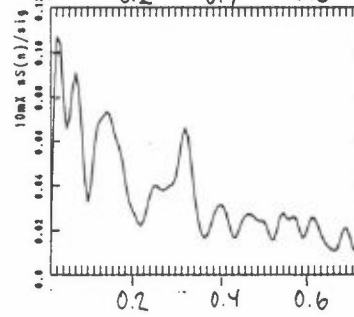
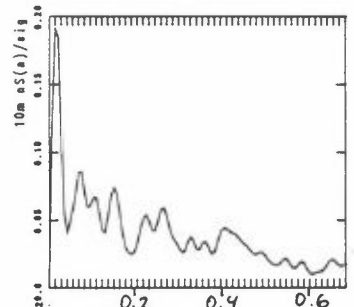
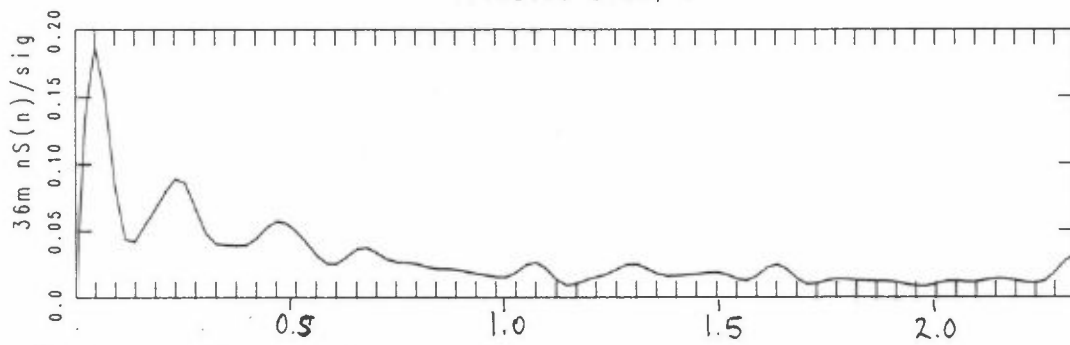
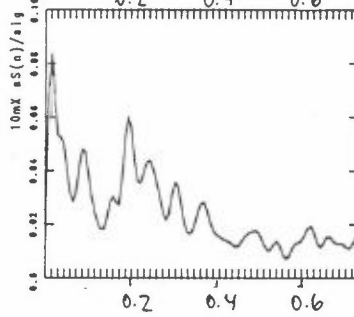
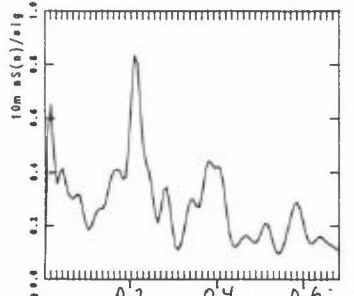
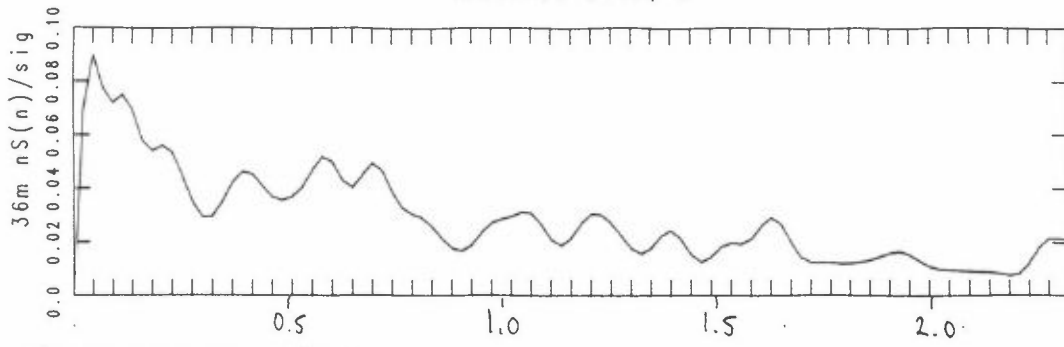


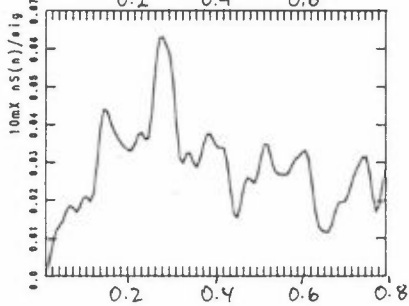
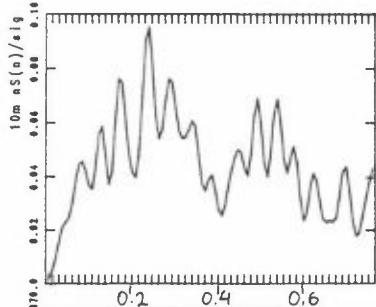
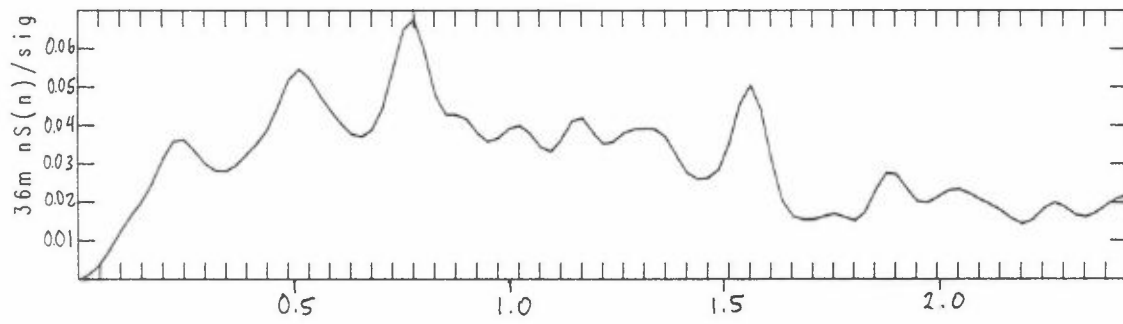
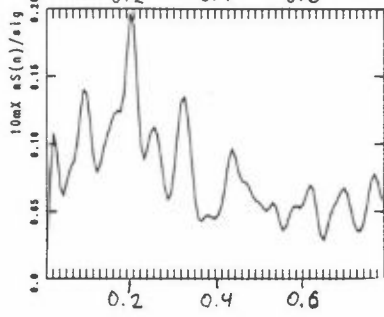
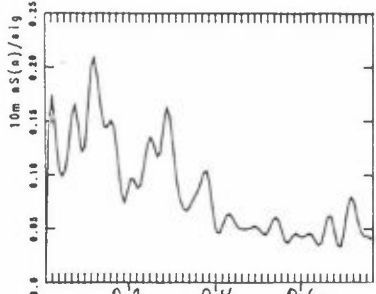
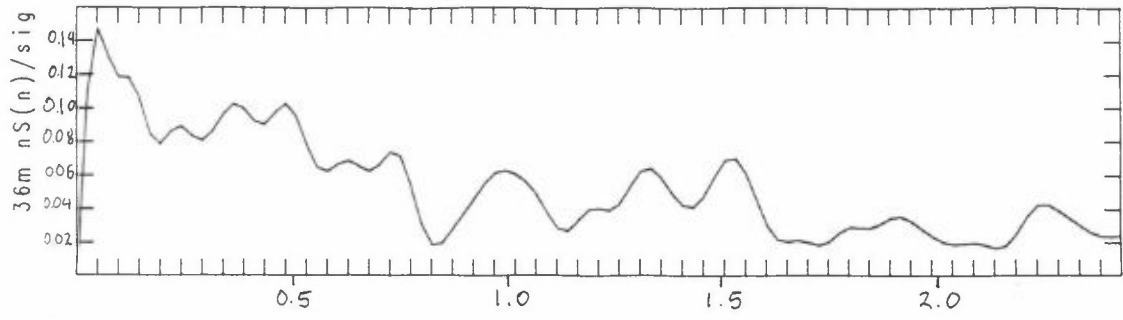
23.01.90 1600, W

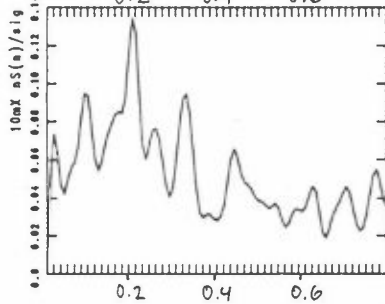
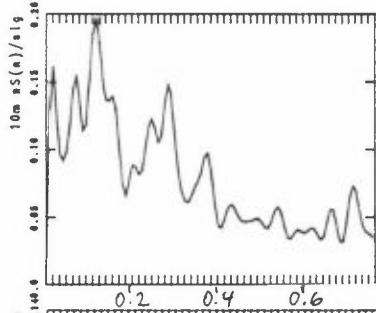
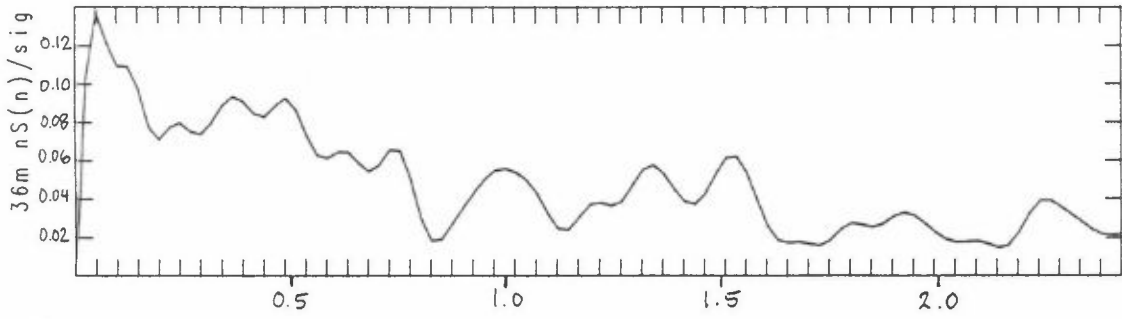
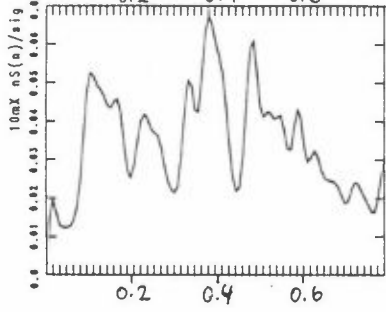
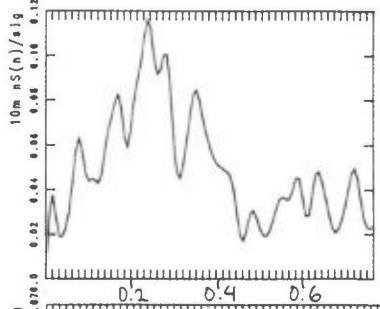
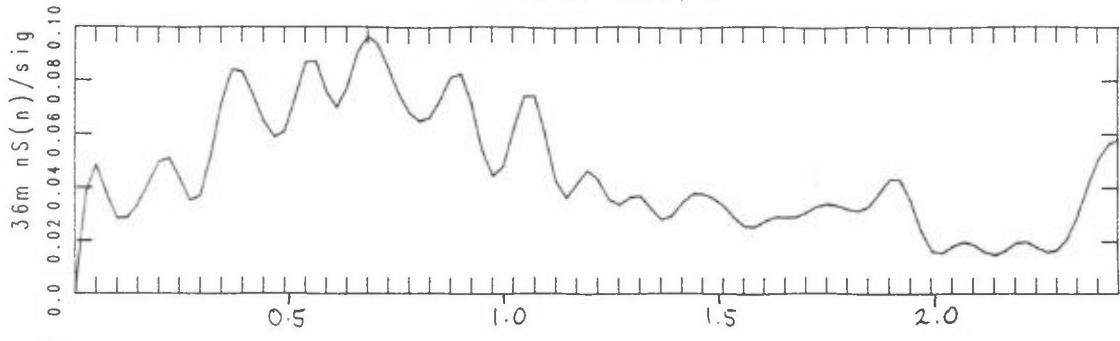


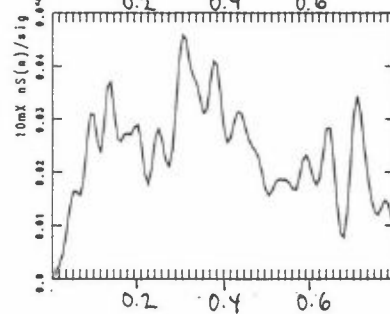
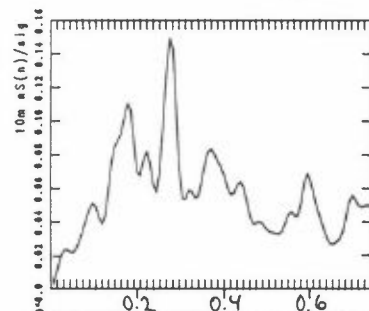
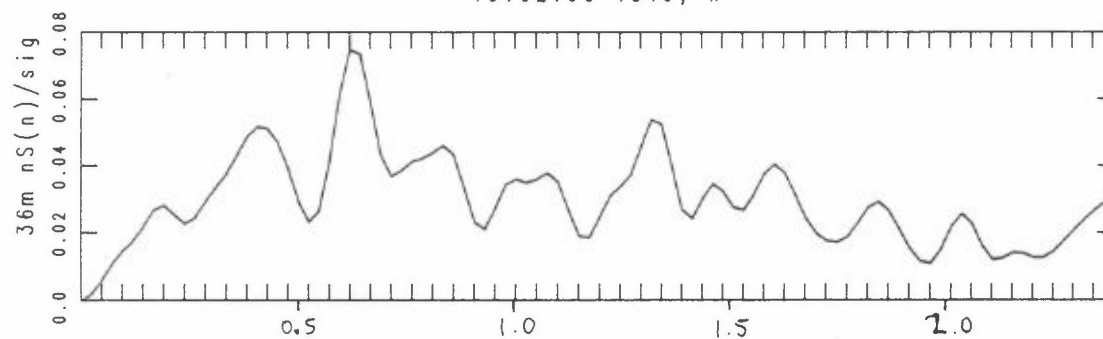
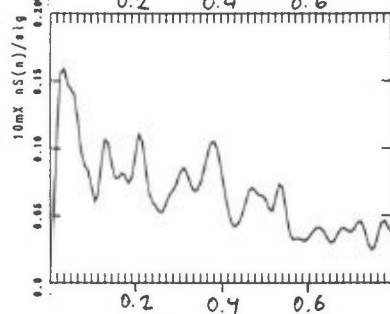
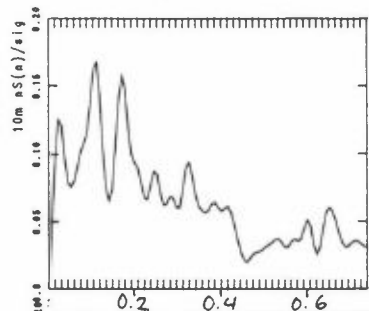
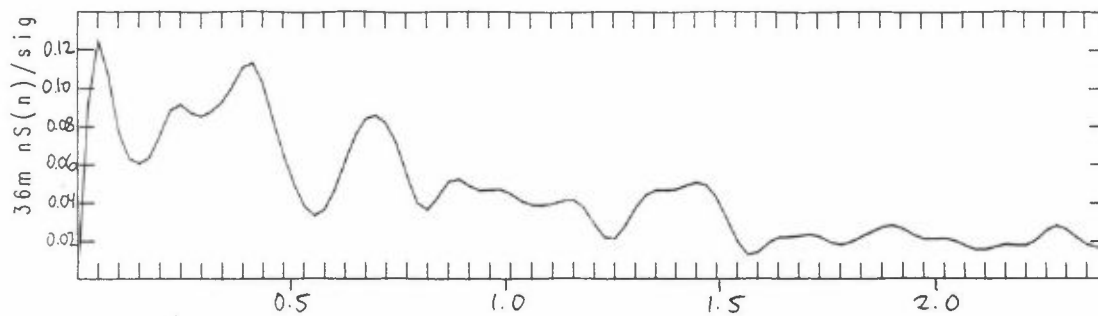


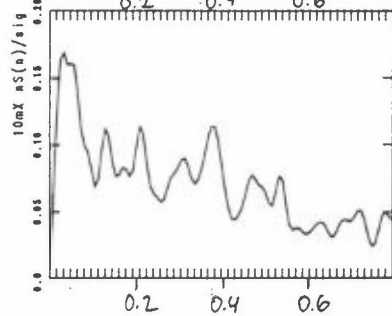
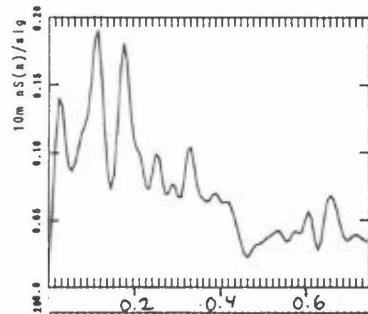
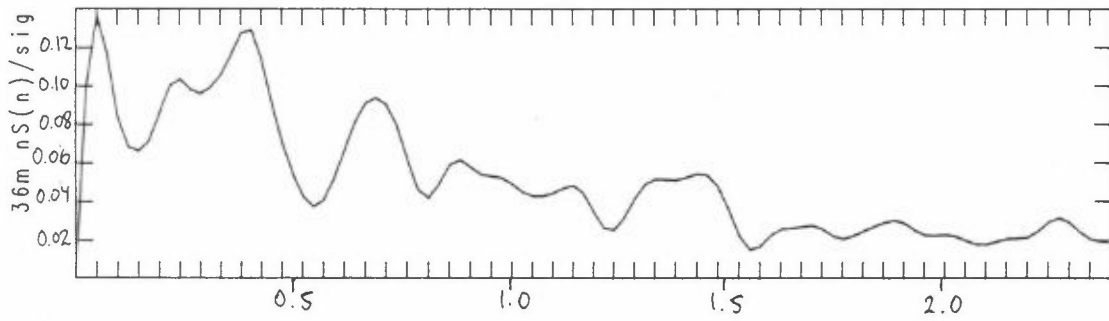
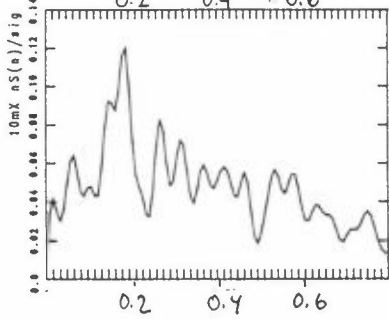
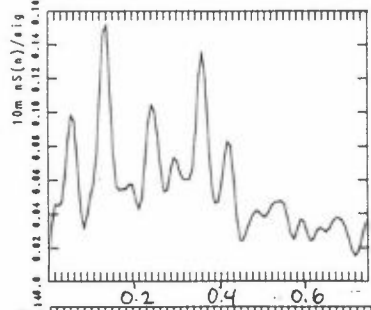
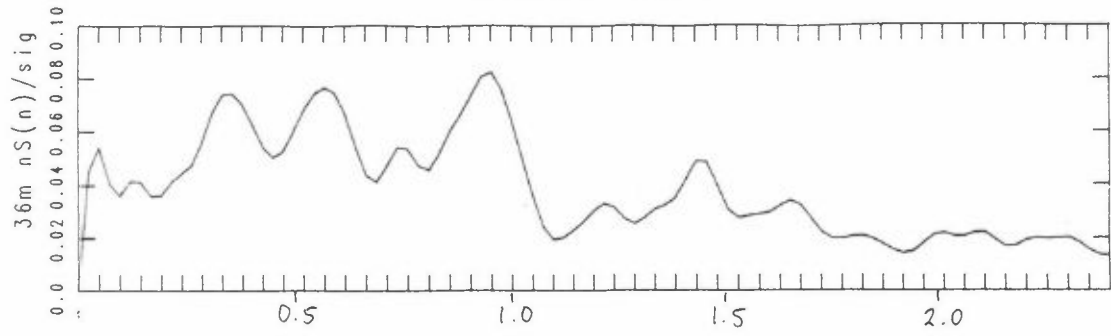


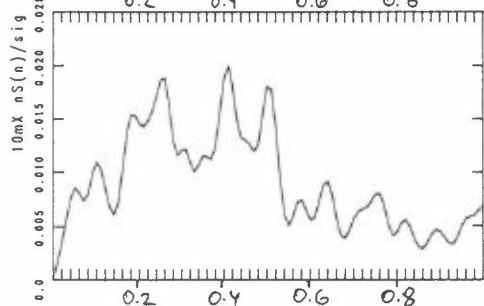
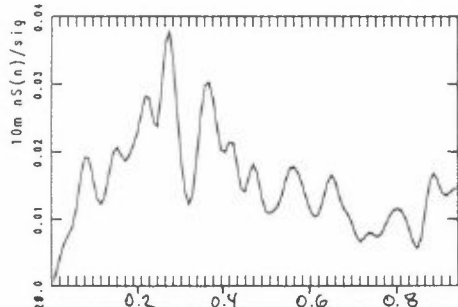
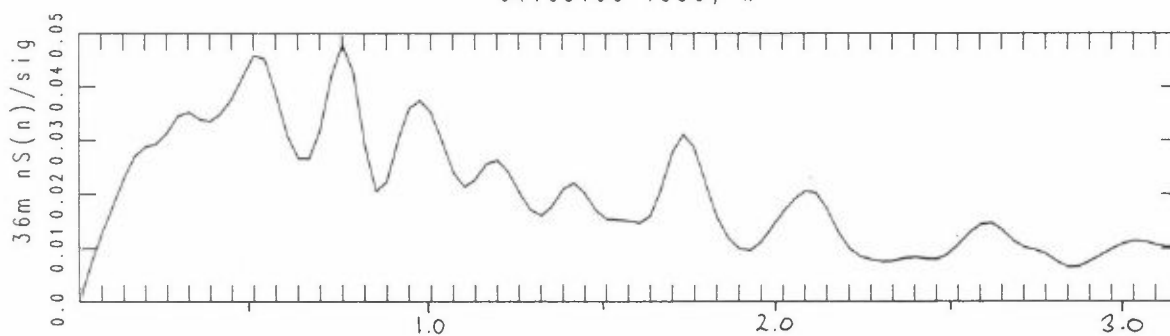
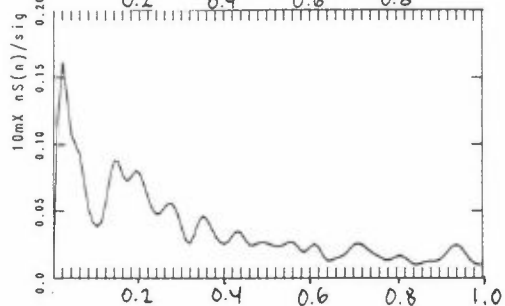
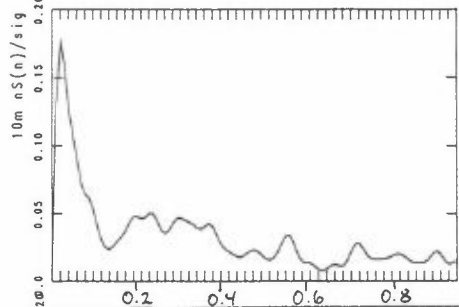
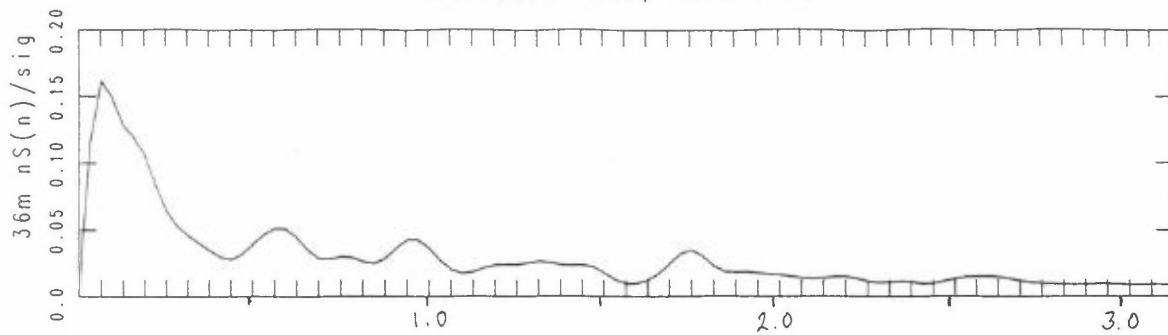


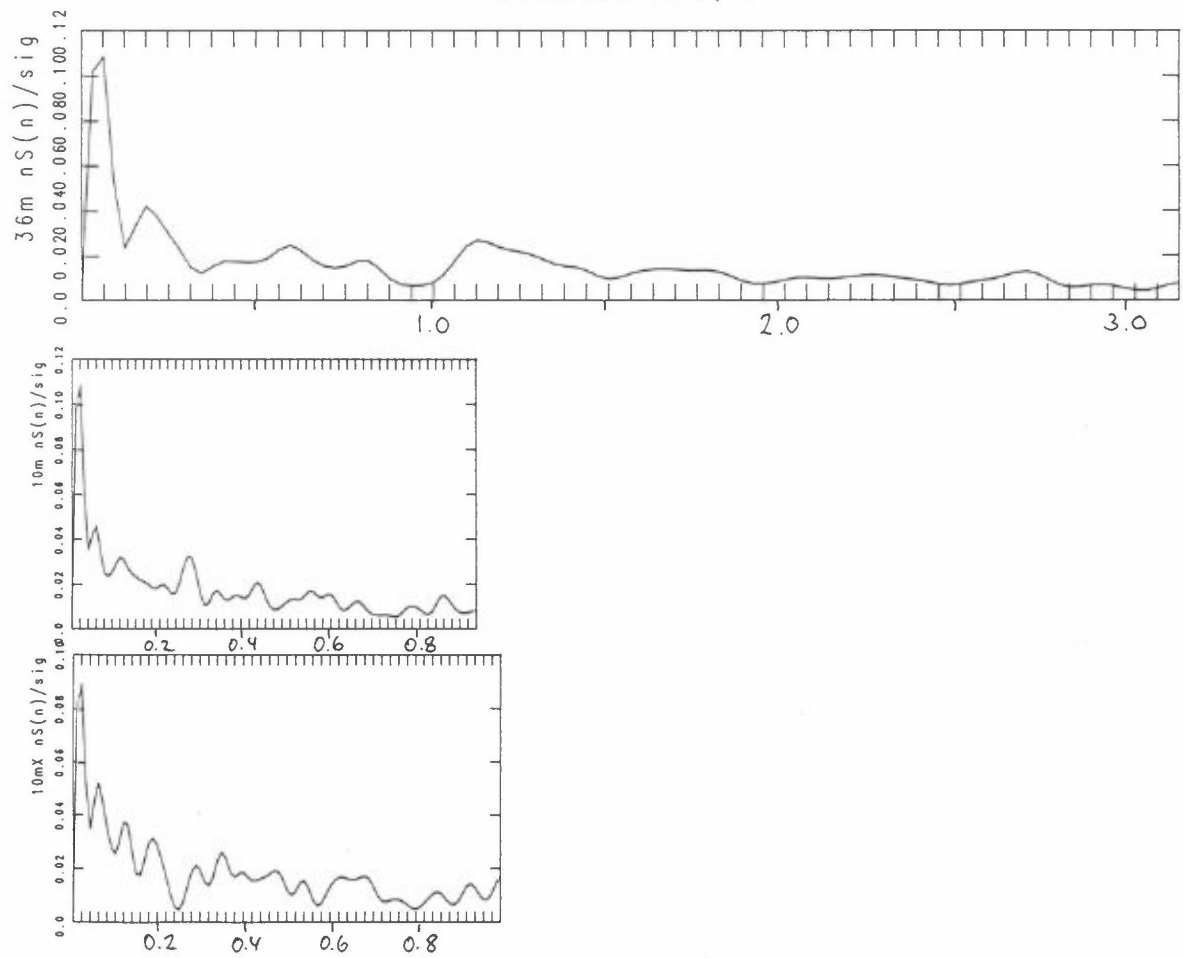
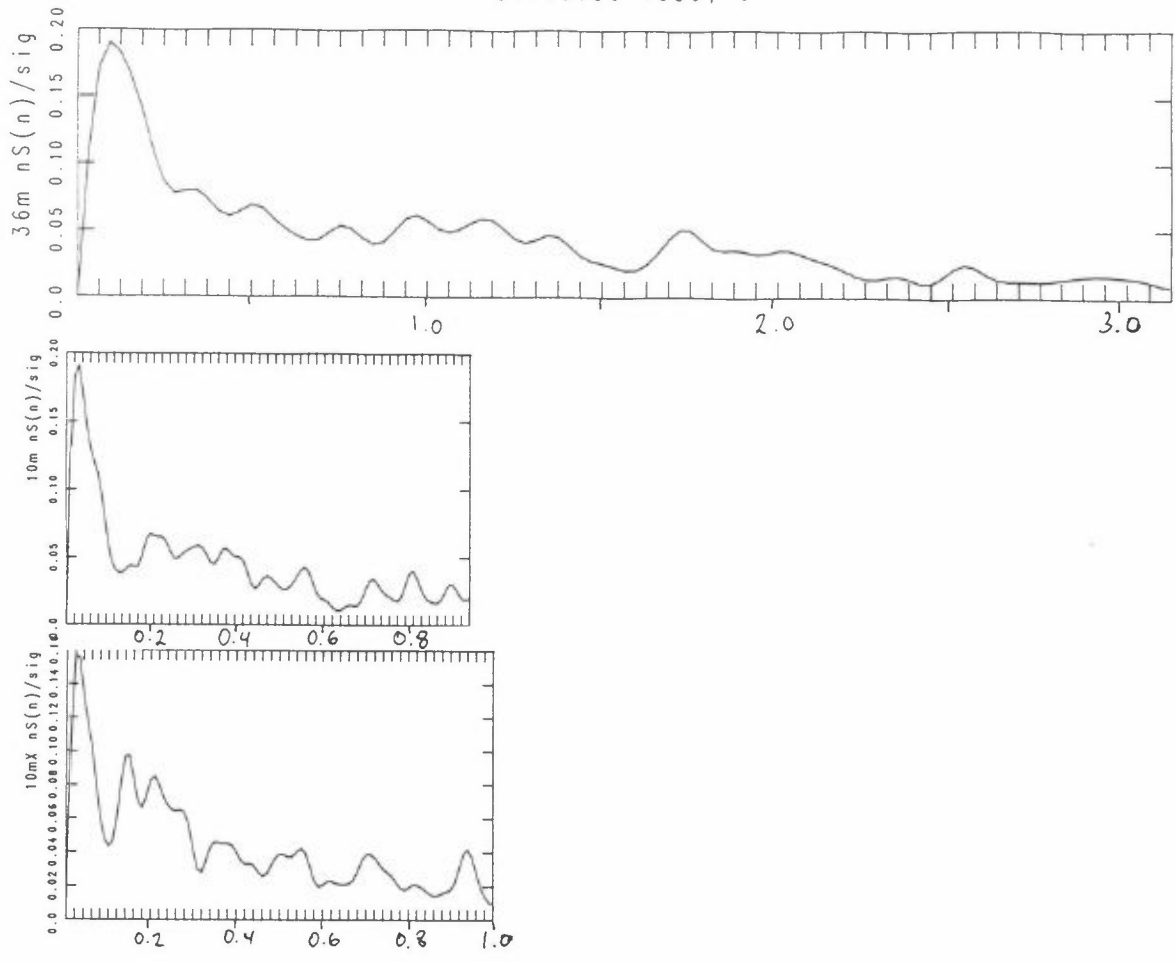


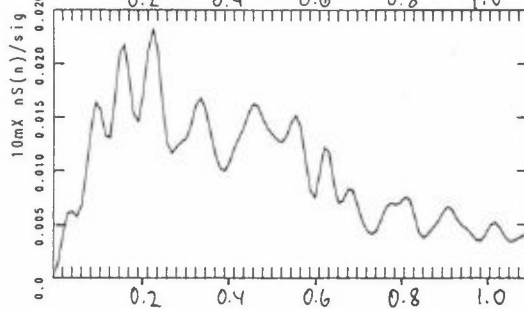
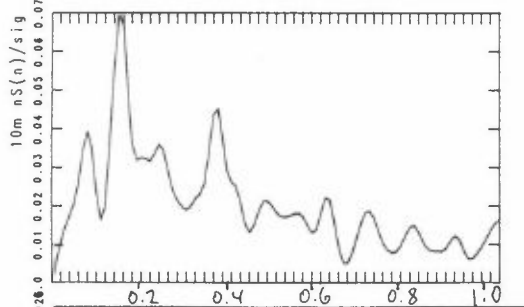
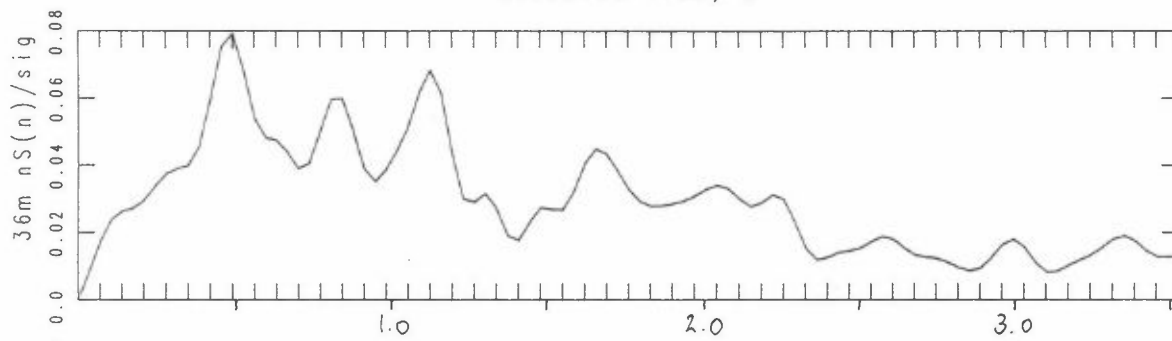
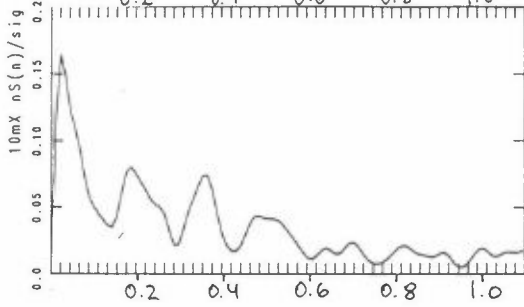
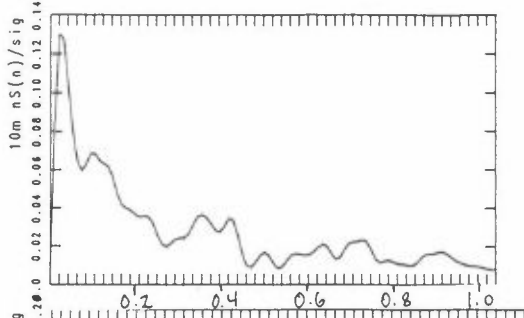
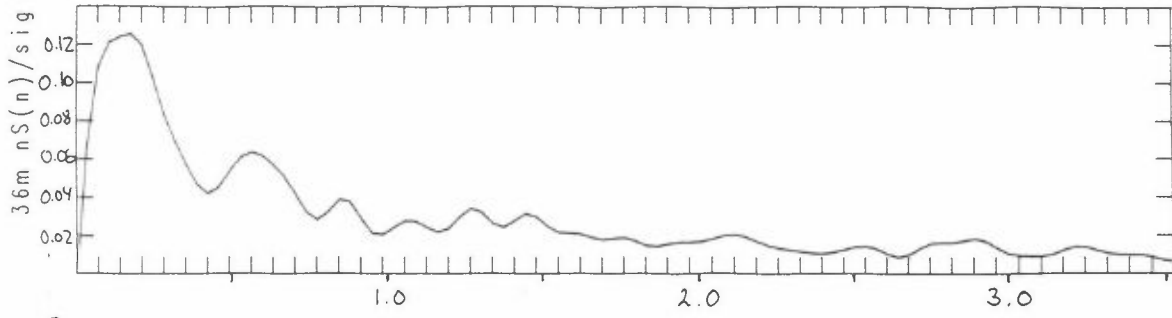


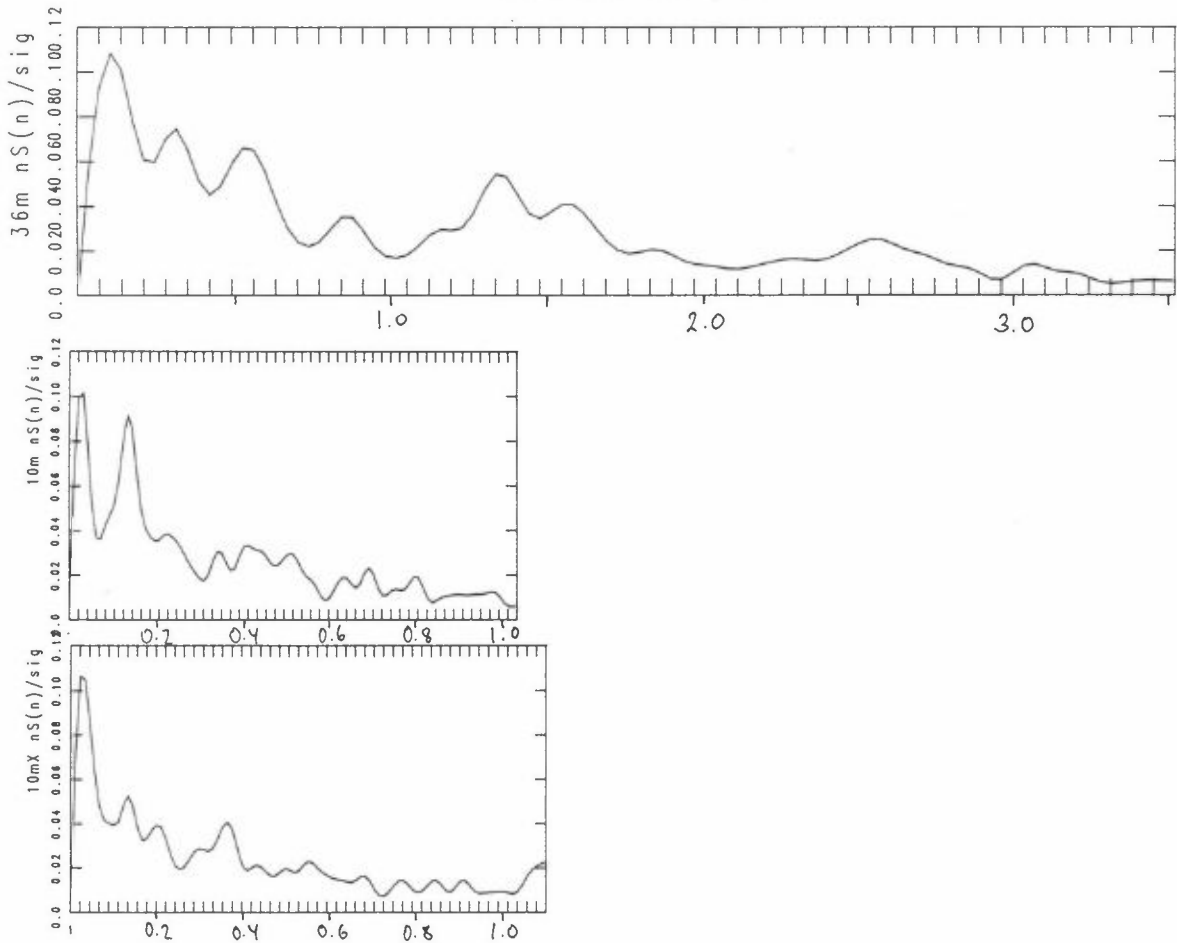
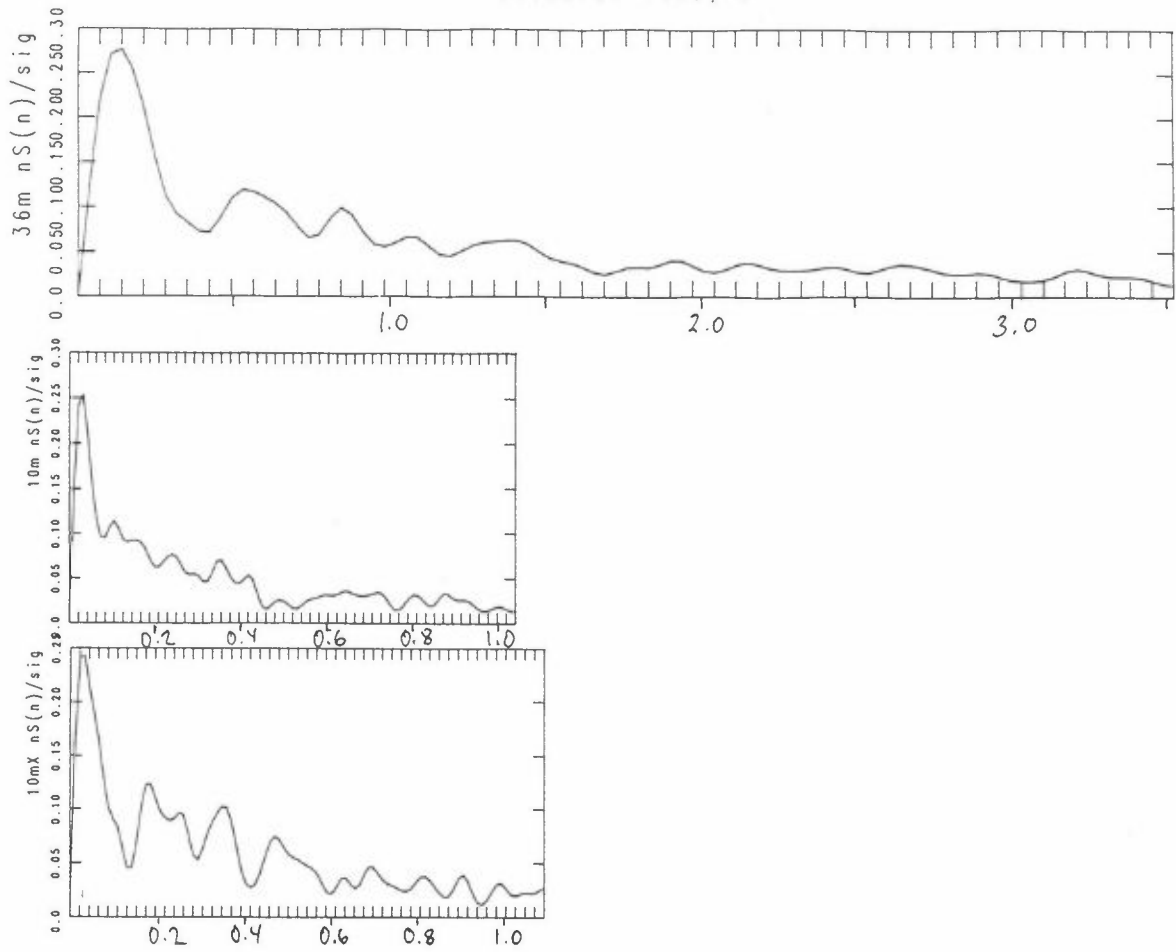


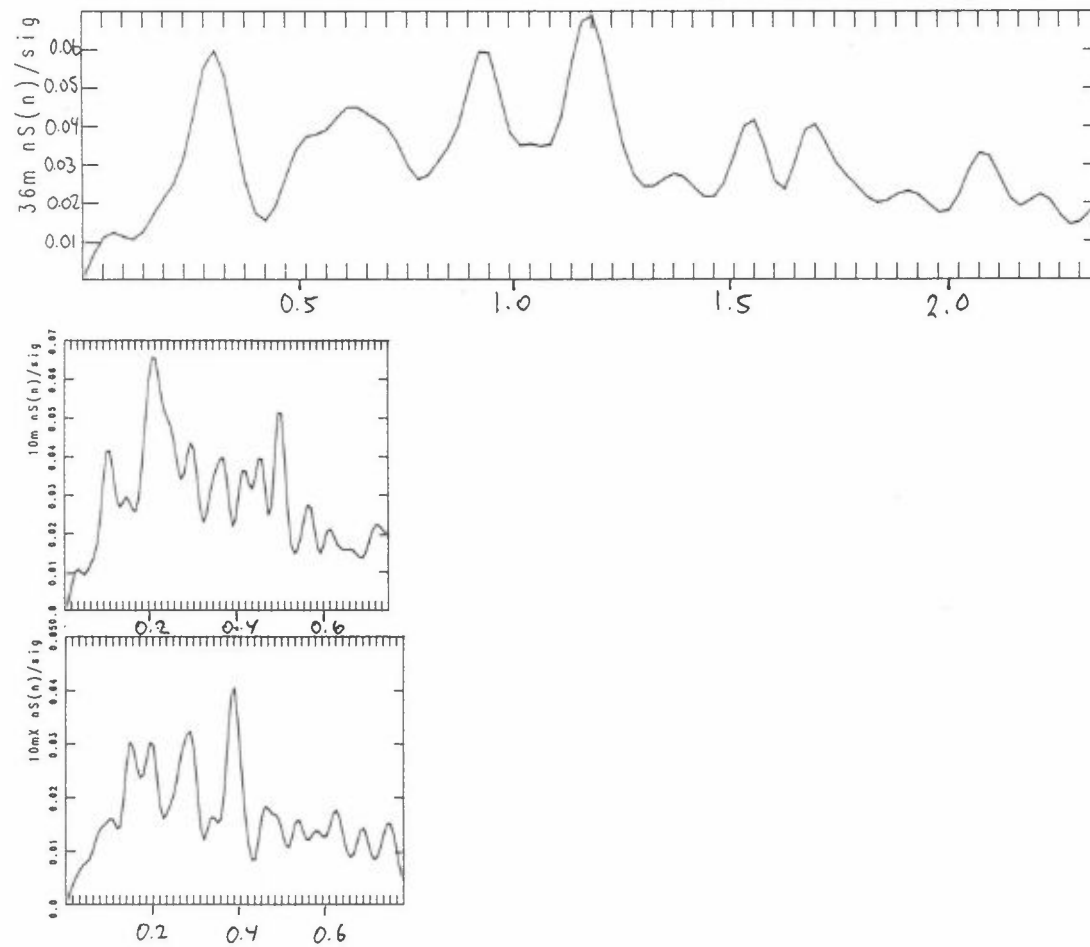
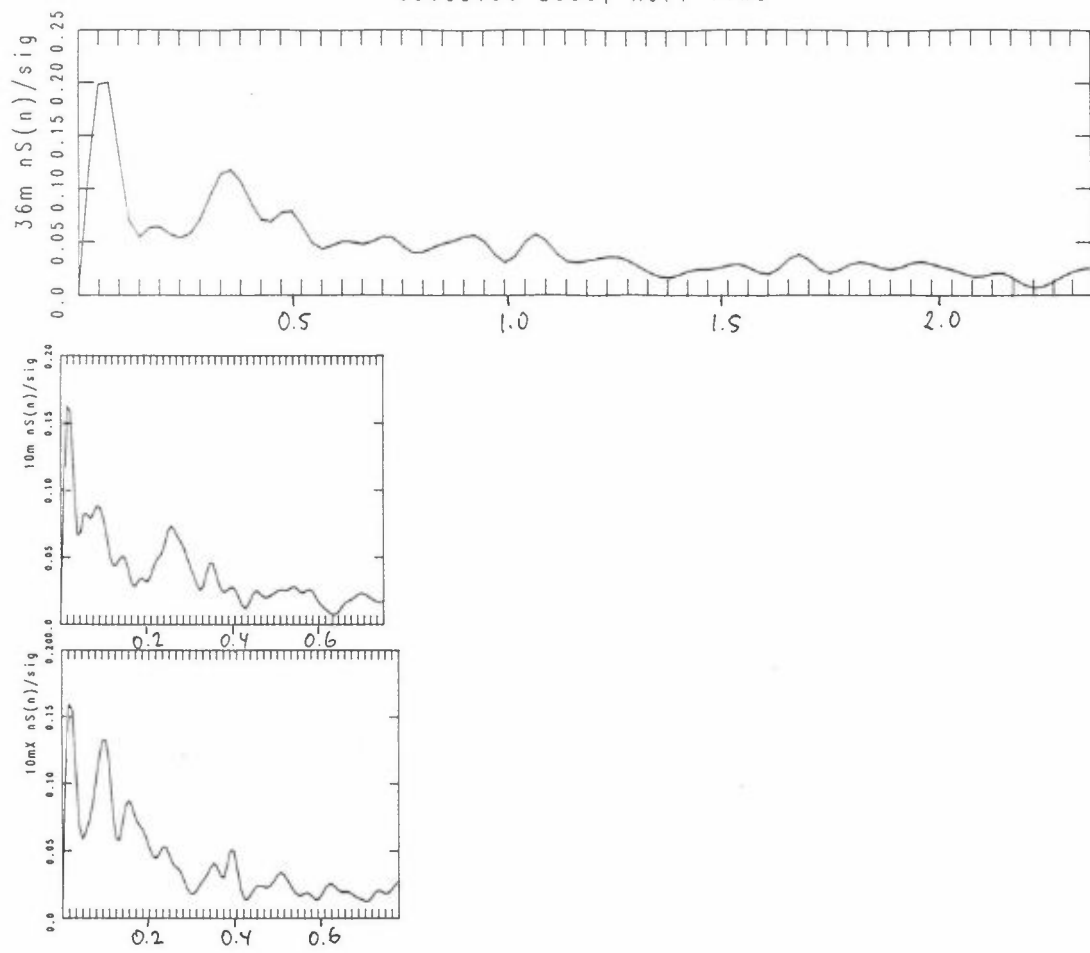


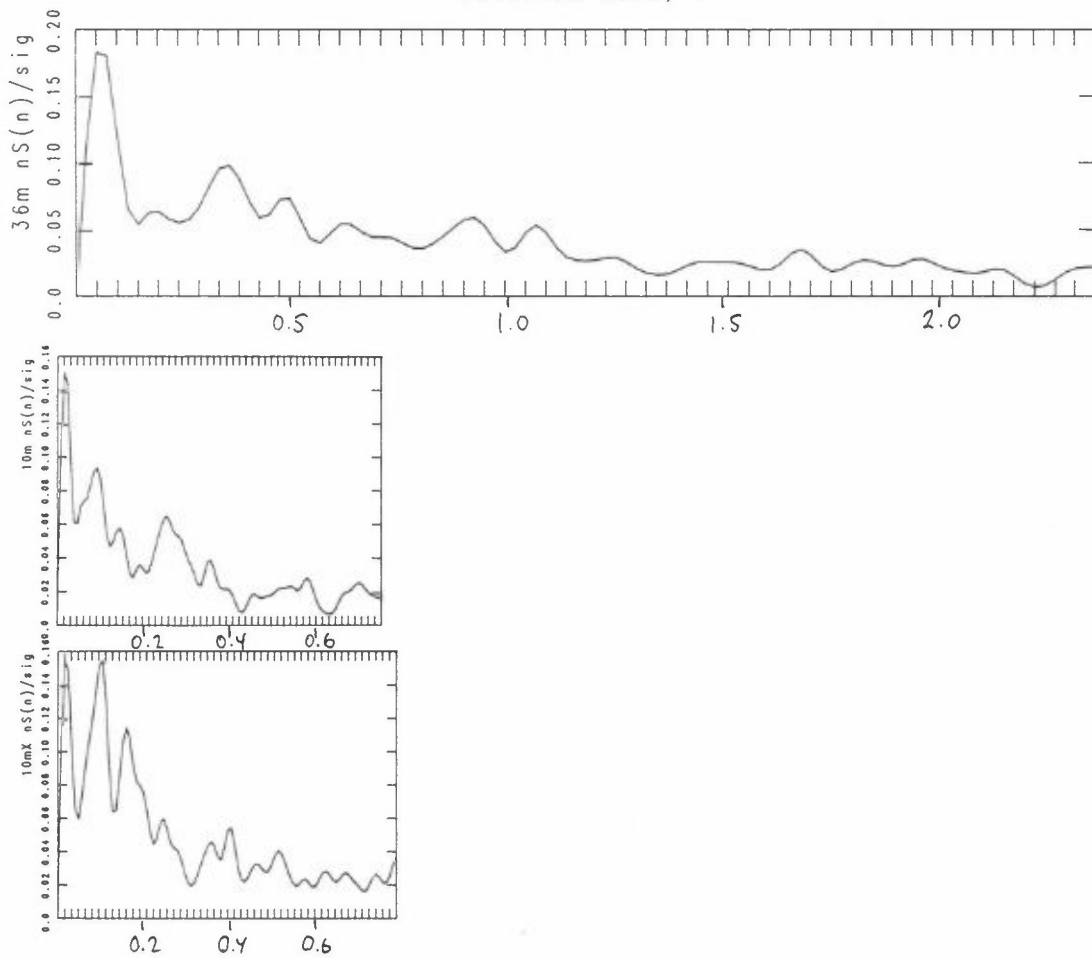
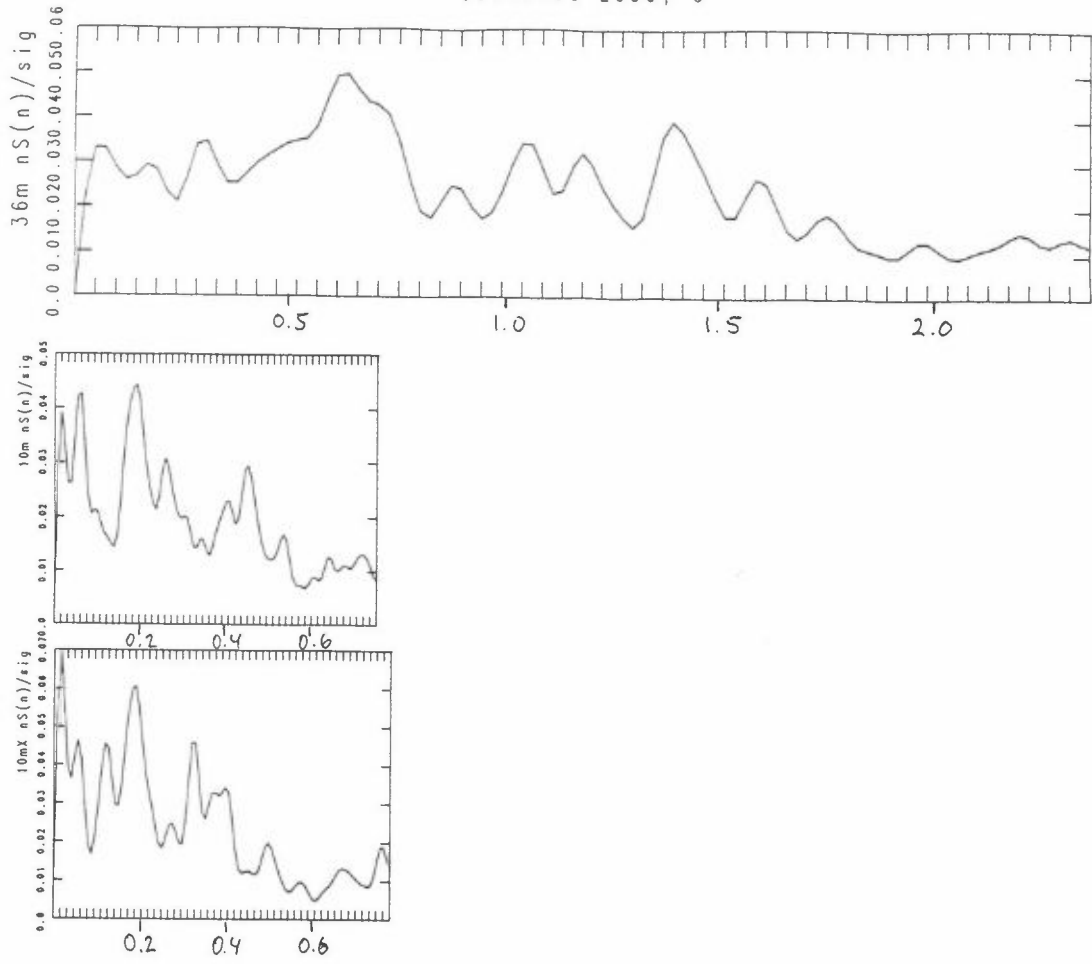


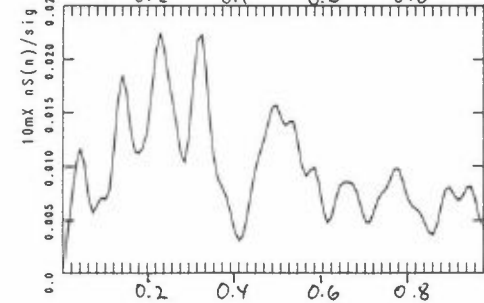
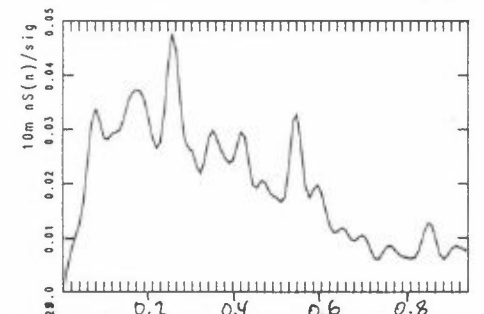
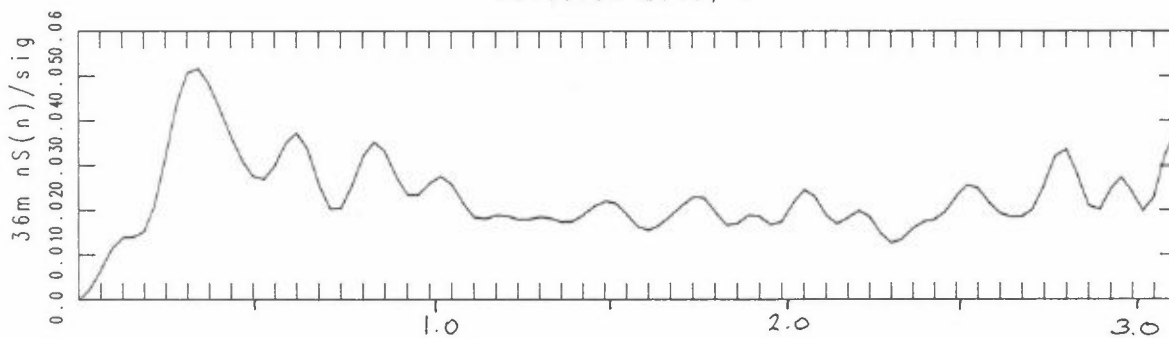
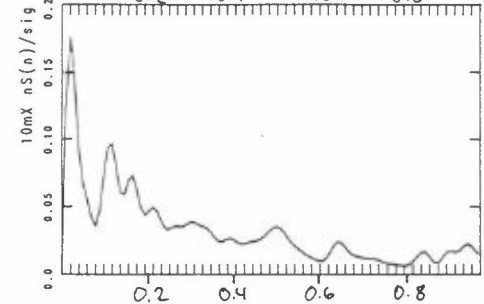
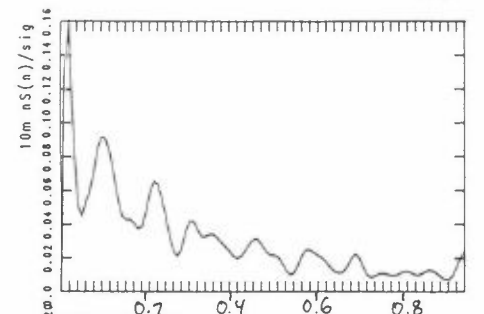
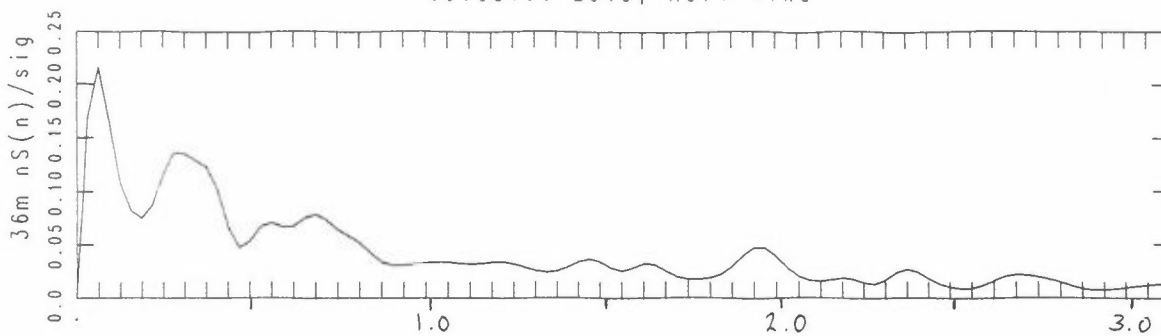




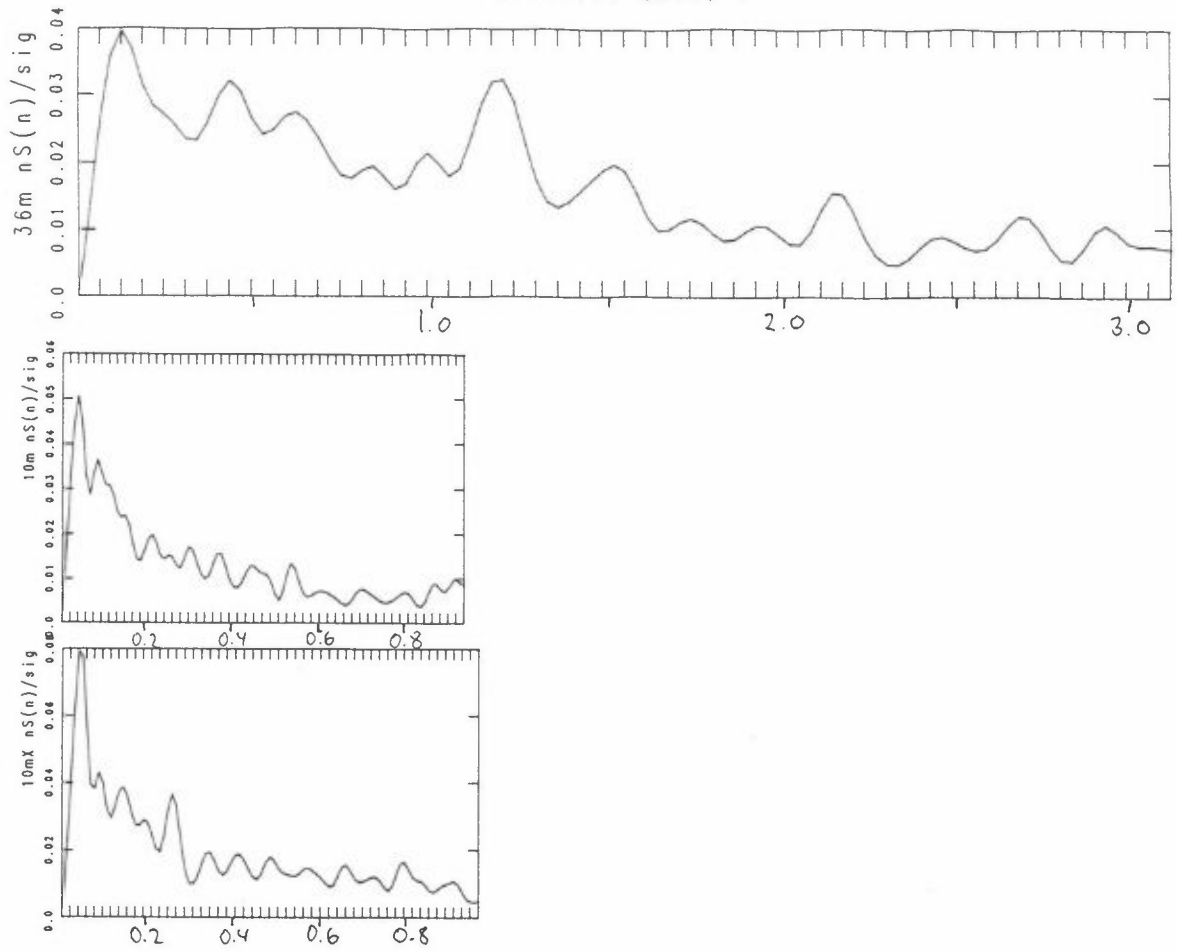




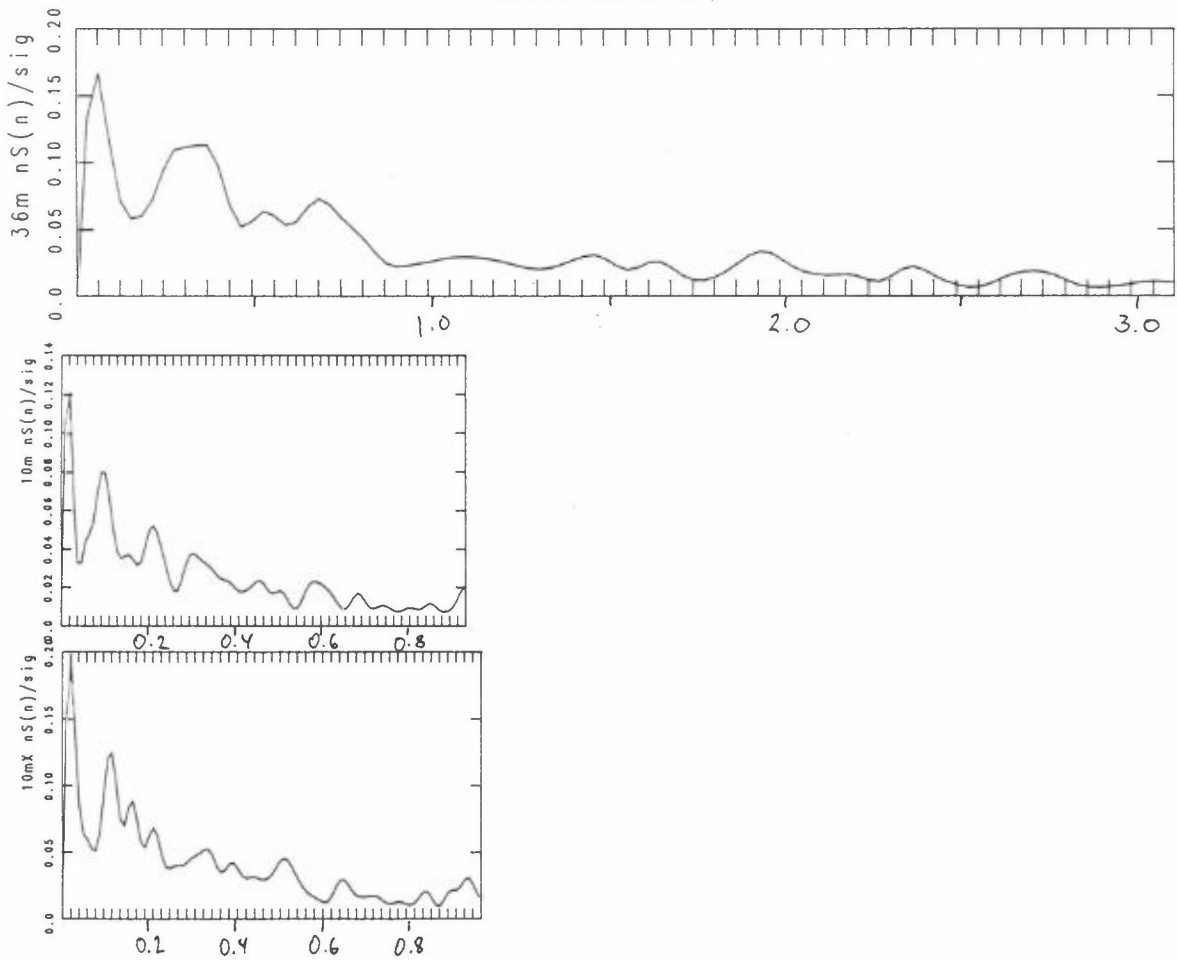


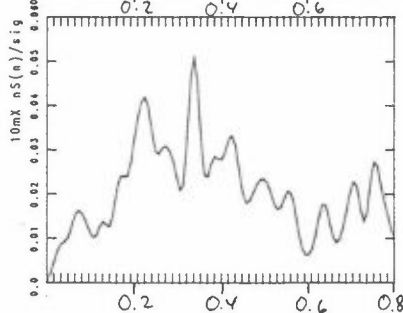
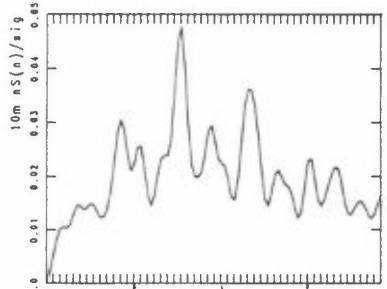
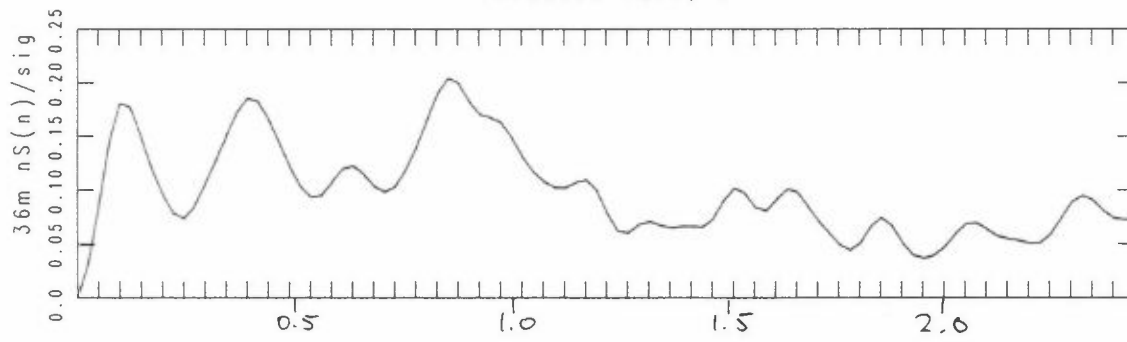
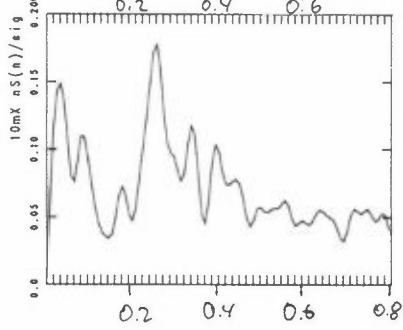
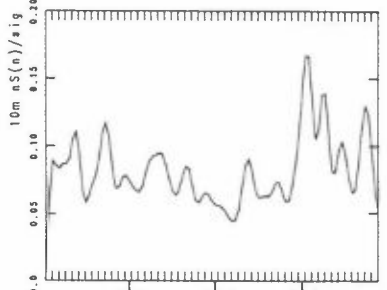
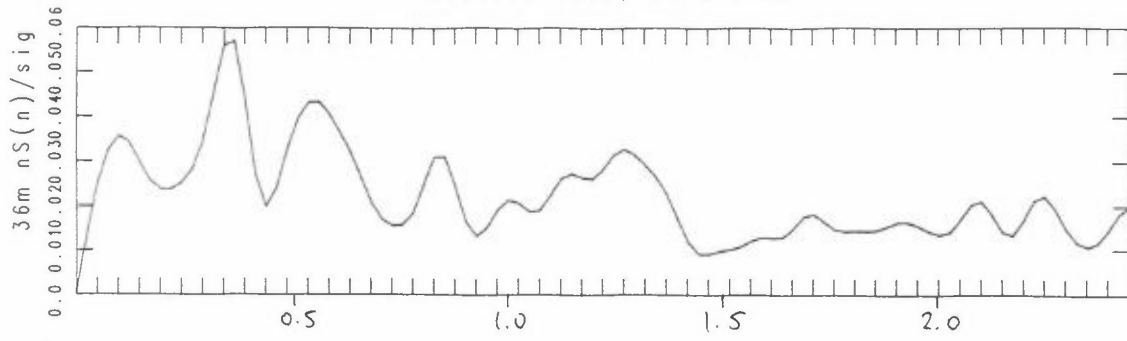


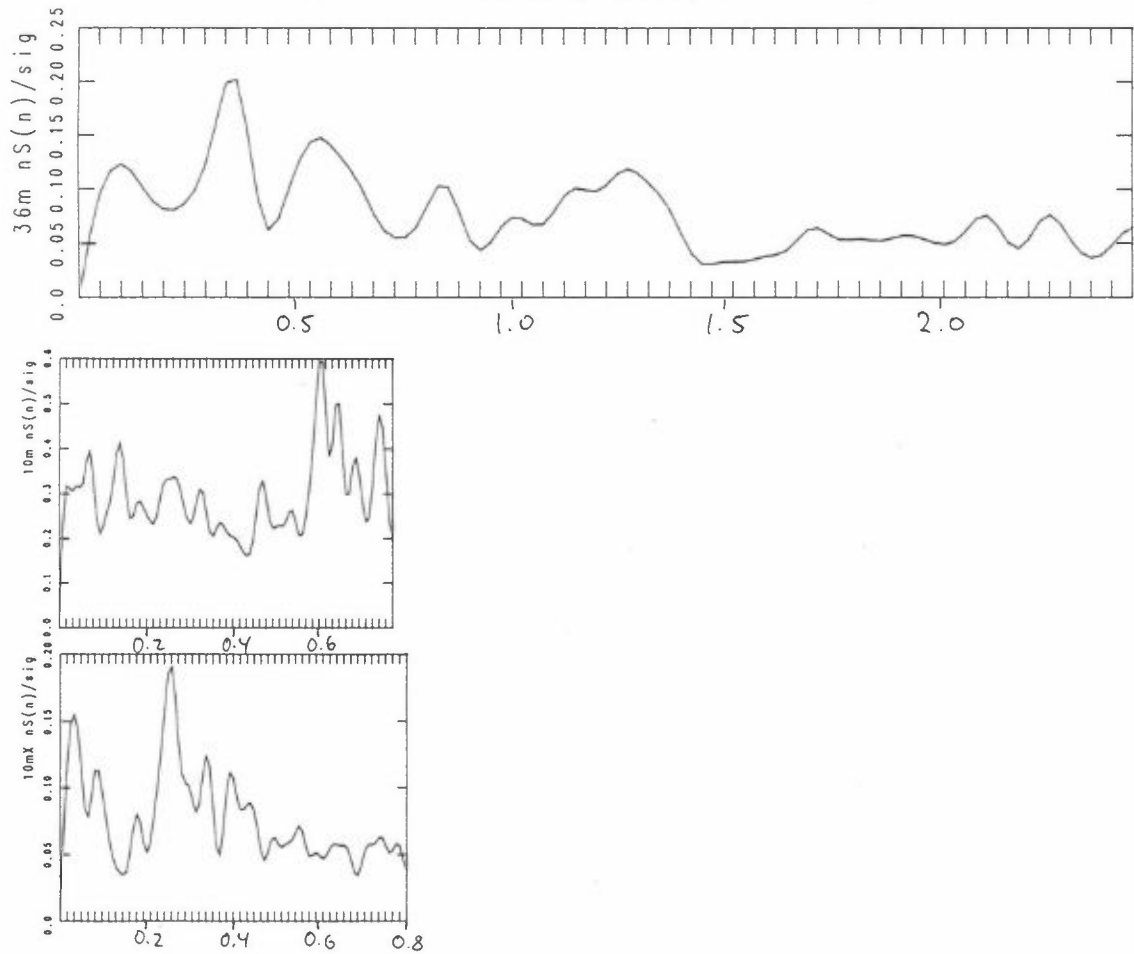
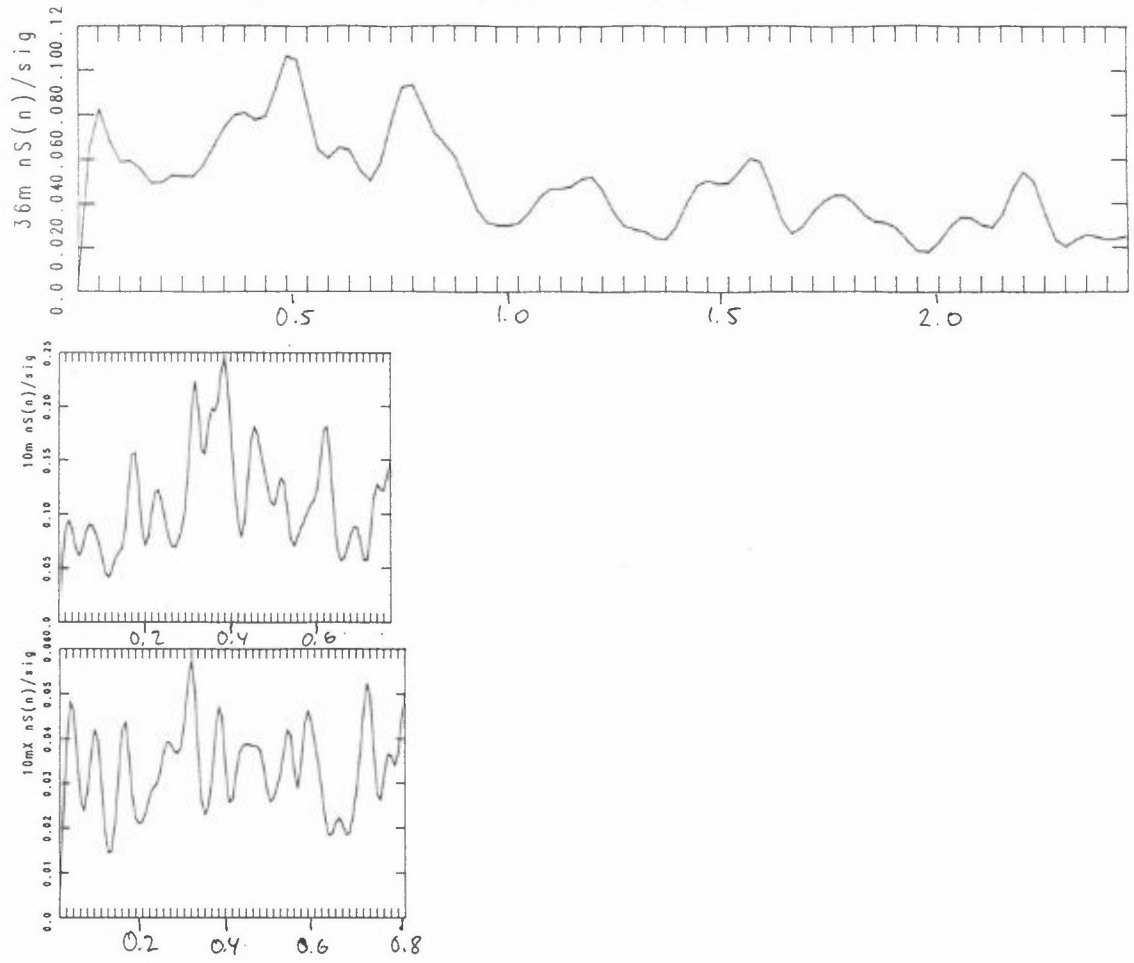
09.03.90 2040, U

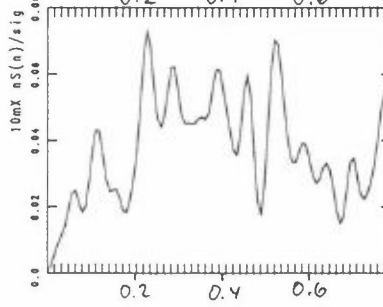
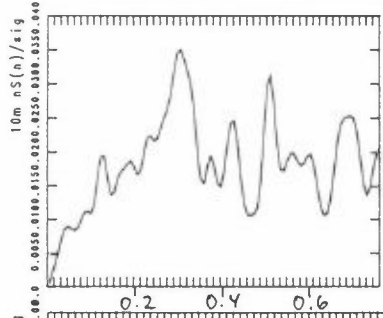
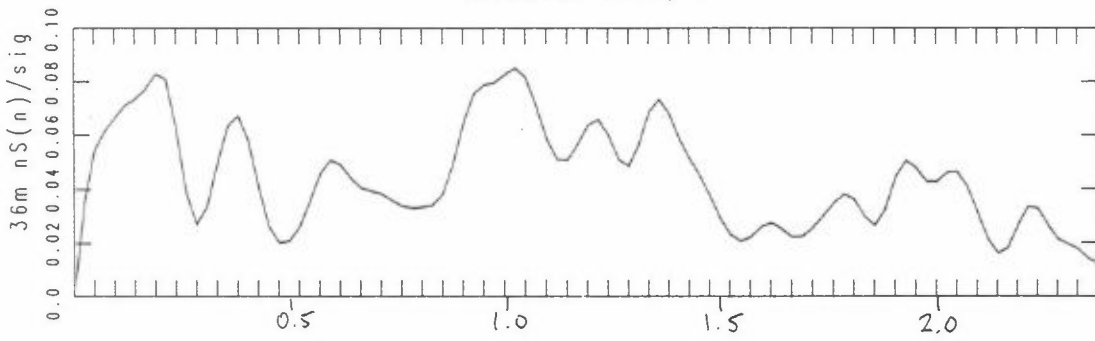
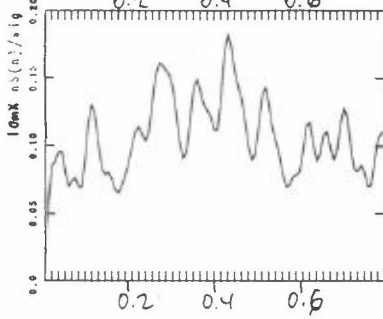
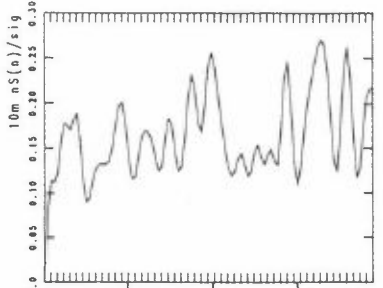
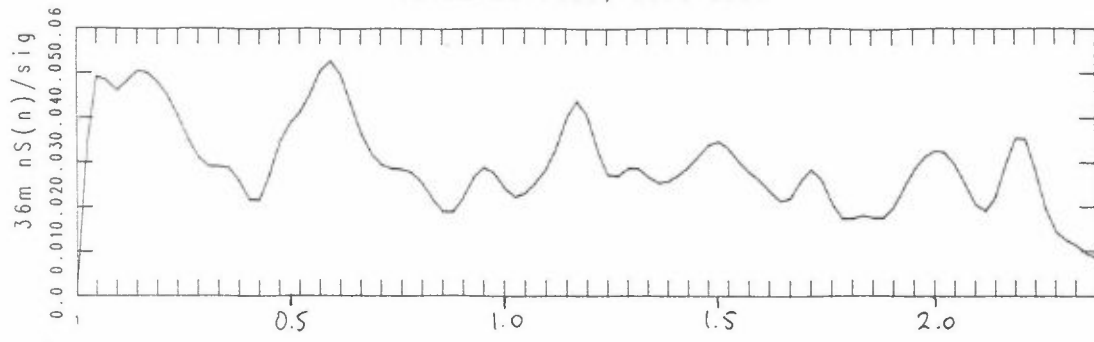


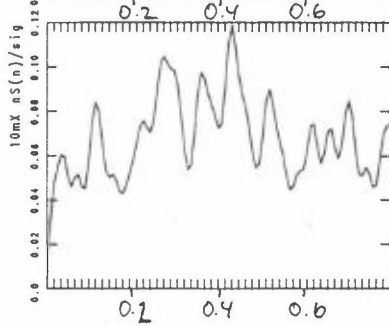
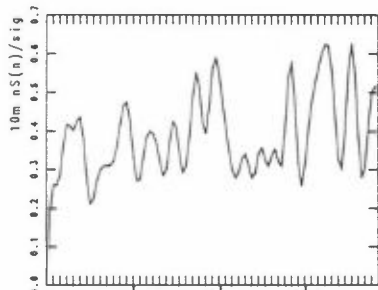
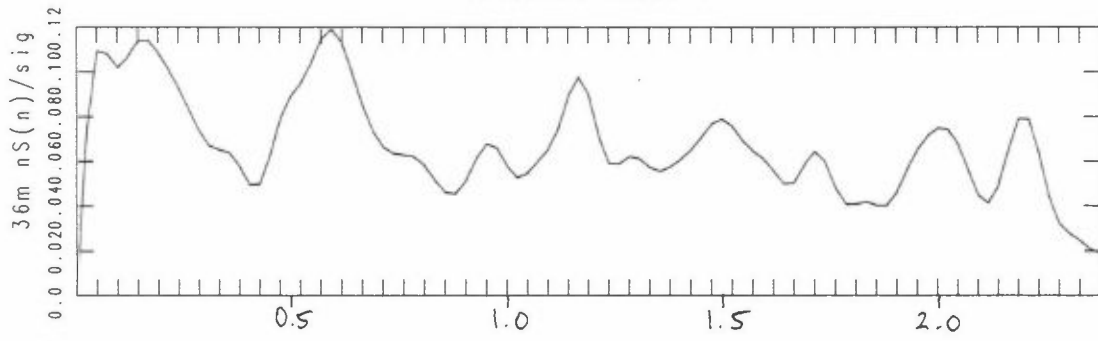
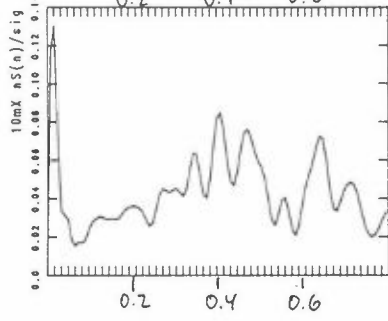
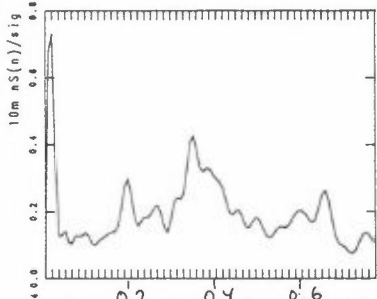
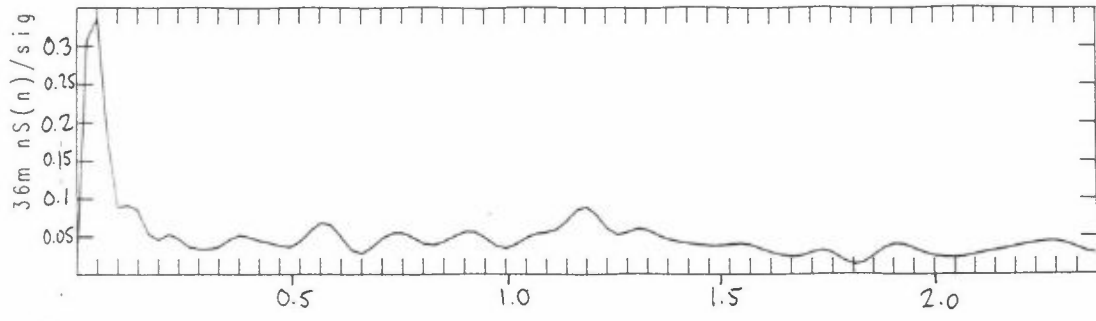
09.03.90 2040, V











VEDLEGG D

Tabeller over korrelasjonskoeffisienter

36U: Østlig vindkomponent i 36 m nivå
36V: Nordlig vindkomponent i 36 m nivå
36W: Vertikalhastighet i 36 m nivå
36H: Horisontal vindvektor i 36 m nivå
10U: Østlig vindkomponent i 10 m nivå i 36 m mast
10V: Nordlig vindkomponent i 10 m nivå i 36 m mast
10W: Vertikalhastighet i 10 m nivå i 36 m mast
10H: Horisontal vindvektor i 10 m nivå i 36 m mast
X10U: Østlig vindkomponent i 10 m nivå, tilleggs mast
X10V: Nordlig vindkomponent i 10 m nivå, tilleggs mast
X10W: Vertikalhastighet i 10 m nivå, tilleggs mast
X10H: Horisontal vindvektor i 10 m nivå, tilleggs mast

VEDLEGG E

Plott av koherensfunksjoner

Kryss-amplitude spektret er definert ved

$$A(\omega) = ((Cf(\omega))^2 + (qf(\omega))^2)^{1/2}$$

og kvadrat koherens er definert ved

$$W(\omega) = \frac{(A(\omega))^2}{S_x(\omega) S_y(\omega)}$$

$cf(\omega)$ er reell del av kryss-spekter

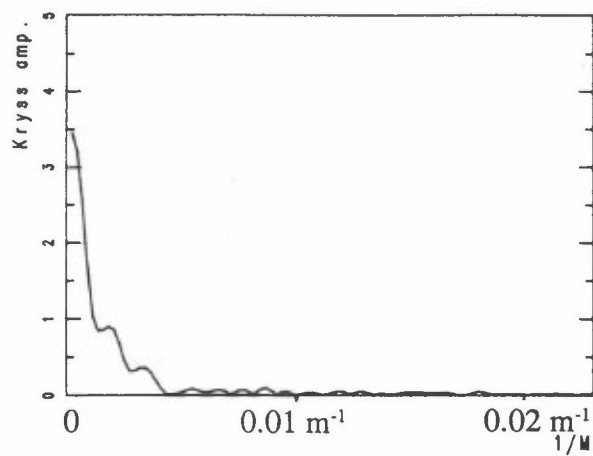
$qf(\omega)$ er imaginær del av kryss-spekter

A og W er vist som funksjon av $\frac{n}{U}$ der n er frekvens og

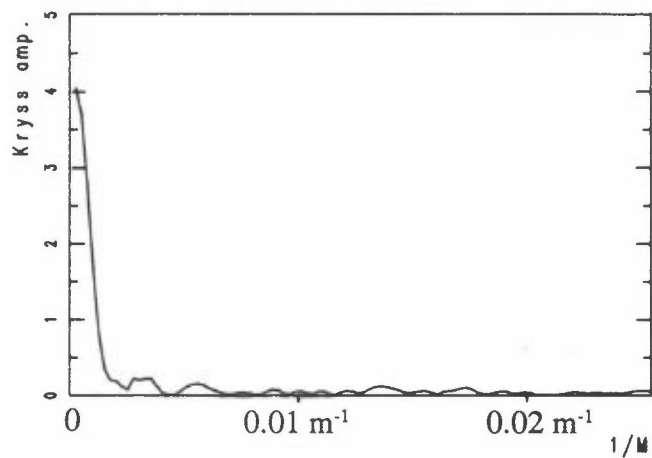
U er midlere vindhastighet

15. januar 1990 kl. 0720

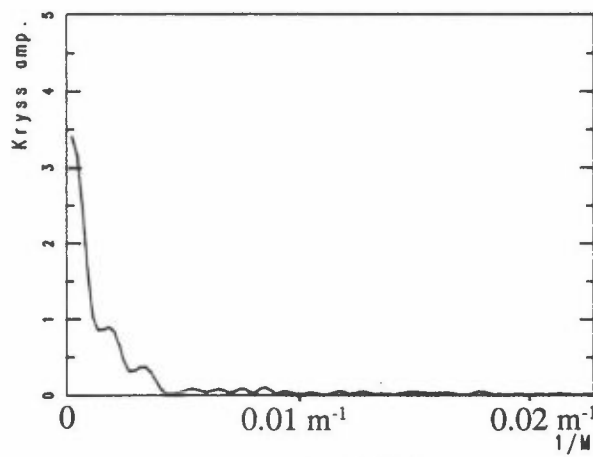
H36-H10



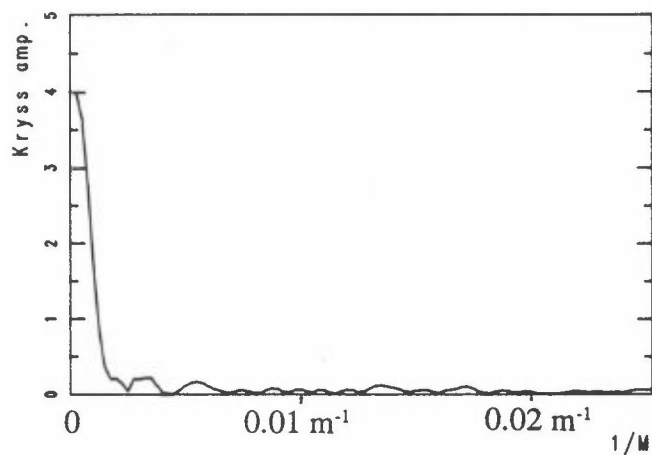
H10-H10x



U36-U10

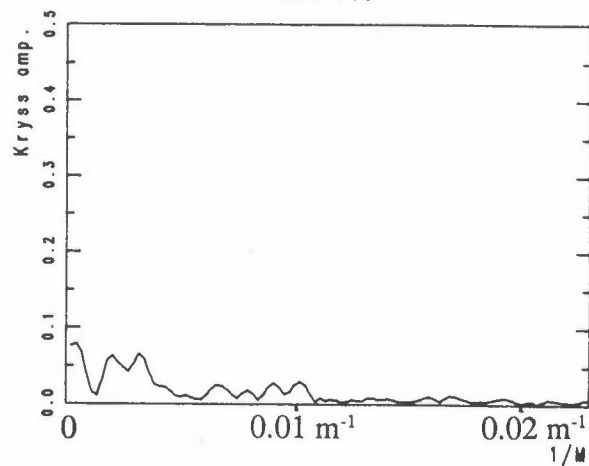


U10-U10x

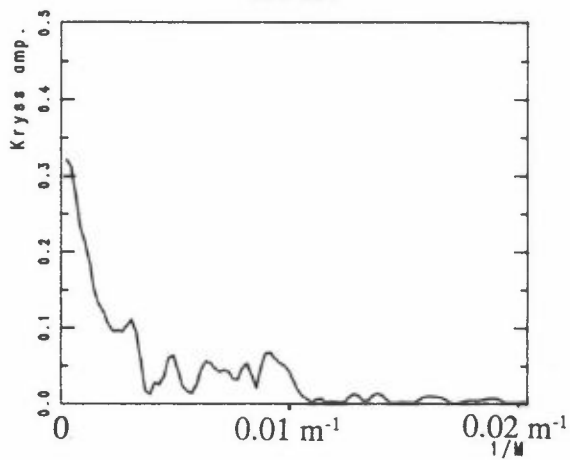


15. januar 1990 kl. 0720

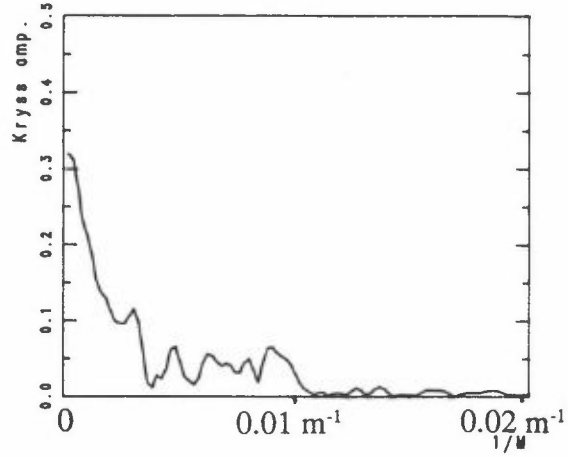
W36-W10



H36-W36

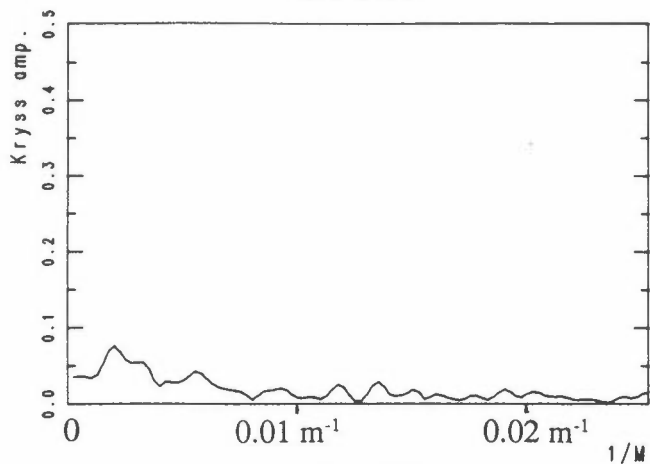


U36-W36

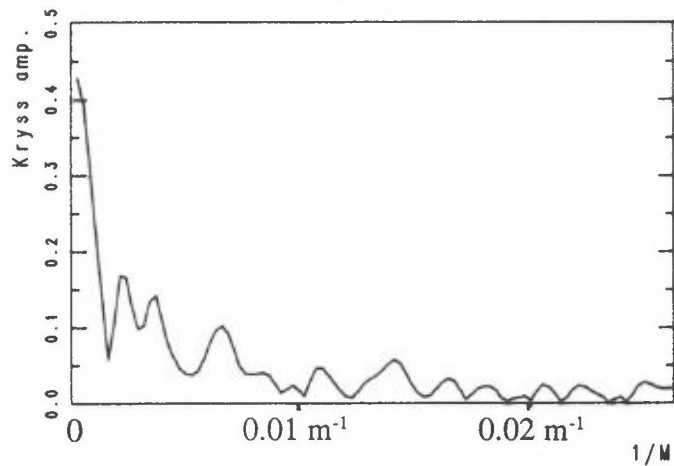


15. januar 1990 kl. 0720

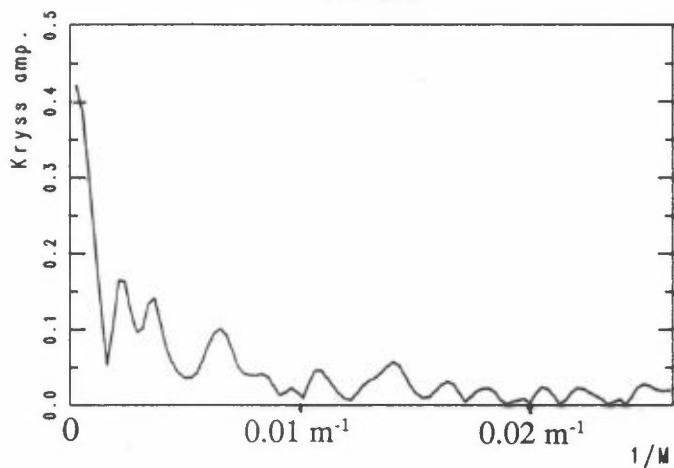
W10-W10x



H10-W10

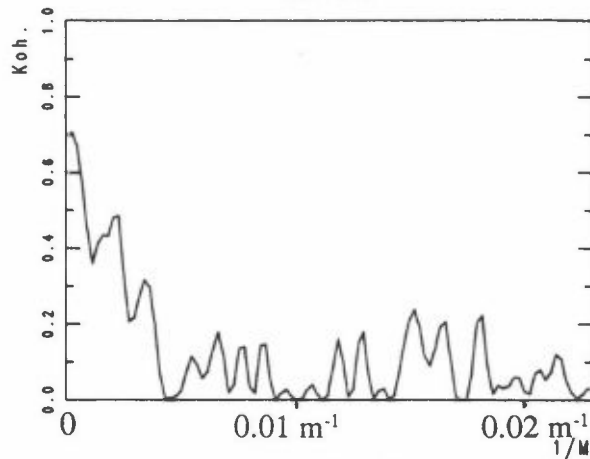


U10-W10

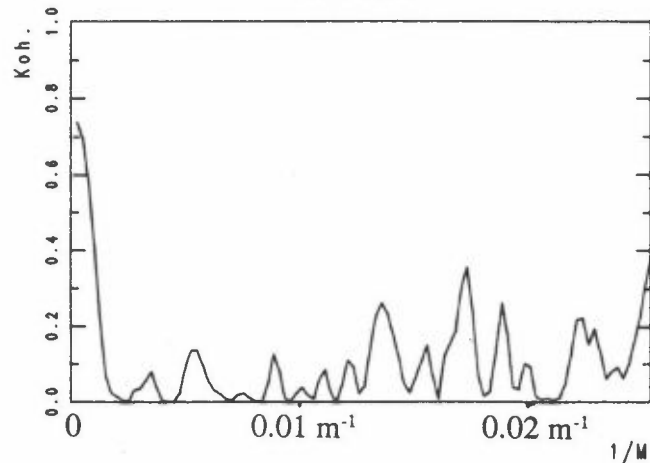


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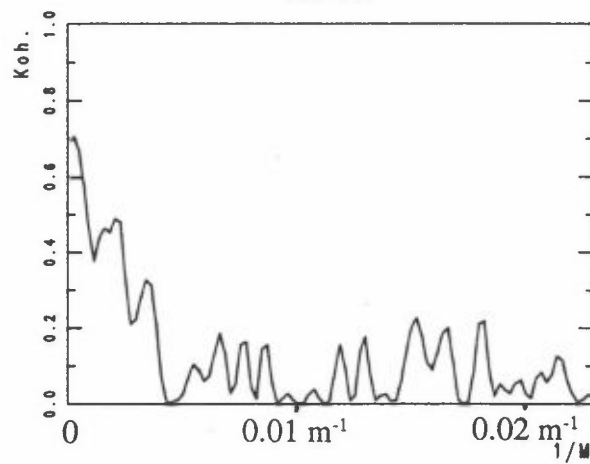
H36-H10



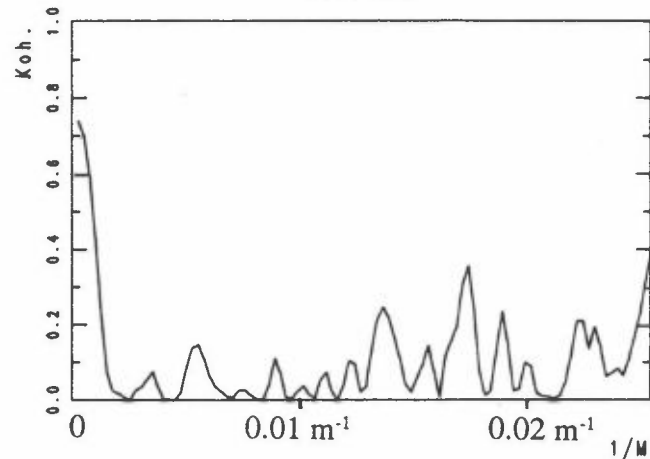
H10-H10x



U36-U10

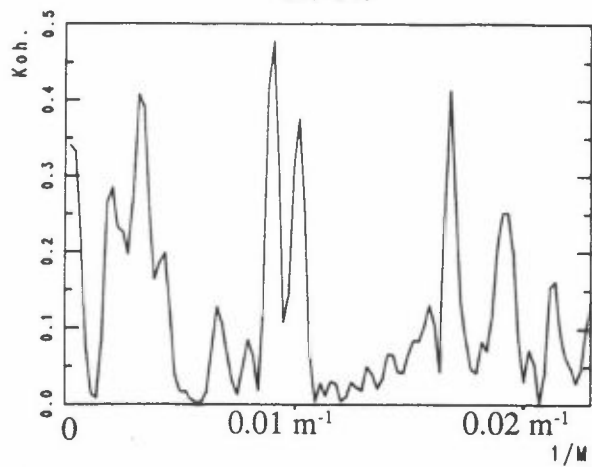


U10-U10x



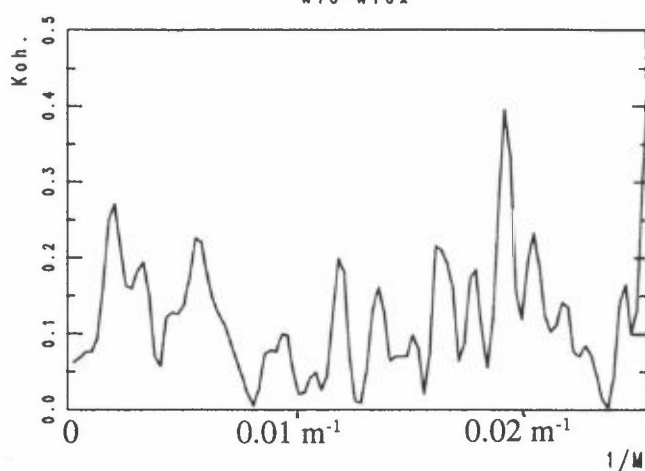
15. januar 1990 kl. 0720

W36-W10

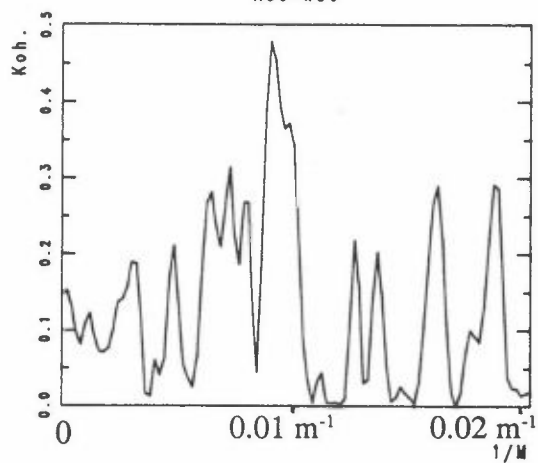


15. januar 1990 kl. 0720

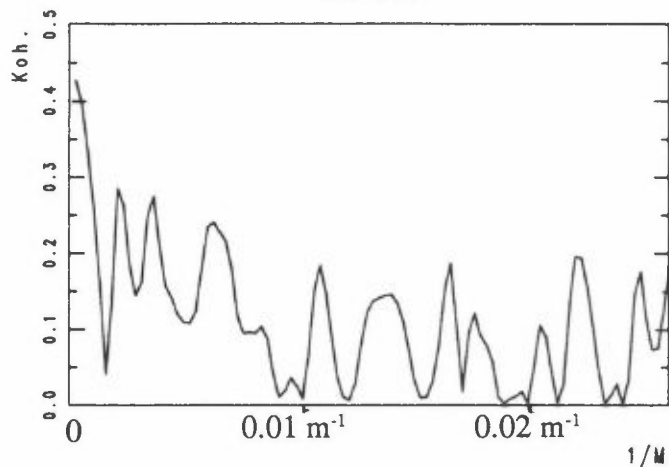
W10-W10x



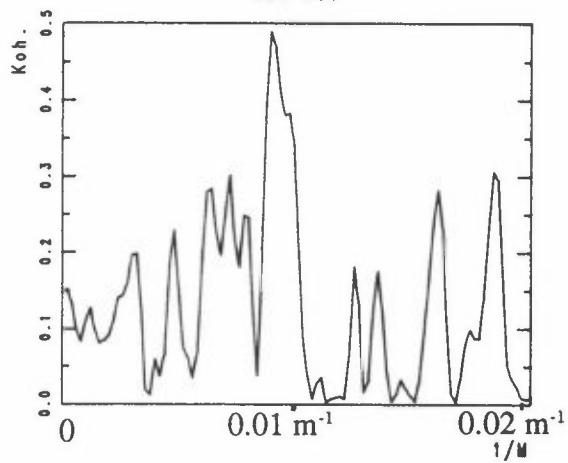
H36-W36



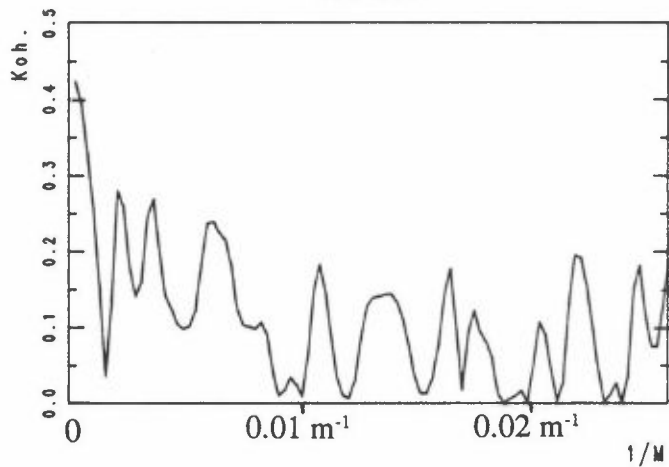
H10-W10



U36-W36

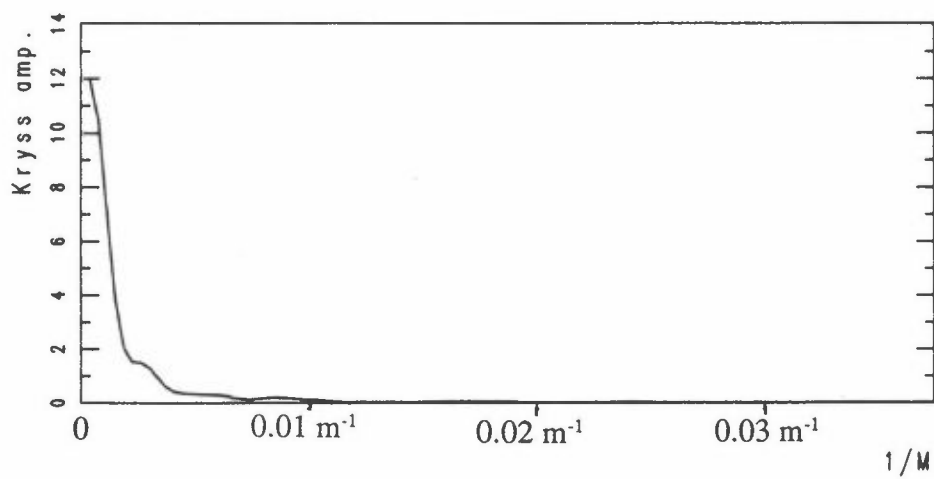
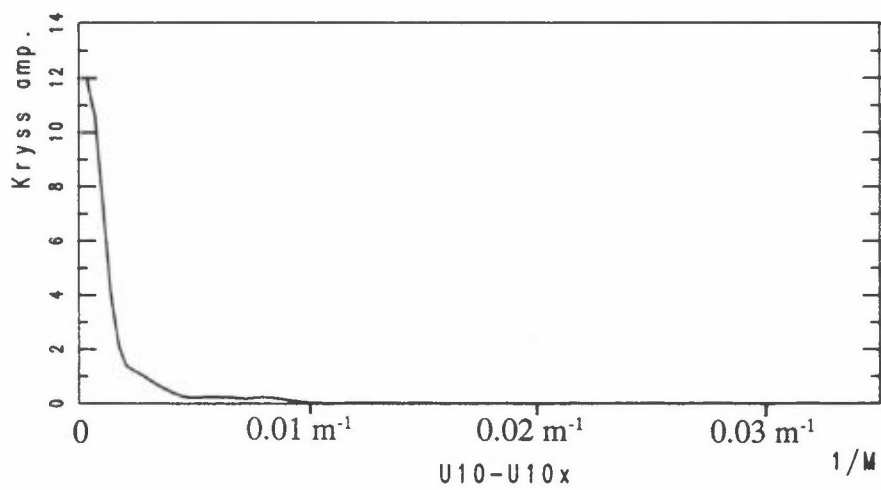
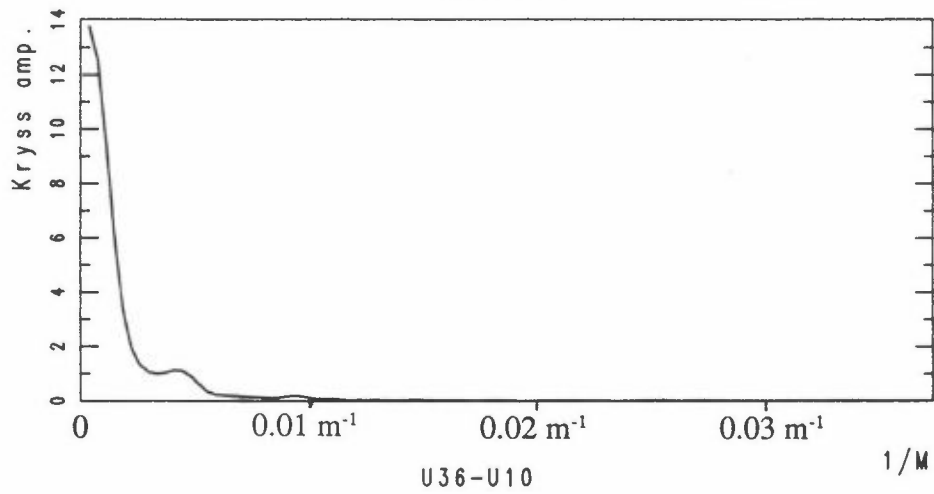
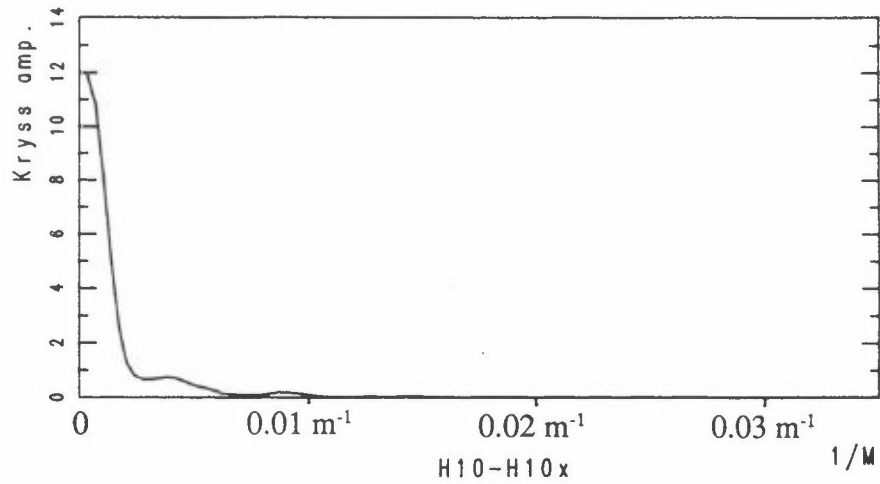


U10-W10



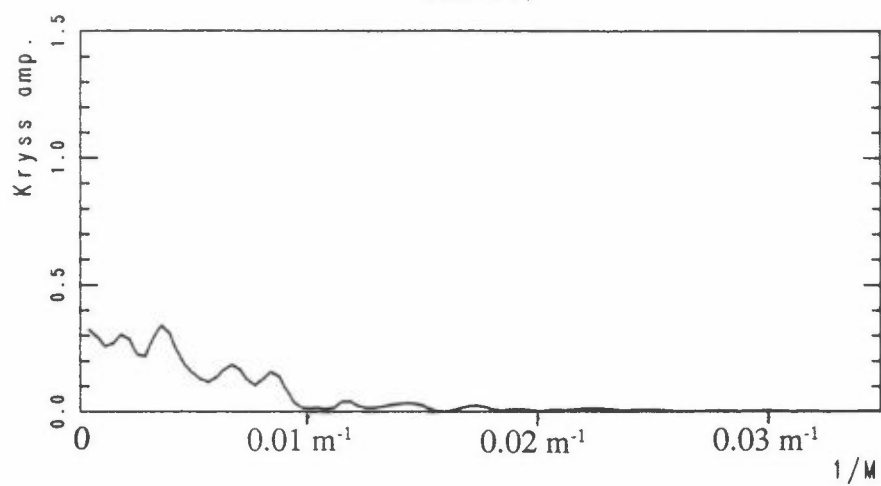
17. januar 1990 kl. 2300

H36-H10

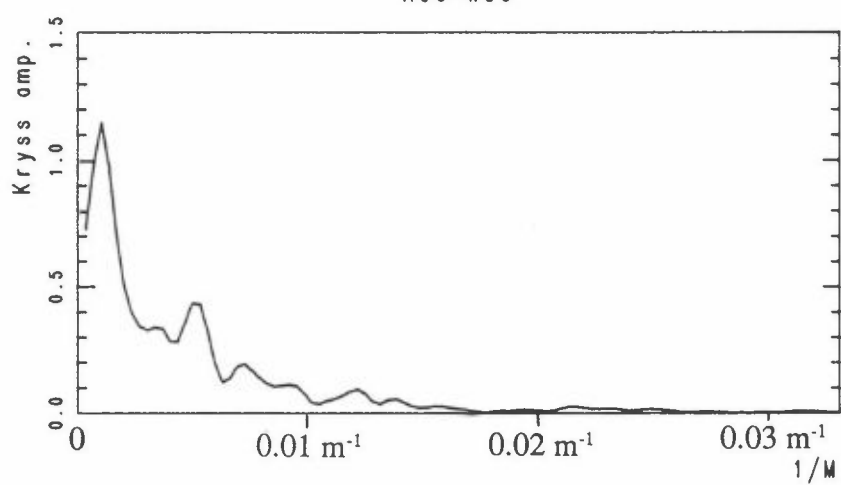


17. januar 1990 kl. 2300

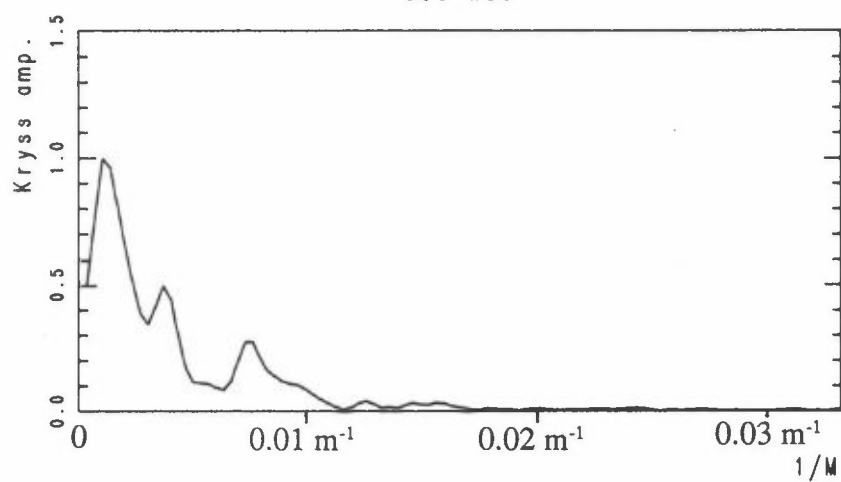
W36-W10



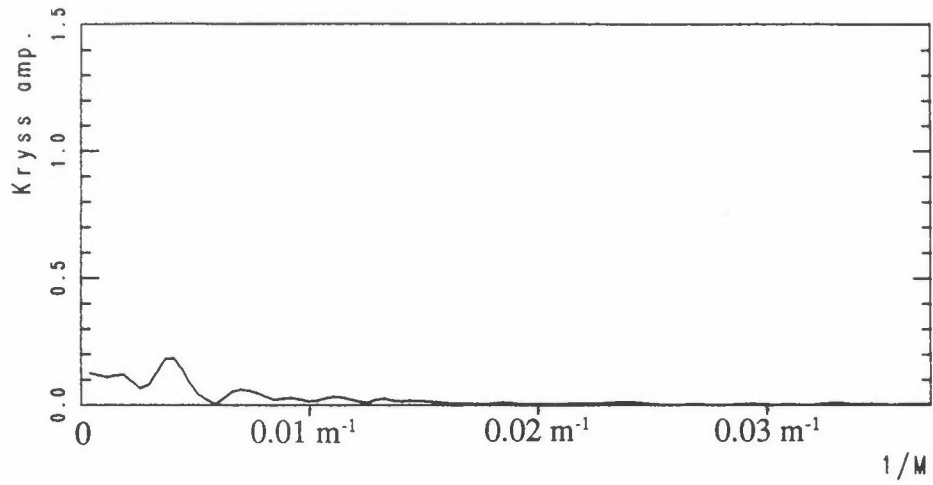
H36-W36



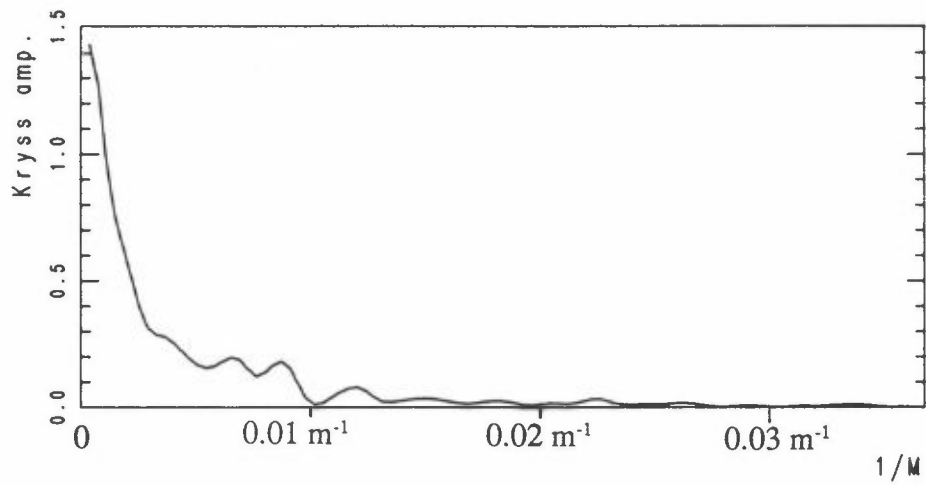
U36-W36



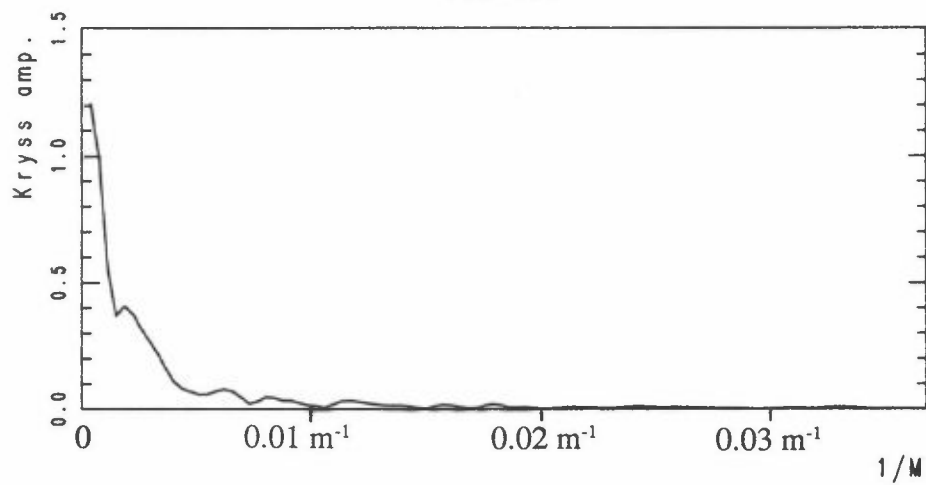
17. januar 1990 kl. 2300
W10-W10x



H10-W10

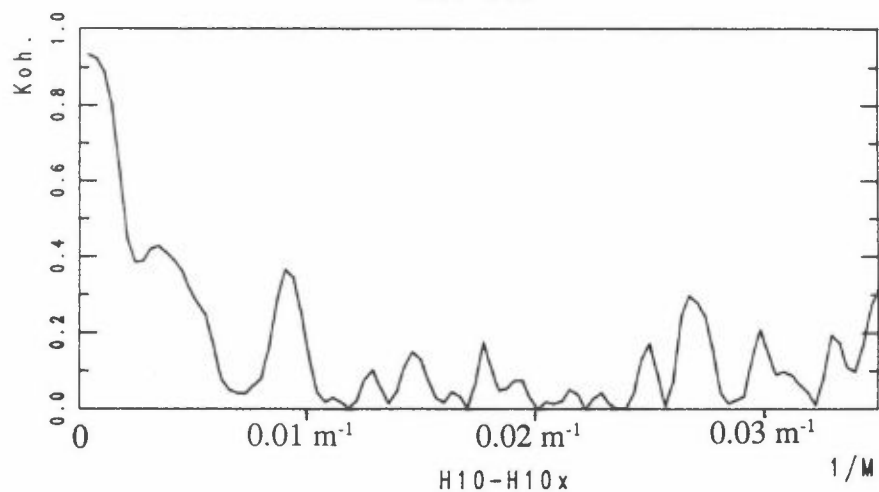


U10-W10

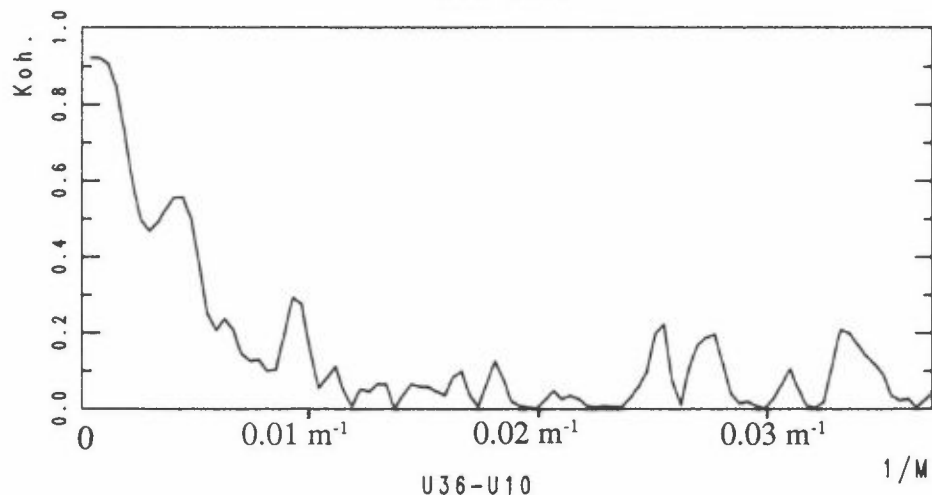


17. januar 1990 kl. 2300

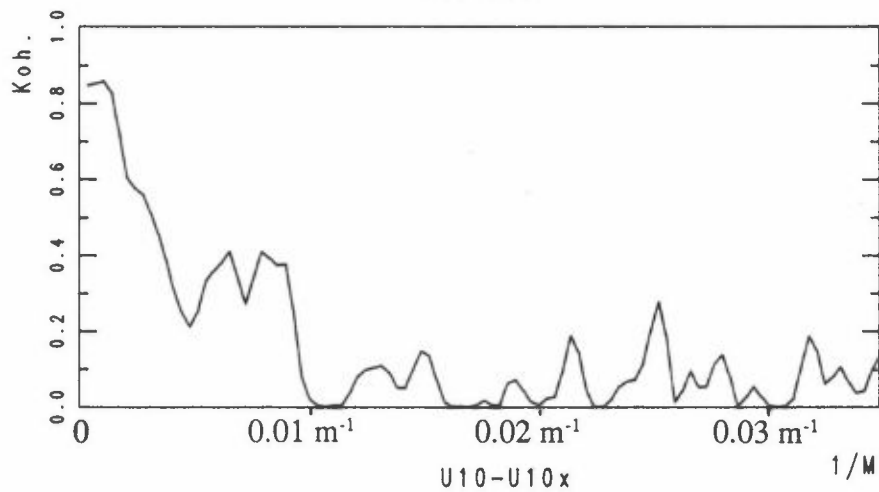
H36-H10



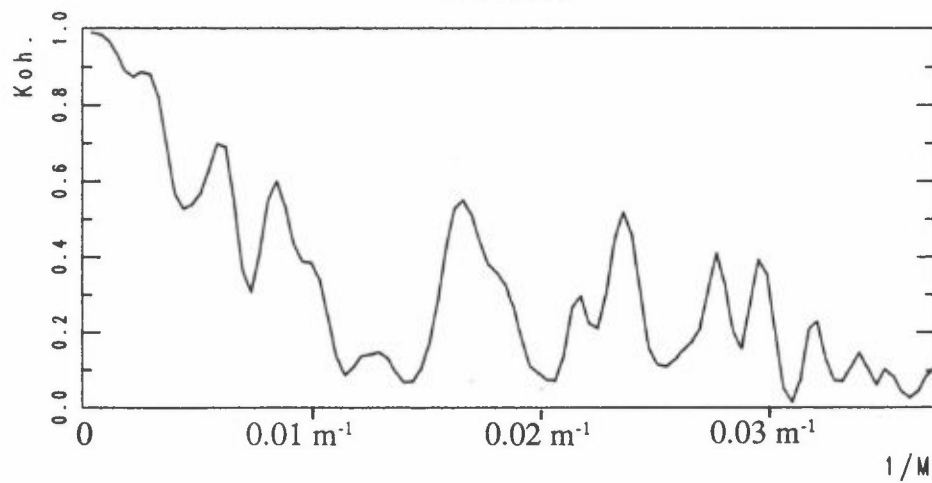
H10-H10x



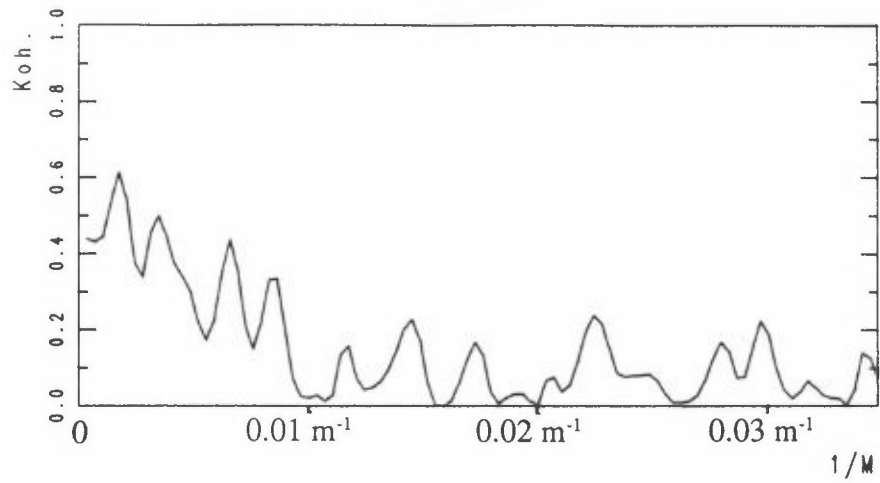
U36-U10



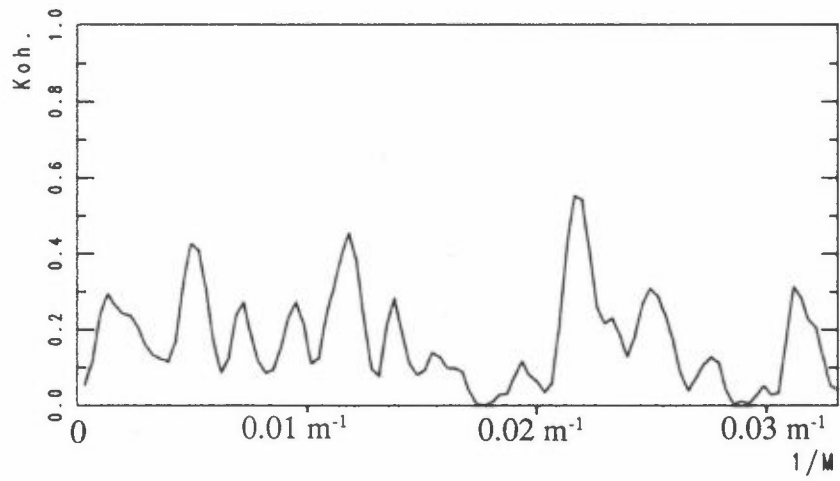
U10-U10x



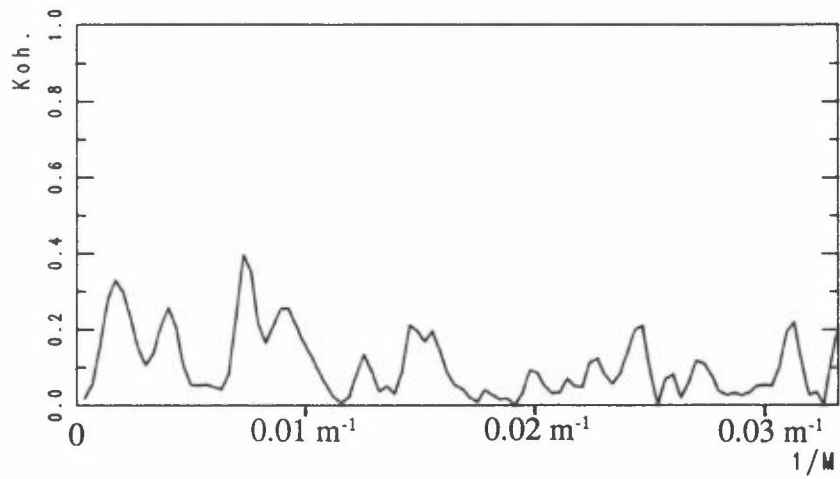
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W36-W10



H36-W36

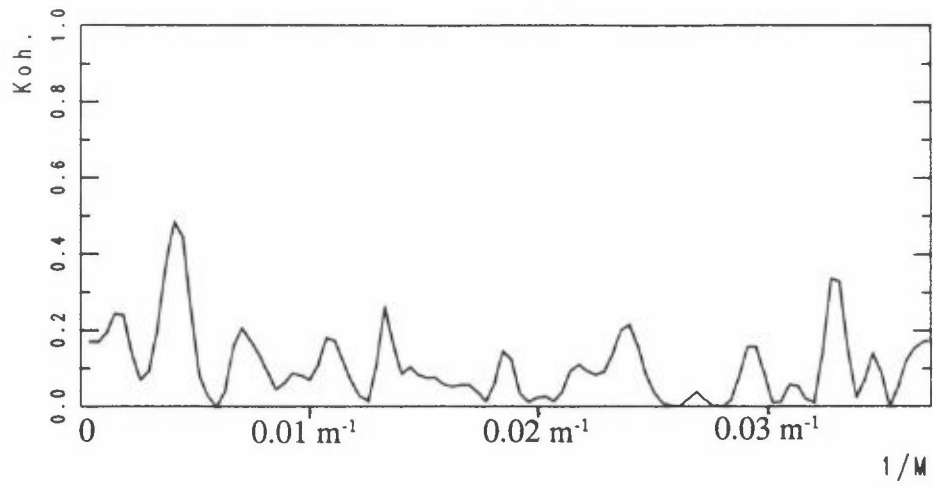


U36-W36

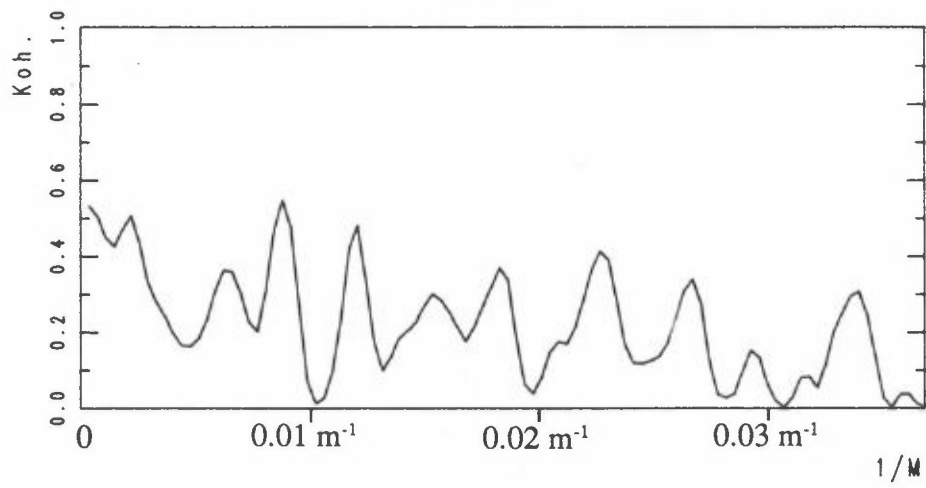


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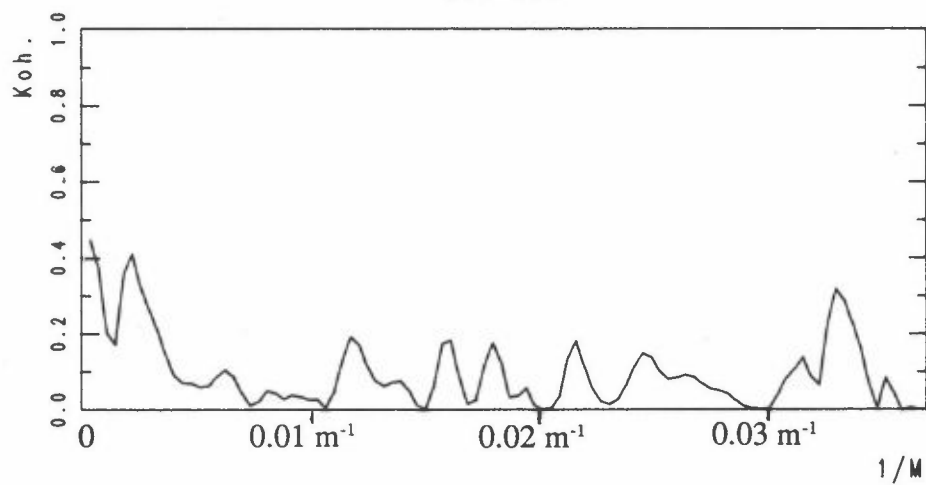
W10-W10x



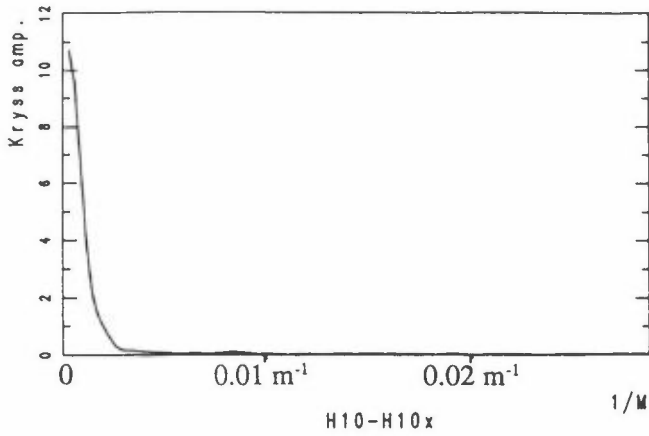
H10-W10



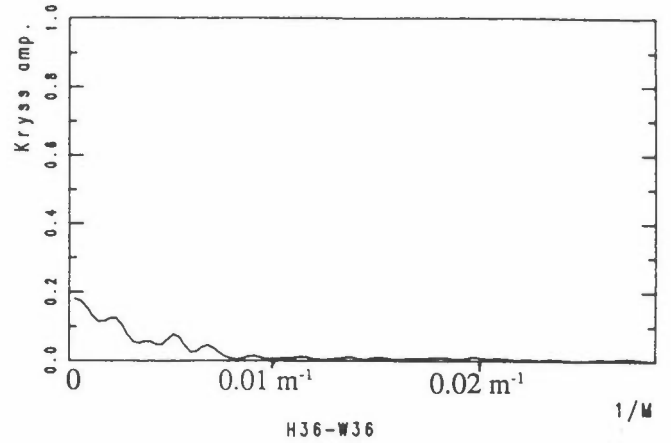
U10-W10



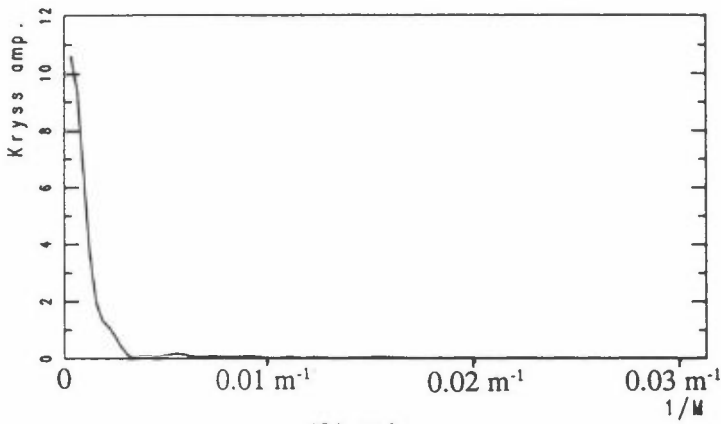
23. januar 1990 kl. 1600
H36-H10



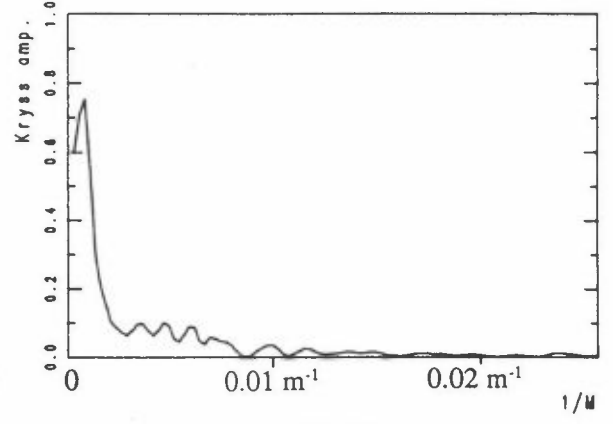
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W36-W10



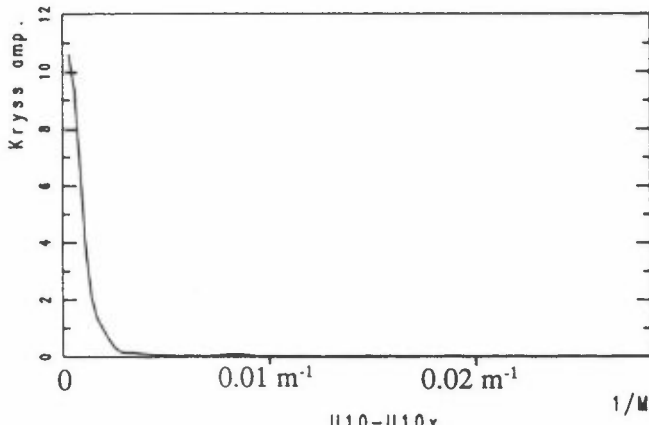
H10-H10x



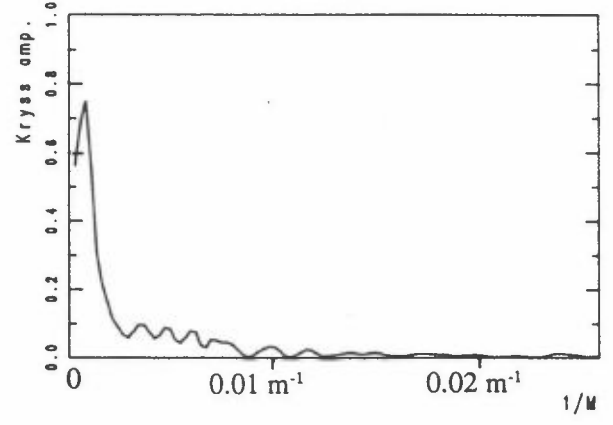
H36-W36



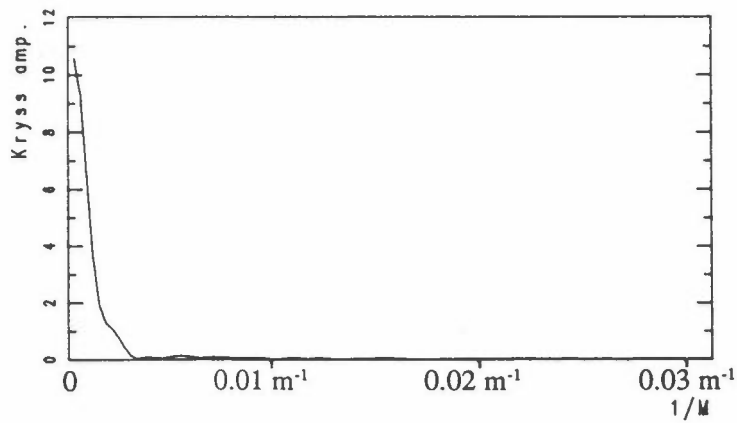
U36-U10



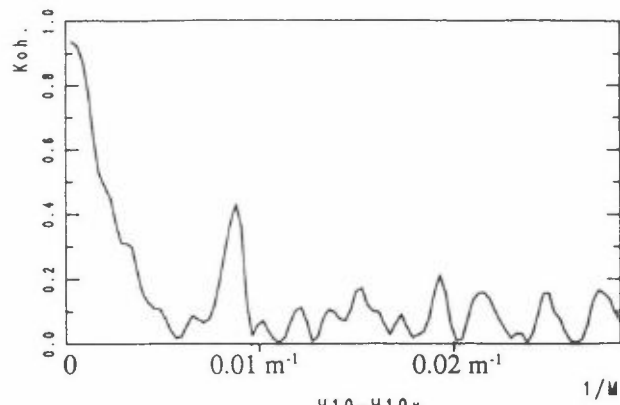
U36-W36



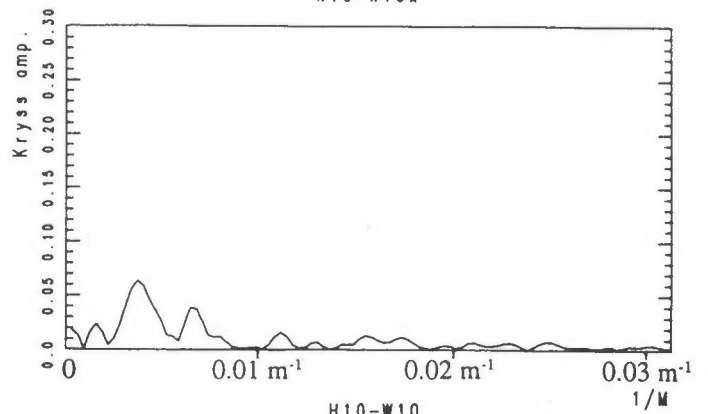
U10-U10x



23. januar 1990 kl. 1600
H36-H10

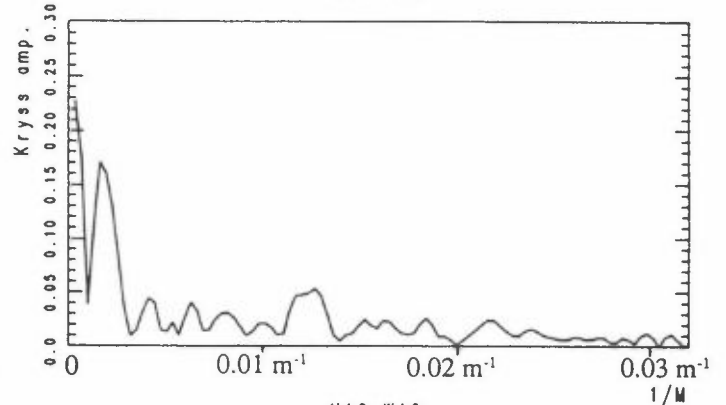
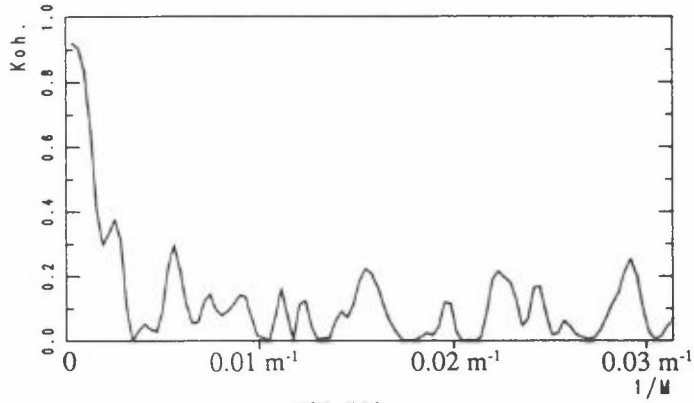


23. januar 1990 kl. 1600
W10-W10x



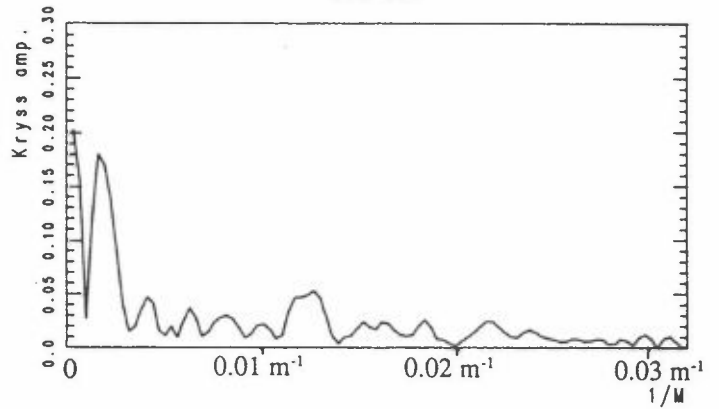
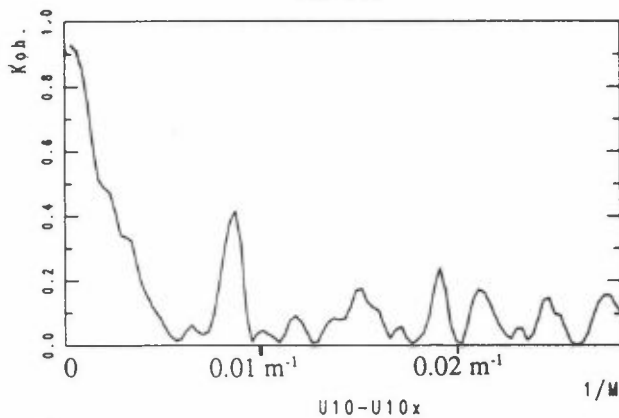
H10-H10x

H10-W10

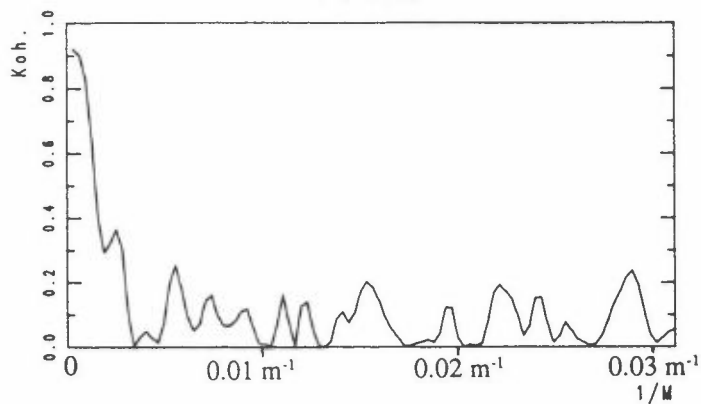


U36-U10

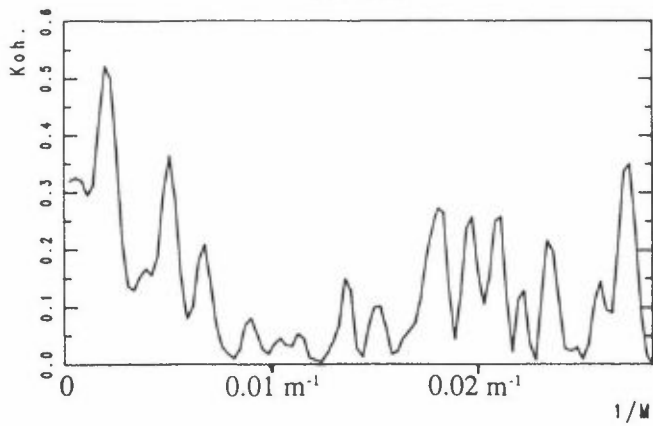
U10-W10



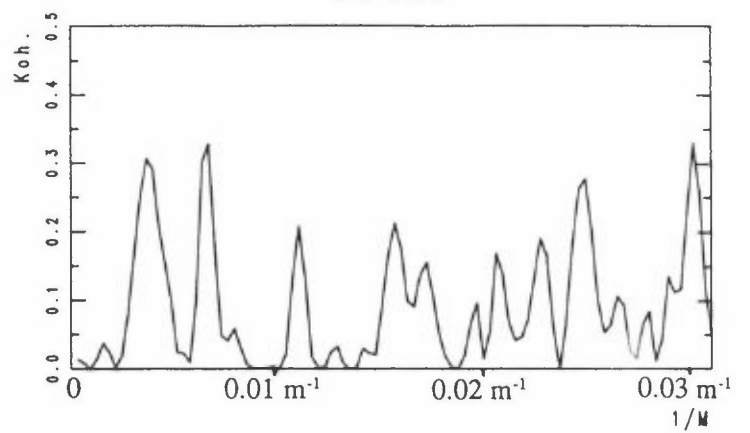
U10-U10x



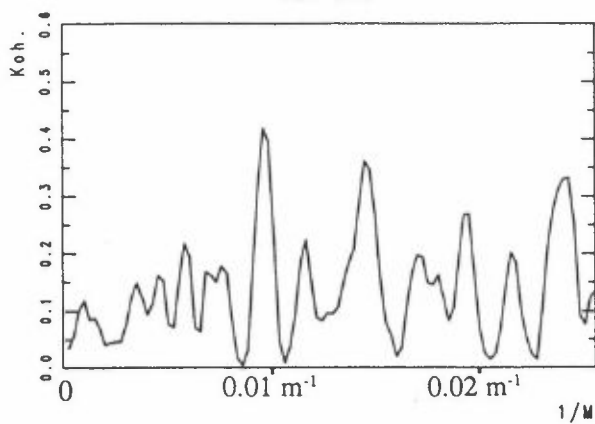
23. januar 1990 kl. 1600
W36-W10



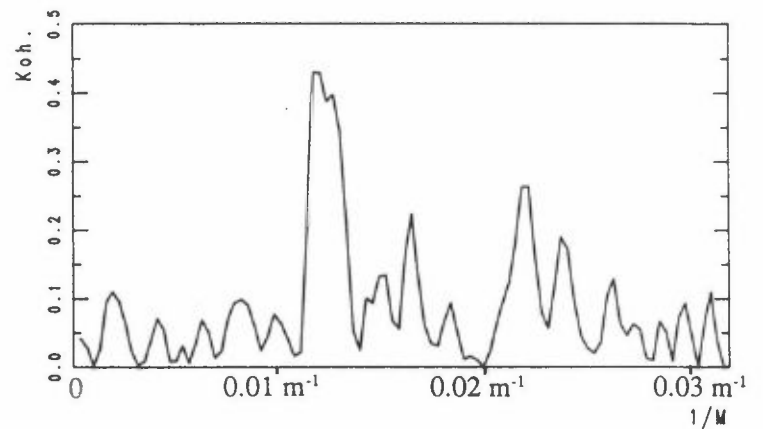
23. januar 1990 kl. 1600
W10-W10x



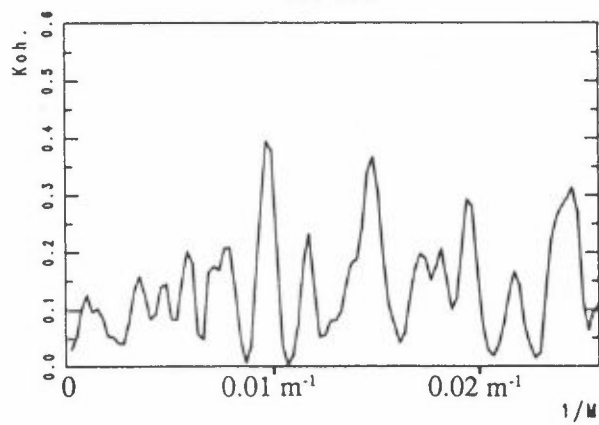
H36-W36



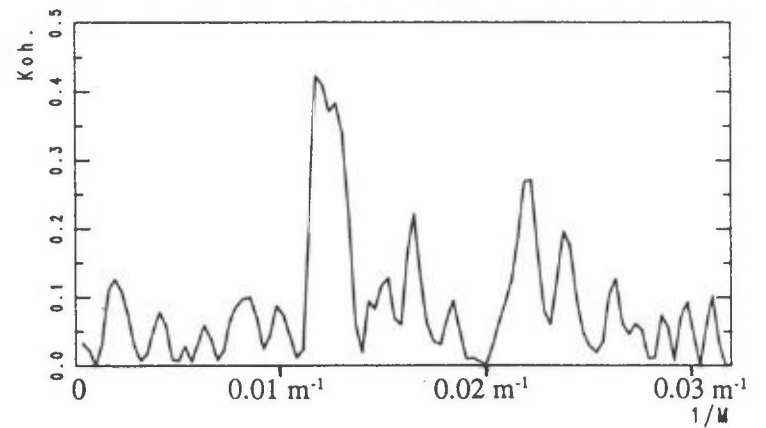
H10-W10



U36-W36

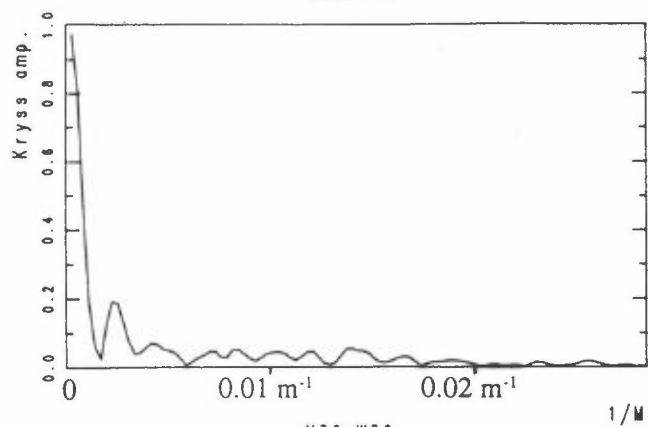


U10-W10

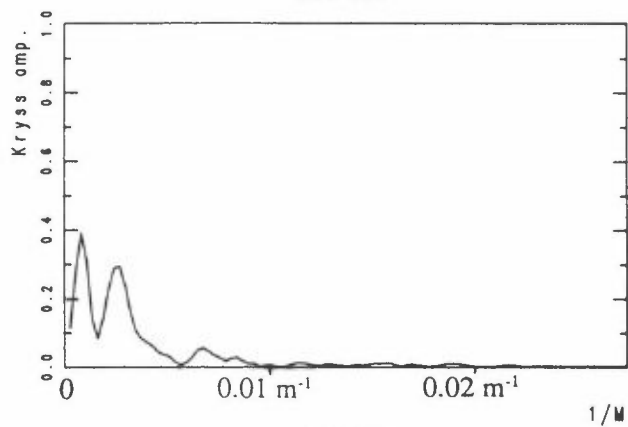


17. februar 1990 kl. 2140

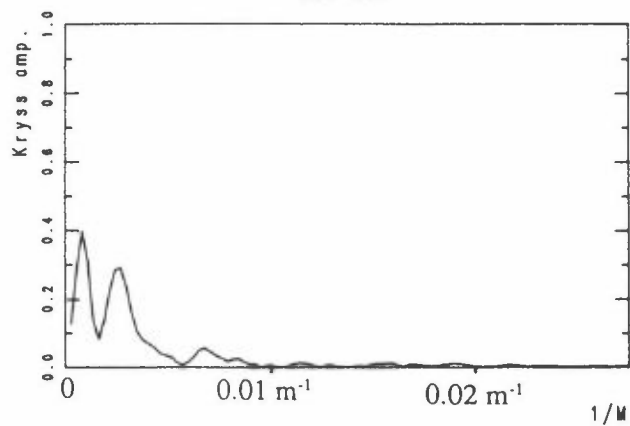
W36-W10



H36-W36

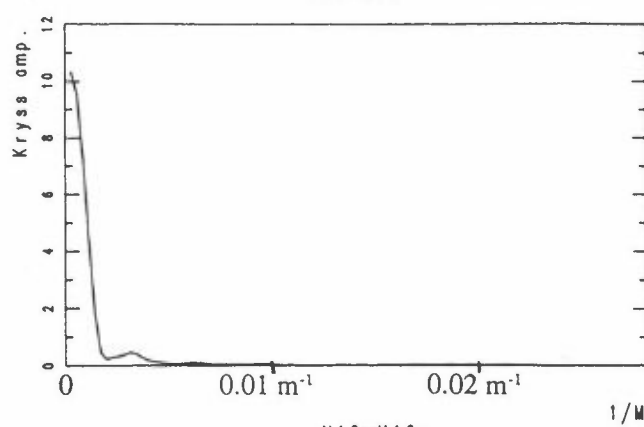


U36-W36

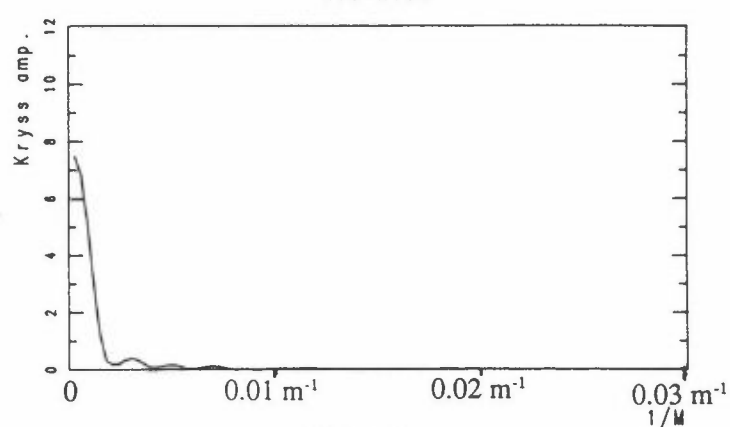


17. februar 1990 kl. 2140

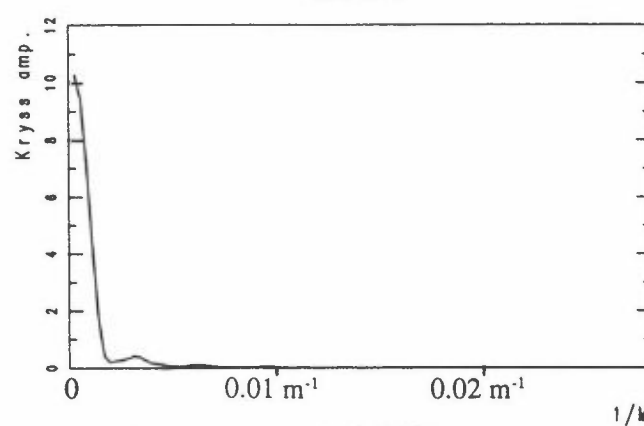
H36-H10



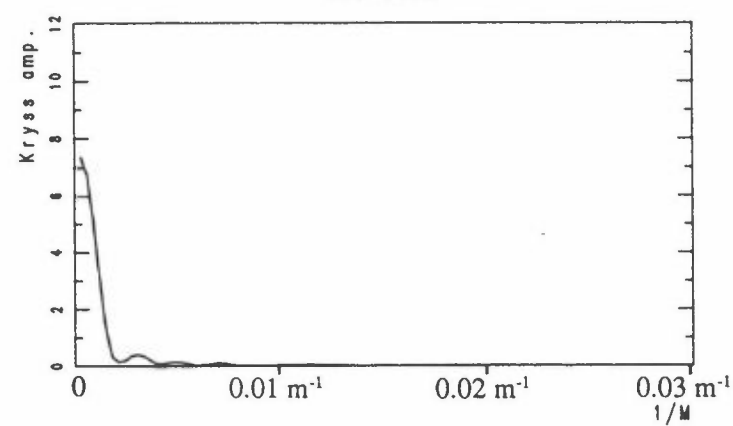
H10-H10x



U36-U10

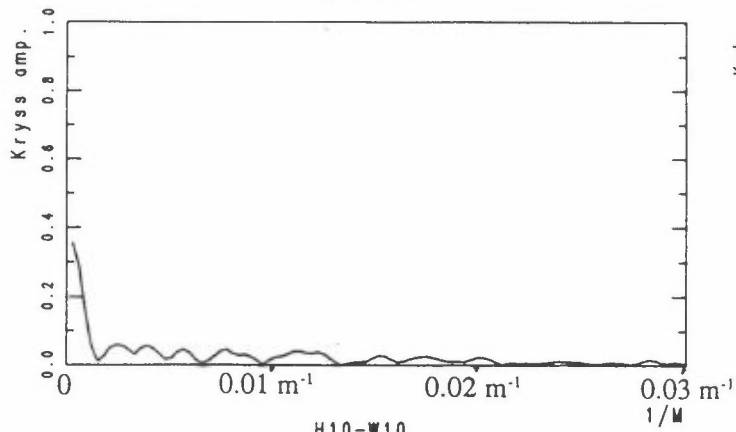


U10-U10x



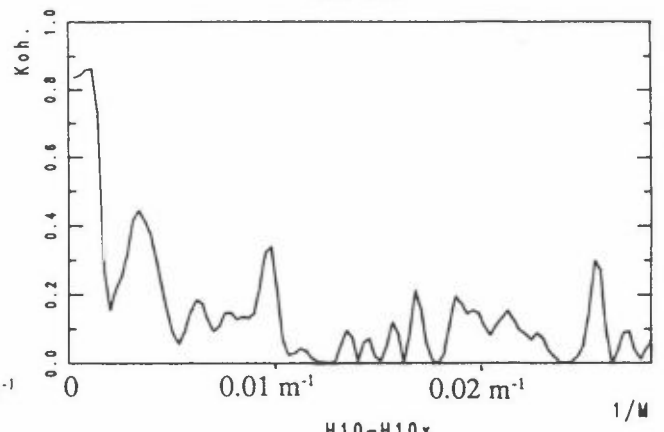
17. februar 1990 kl. 2140

W10-W10x

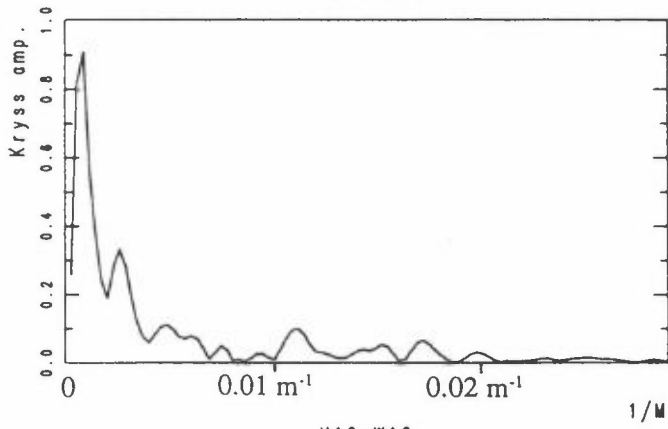


17. februar 1990 kl. 2140

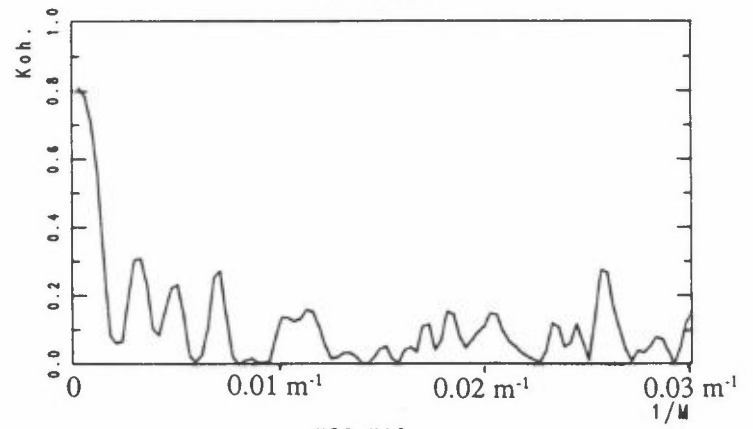
H36-H10



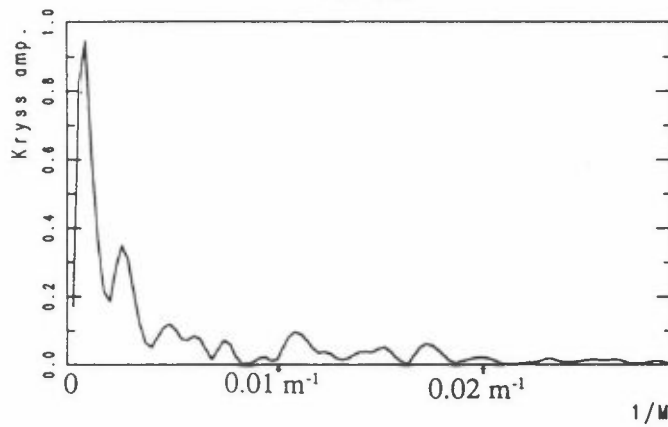
H10-W10



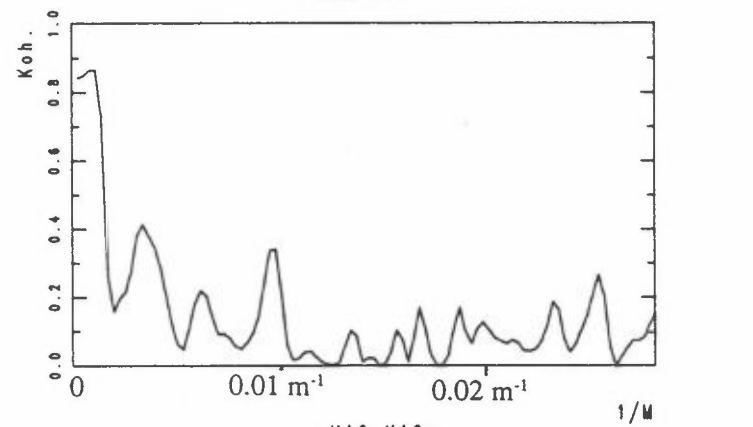
H10-H10x



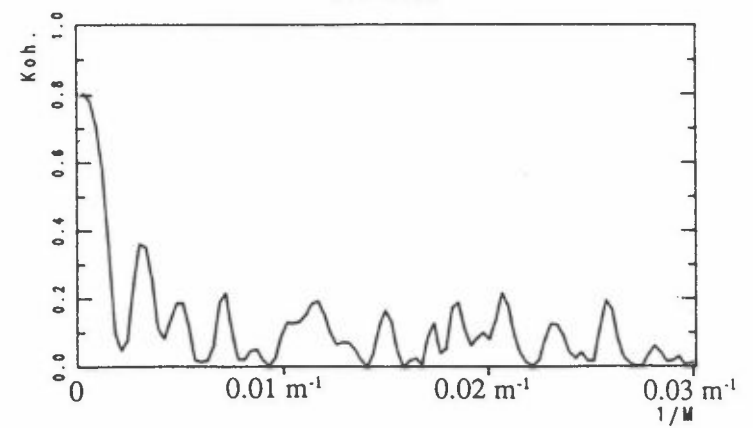
U10-W10



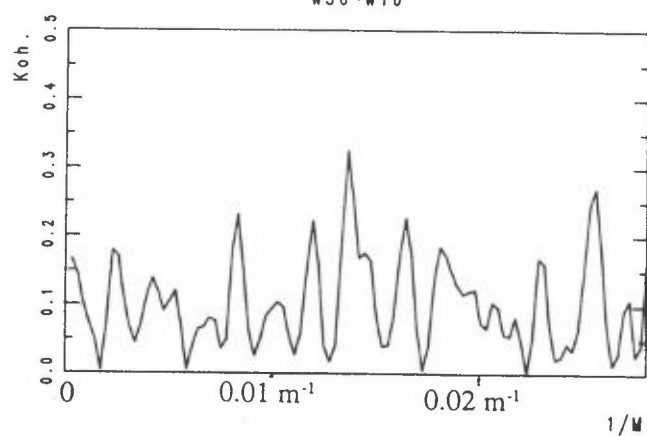
U36-U10



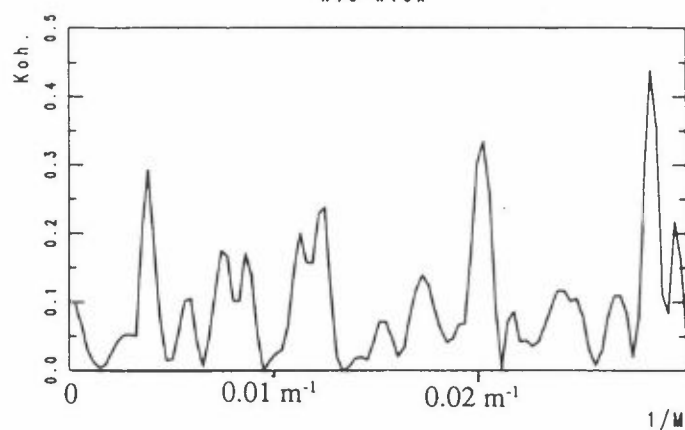
U10-U10x



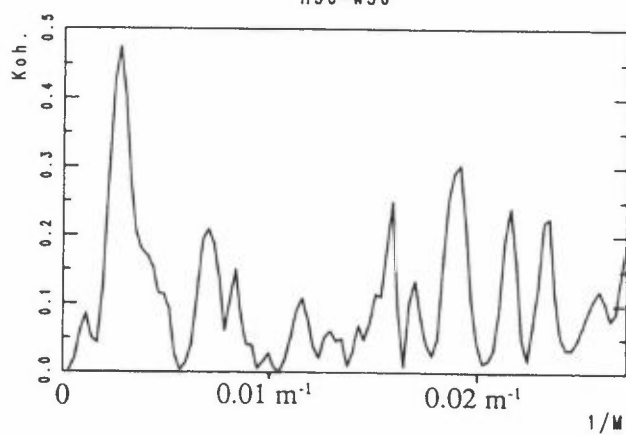
17. februar 1990 kl. 2140
W36-W10



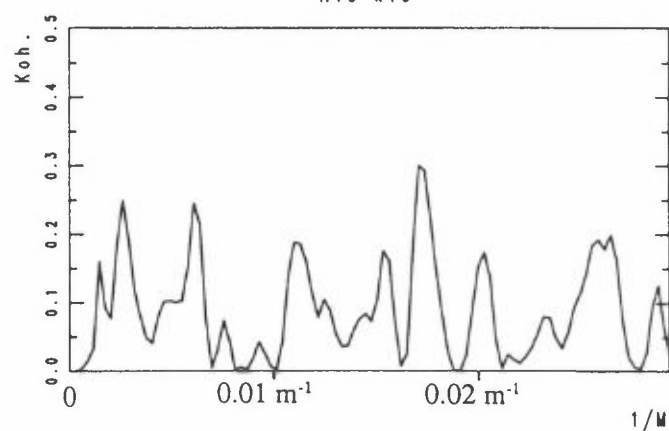
17. februar 1990 kl. 2140
W10-W10x



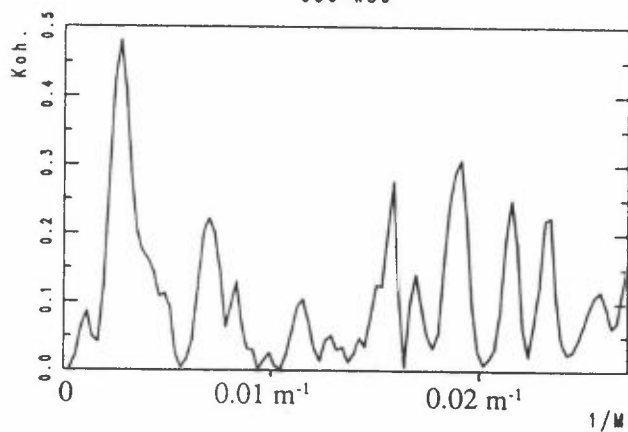
H36-W36



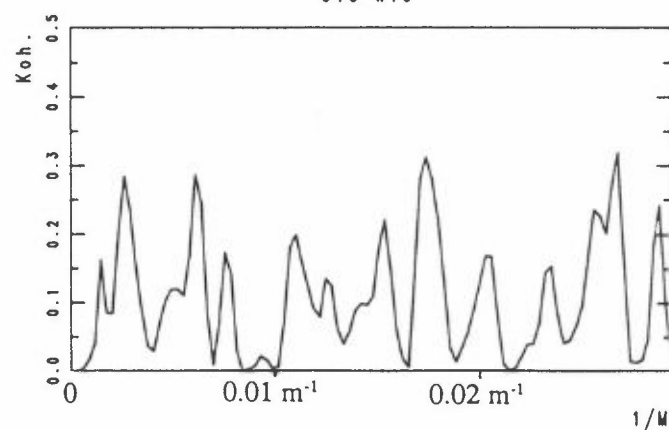
H10-W10



U36-W36

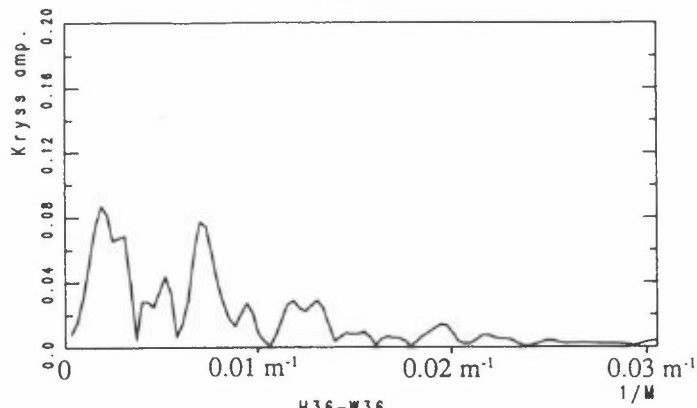


U10-W10

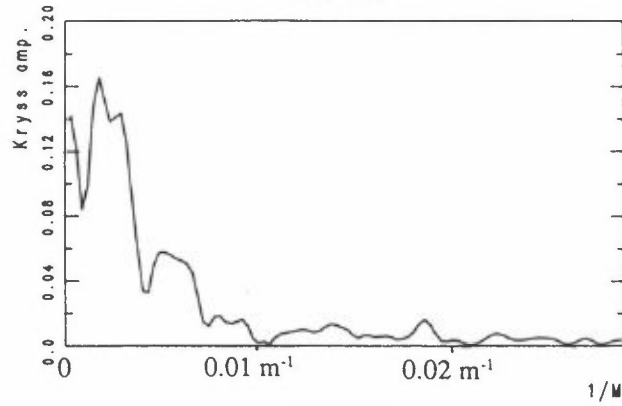


19. februar 1990 kl. 1530

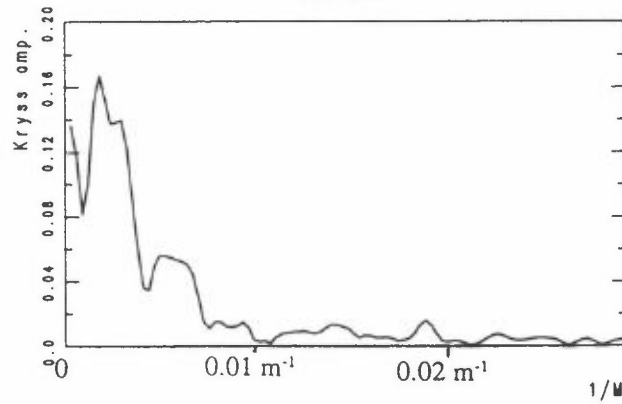
W36-W10



H36-W36

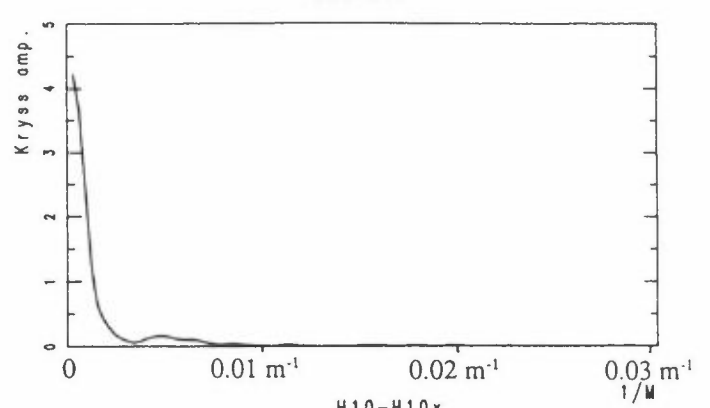


U36-W36

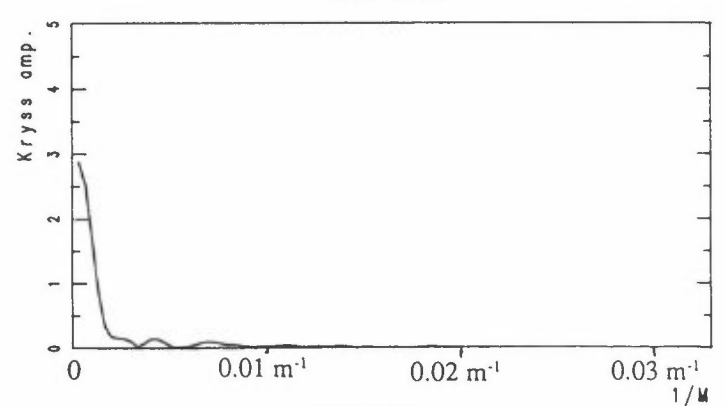


19. februar 1990 kl. 1530

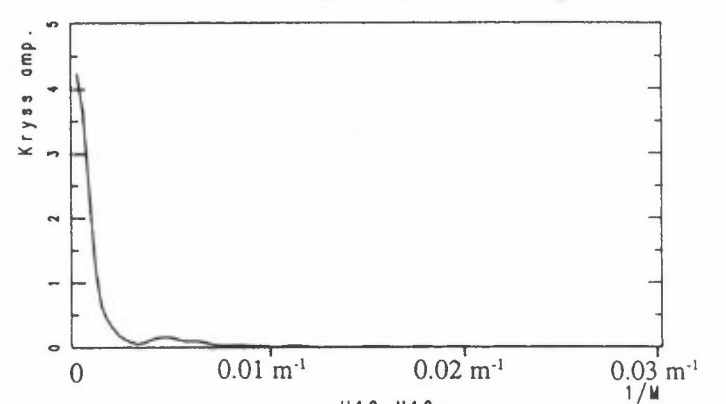
H36-H10



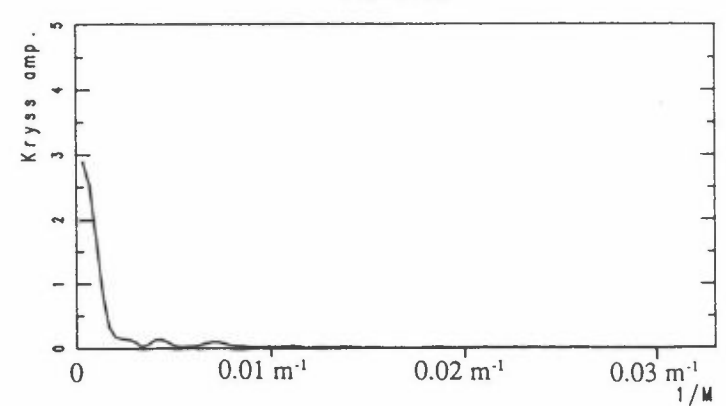
H10-H10x



U36-U10

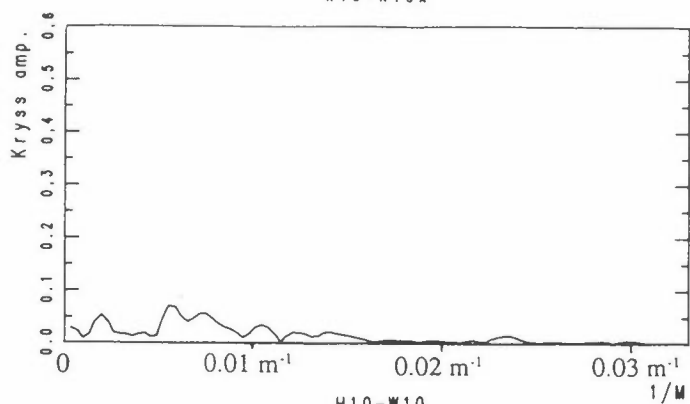


U10-U10x



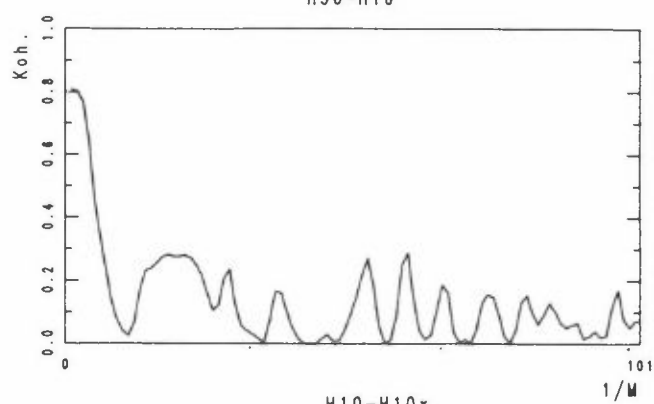
19. februar 1990 kl. 1530

W10-W10x

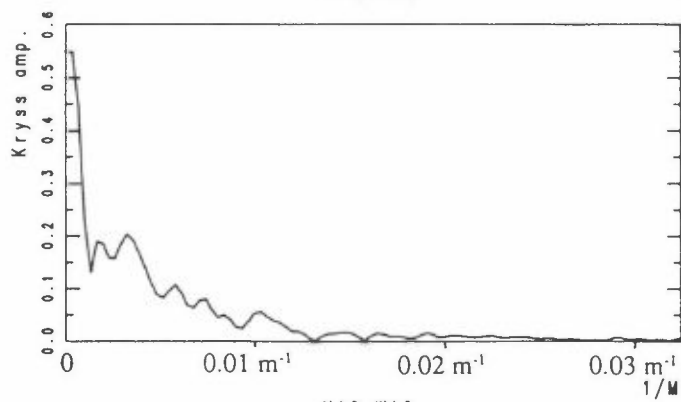


19. februar 1990 kl. 1530

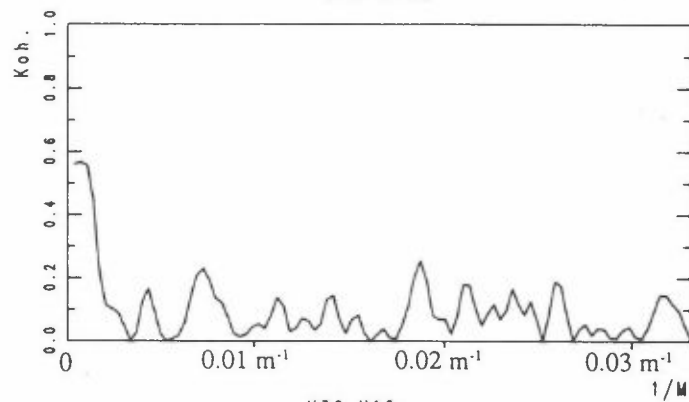
H36-H10



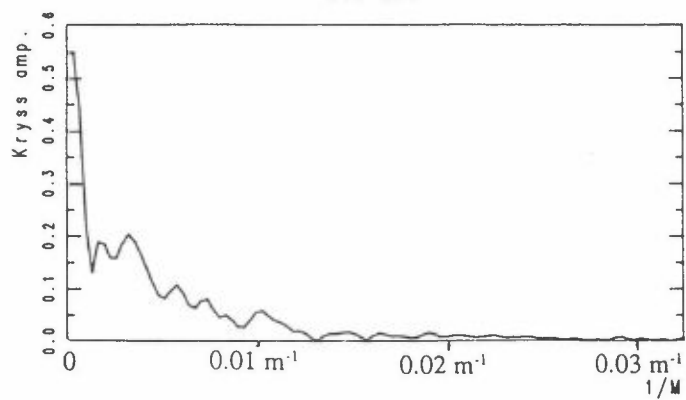
H10-W10



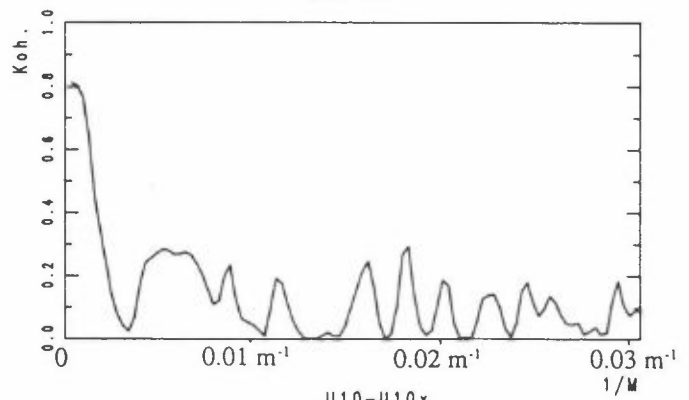
H10-H10x



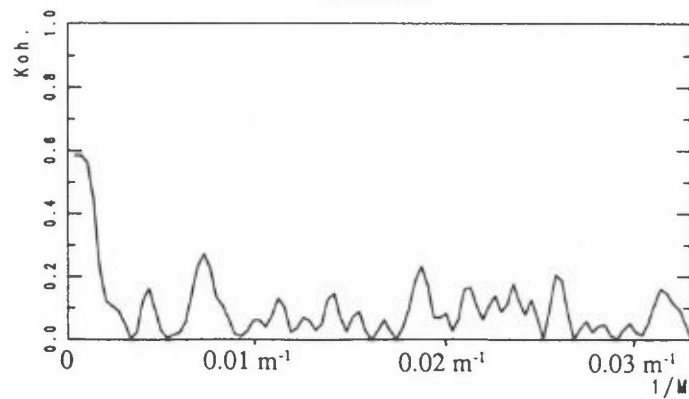
U10-W10



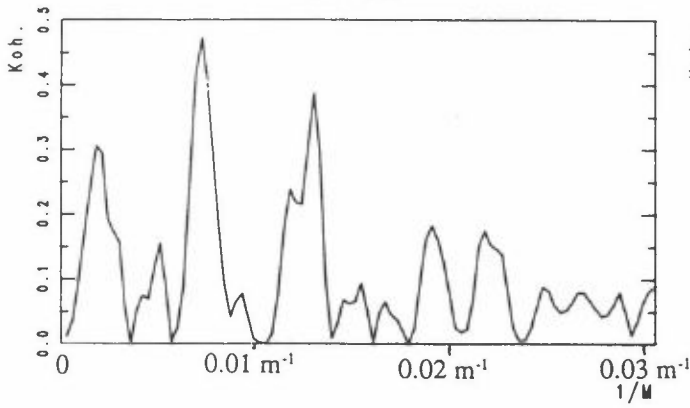
U36-U10



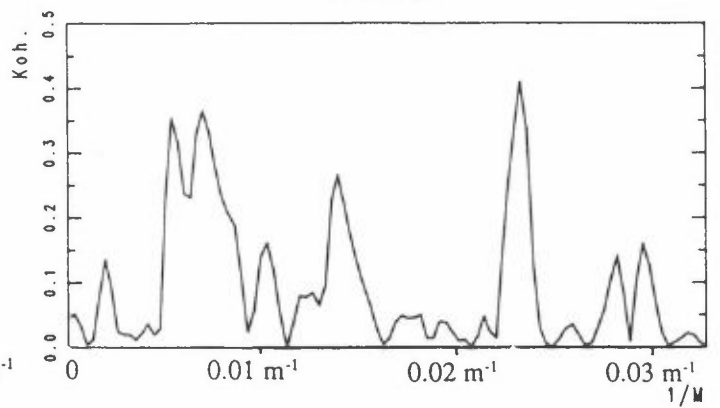
U10-U10x



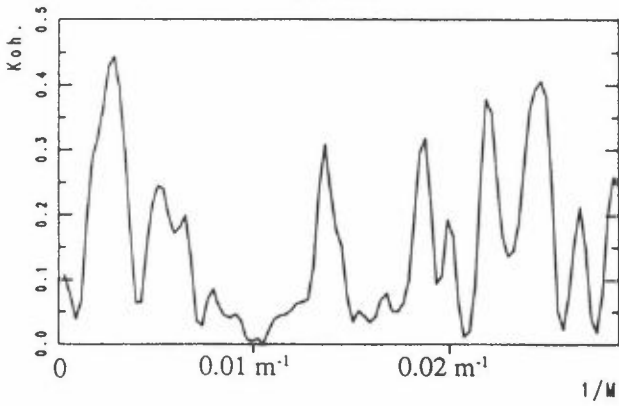
19. februar 1990 kl. 1530
W36-W10



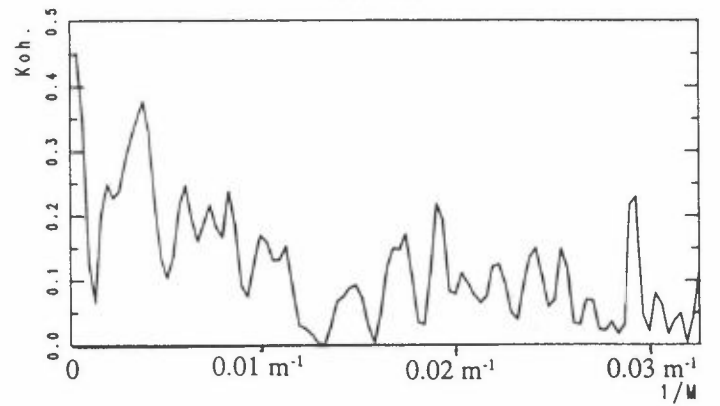
19. februar 1990 kl. 1530
W10-W10x



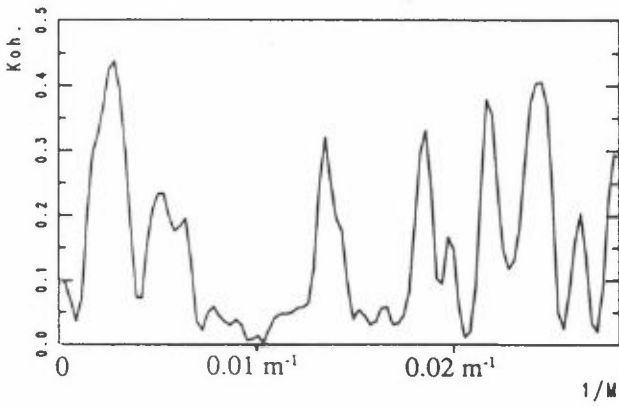
H36-W36



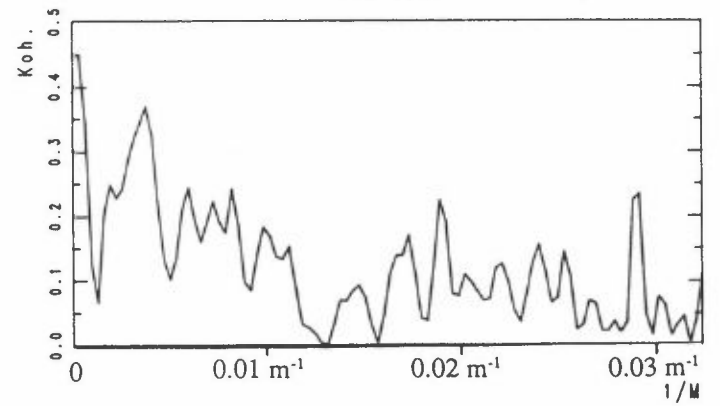
H10-W10



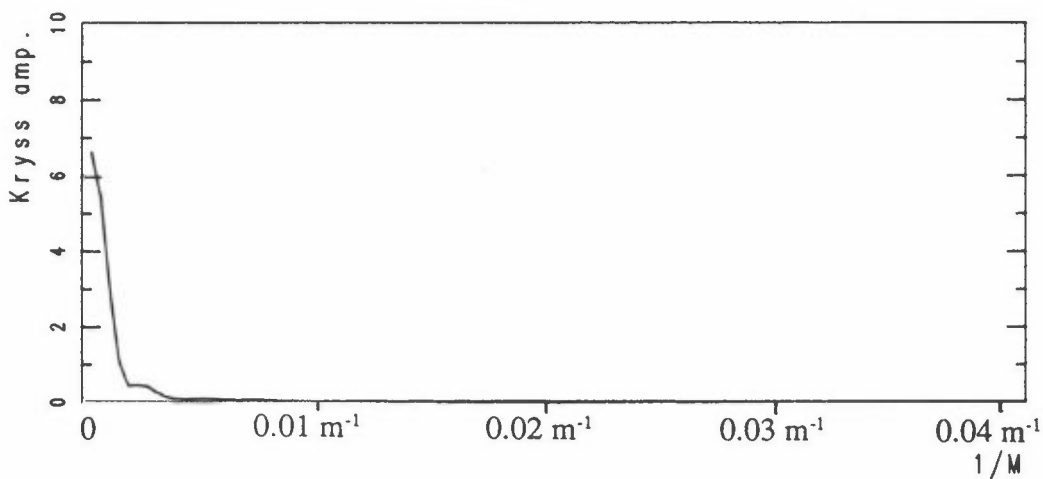
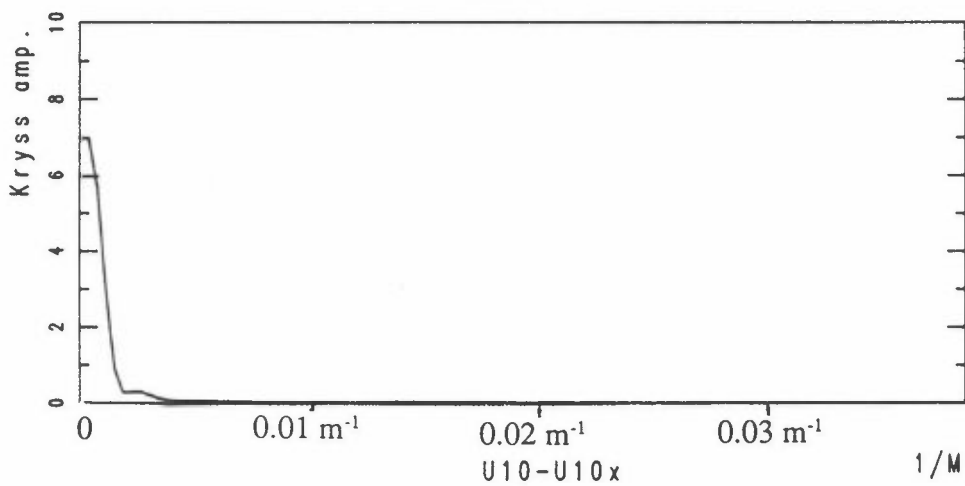
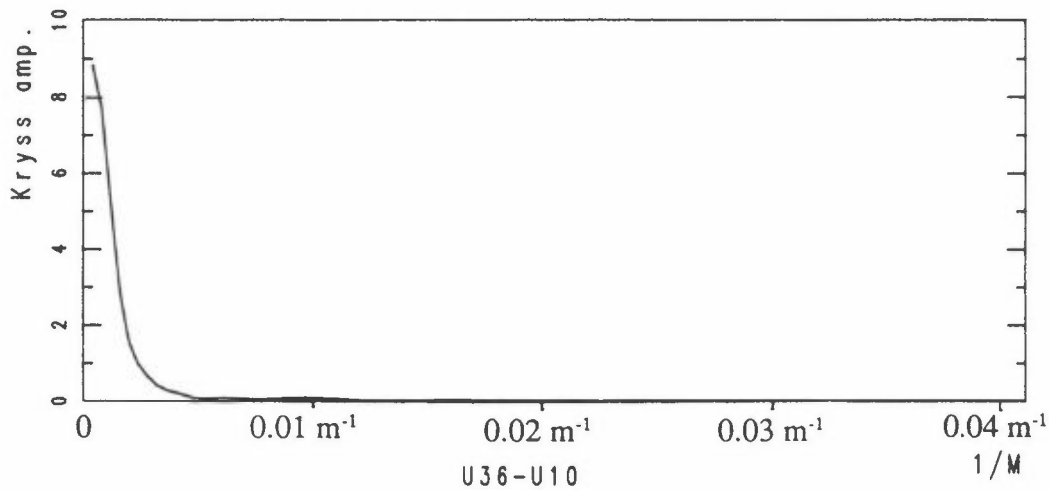
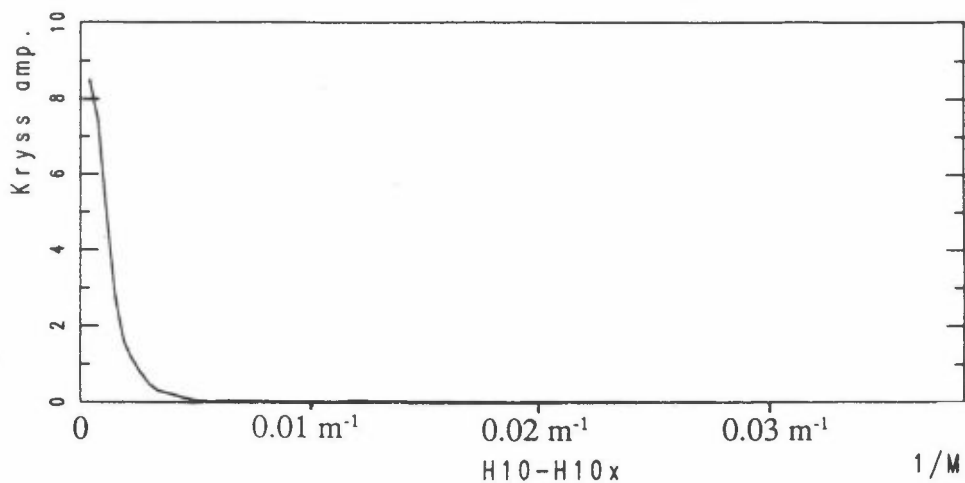
U36-W36



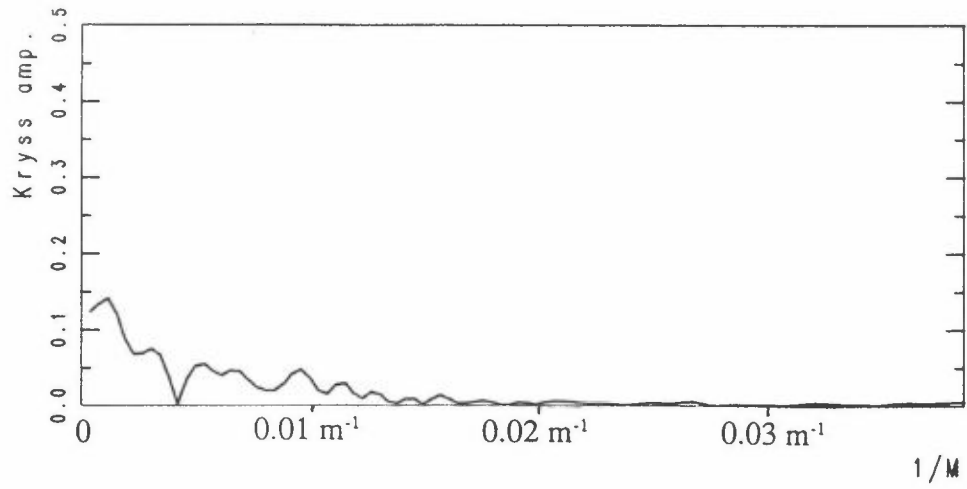
U10-W10



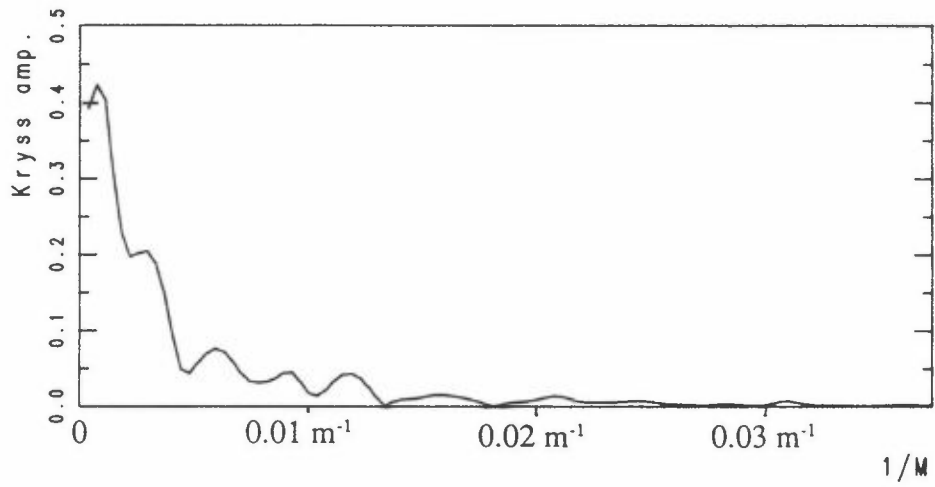
4. mars 1990 kl. 1350
H36-H10



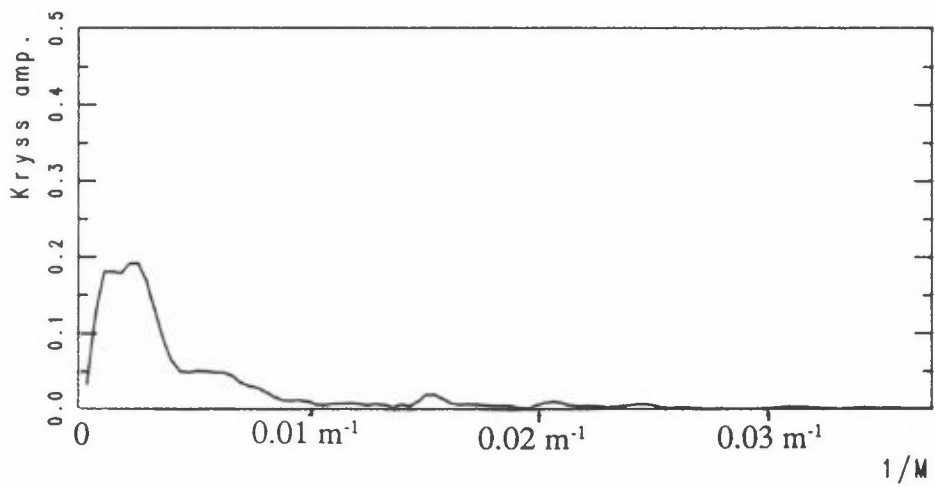
4. mars 1990 kl. 1350
W36-W10



H36-W36

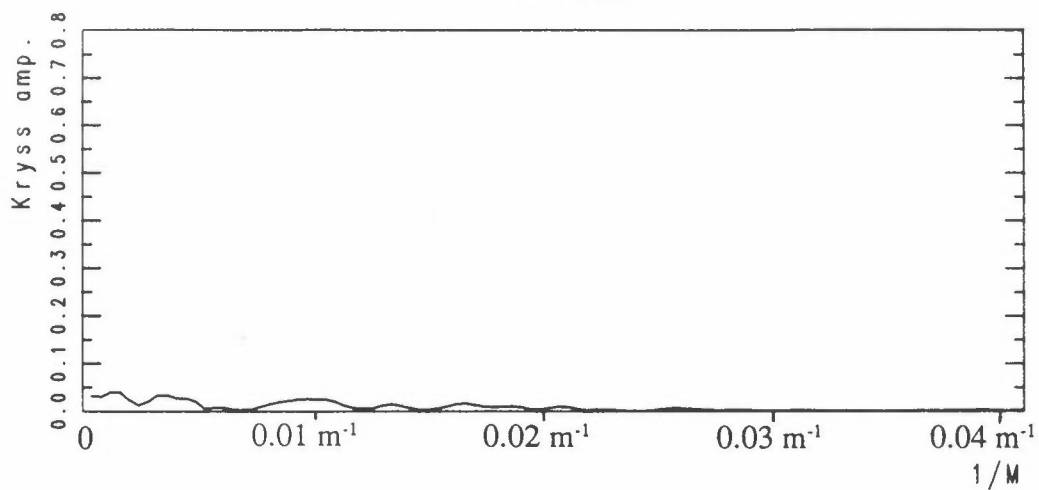


U36-W36

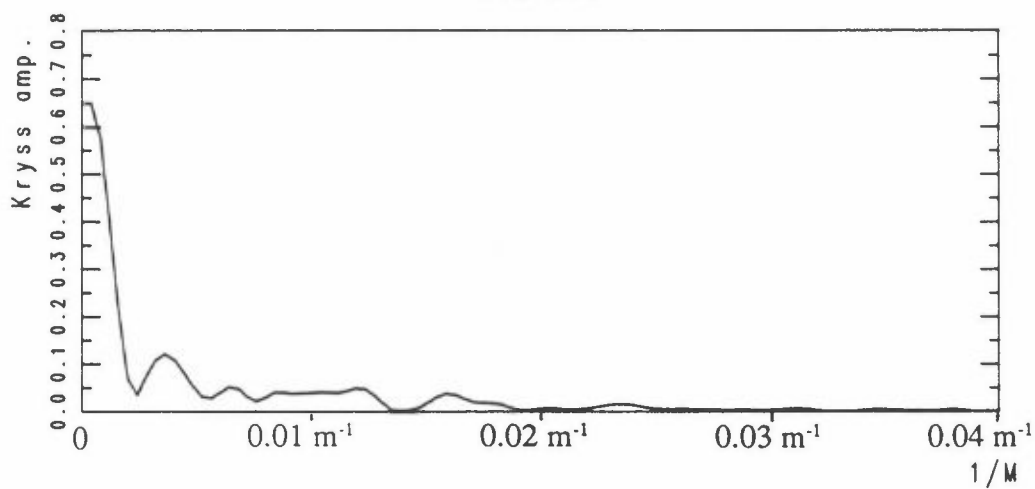


4. mars 1990 kl. 1350

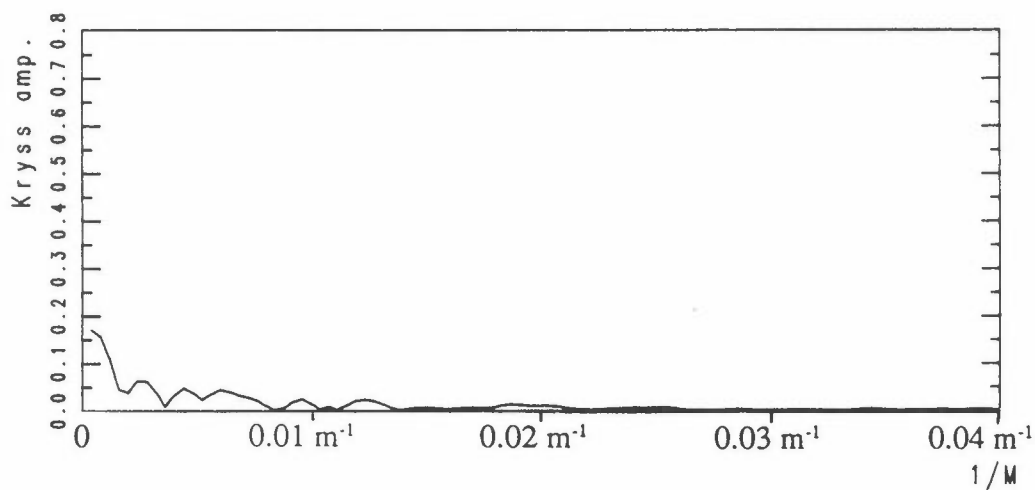
W10-W10x



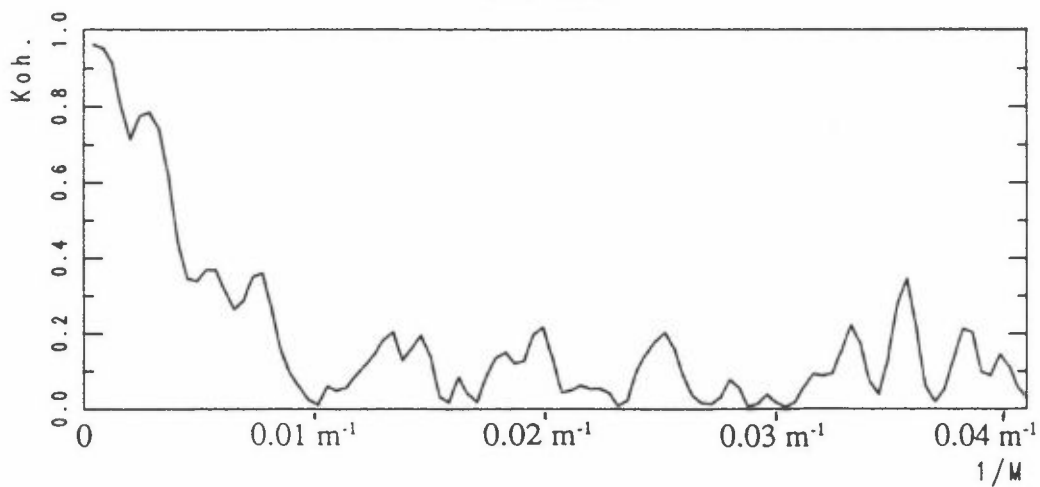
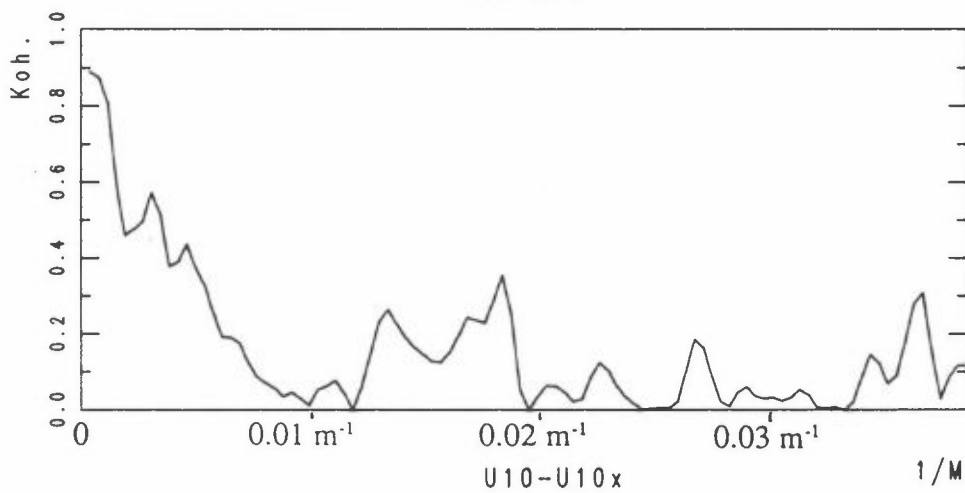
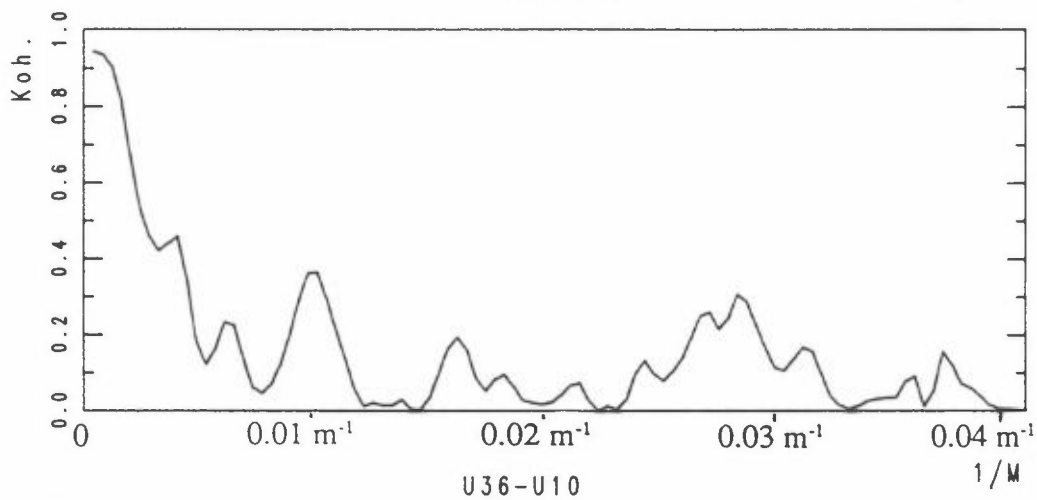
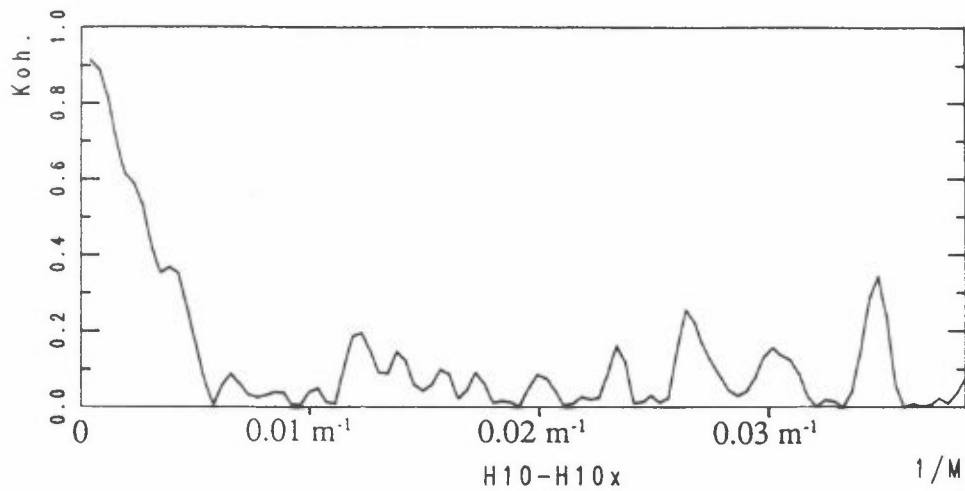
H10-W10



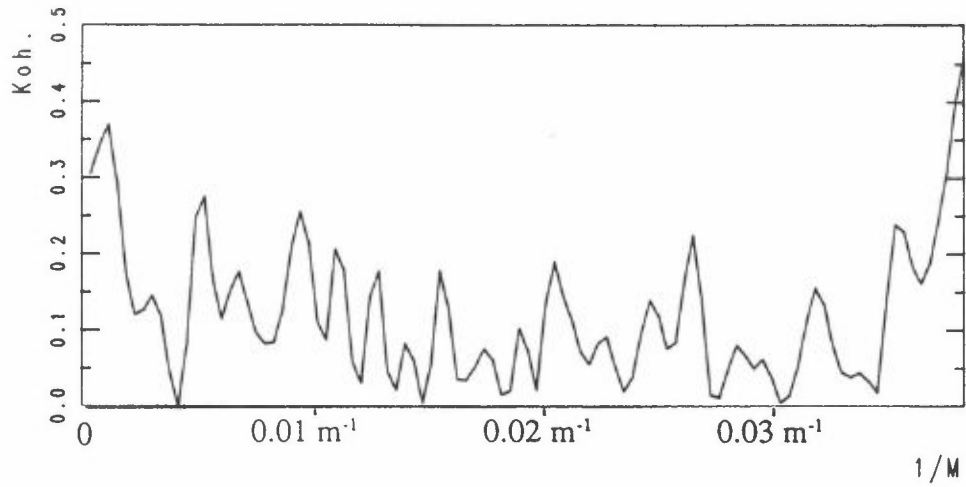
U10-W10



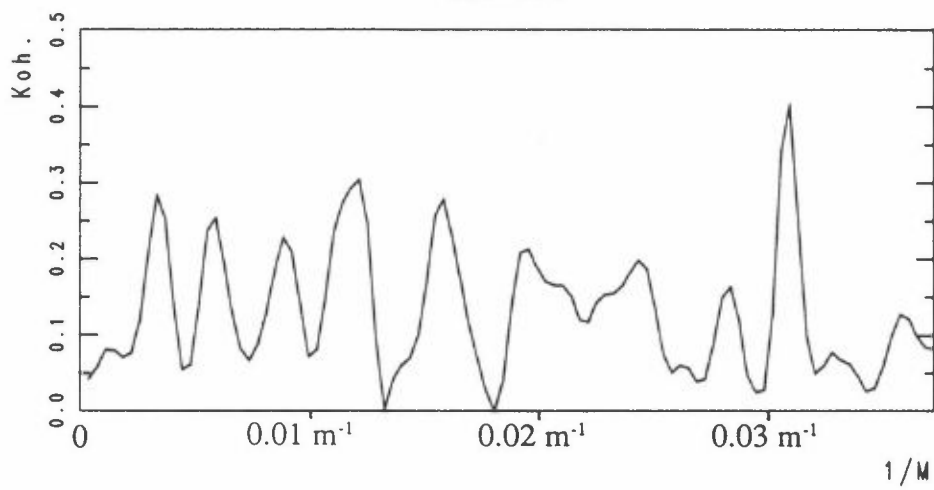
4. mars 1990 kl. 1350
H36-H10



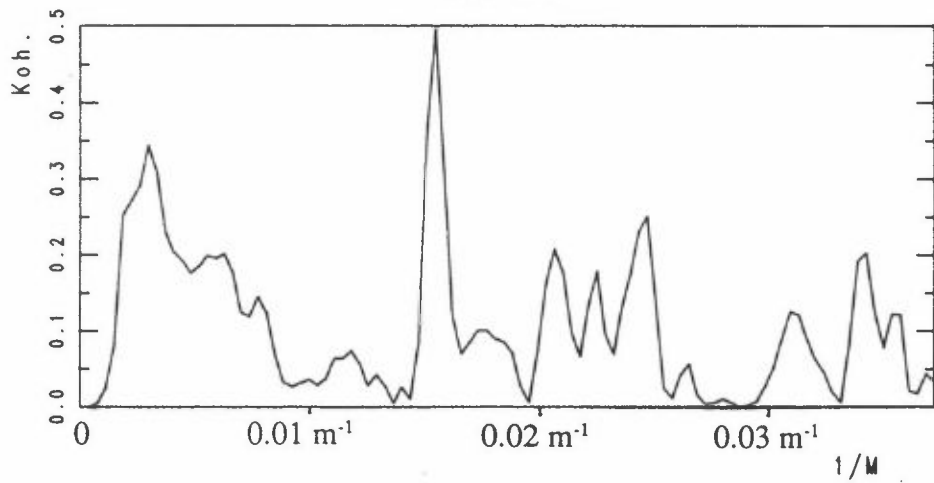
4. mars 1990 kl. 1350
W36-W10



H36-W36

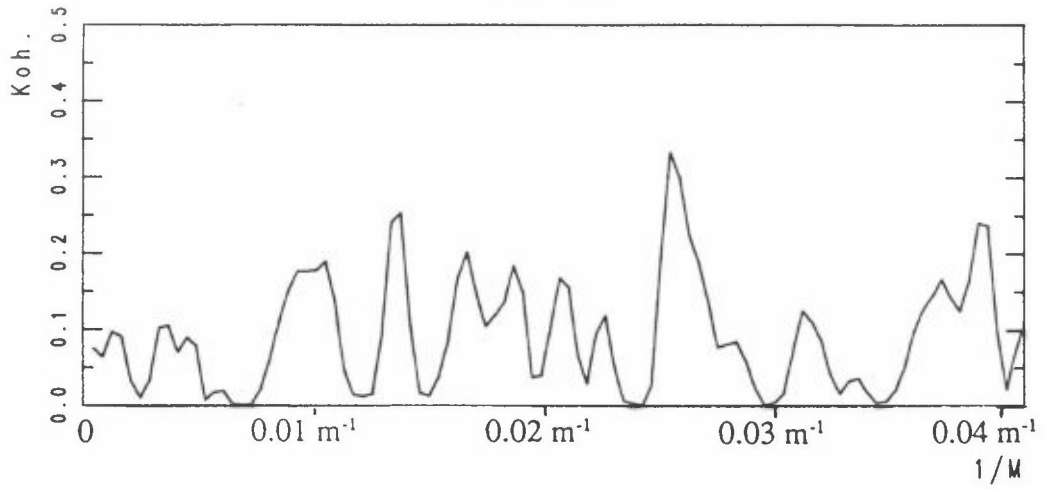


U36-W36

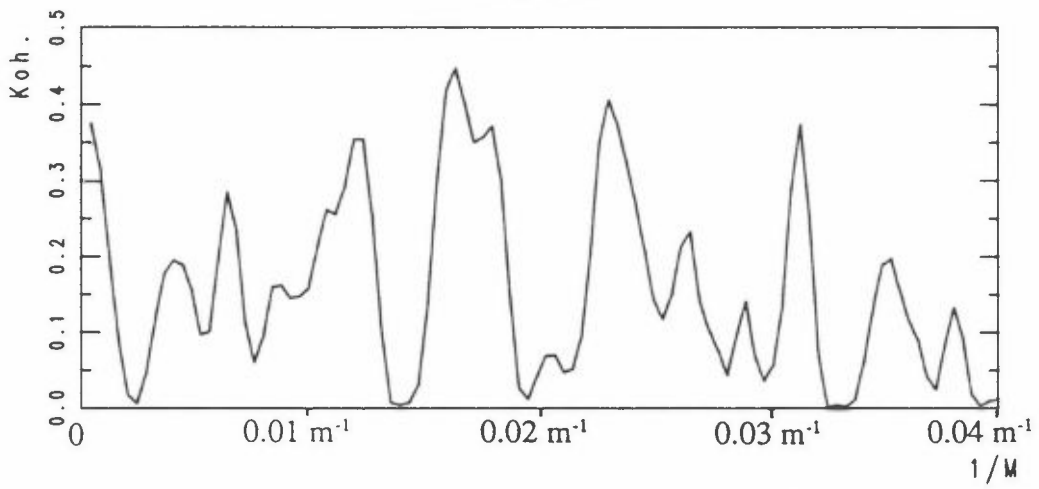


4. mars 1990 kl. 1350

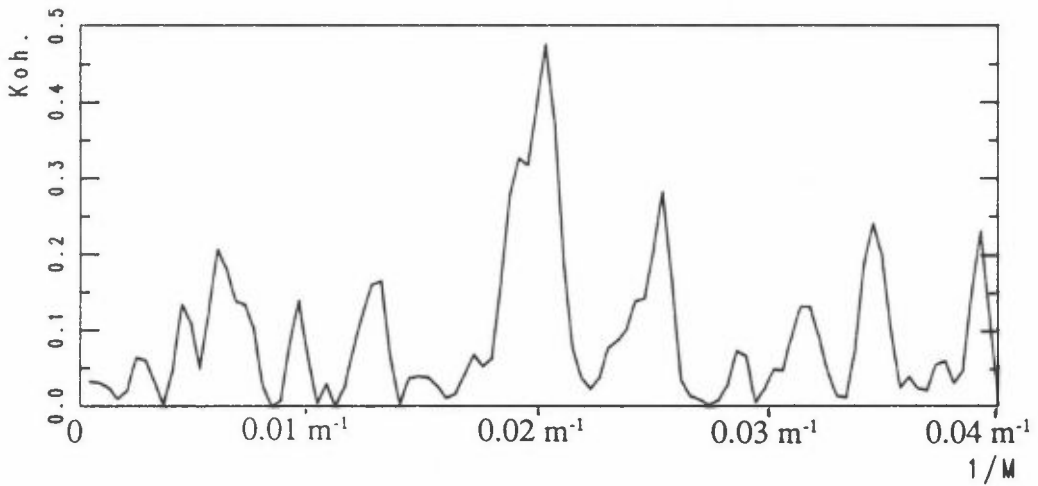
W10-W10x



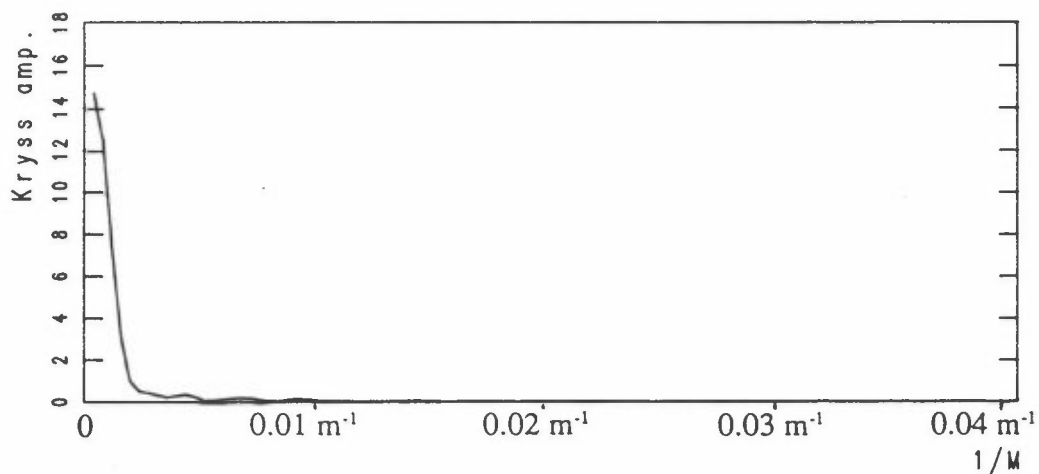
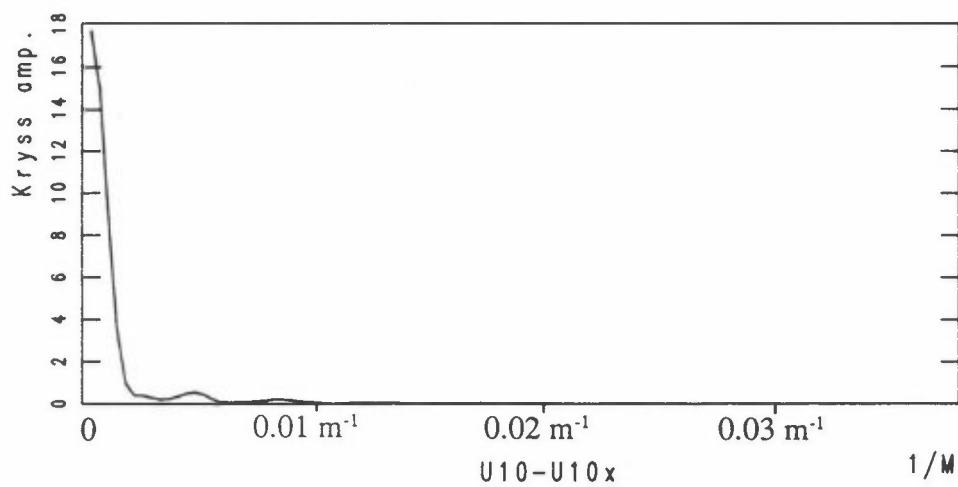
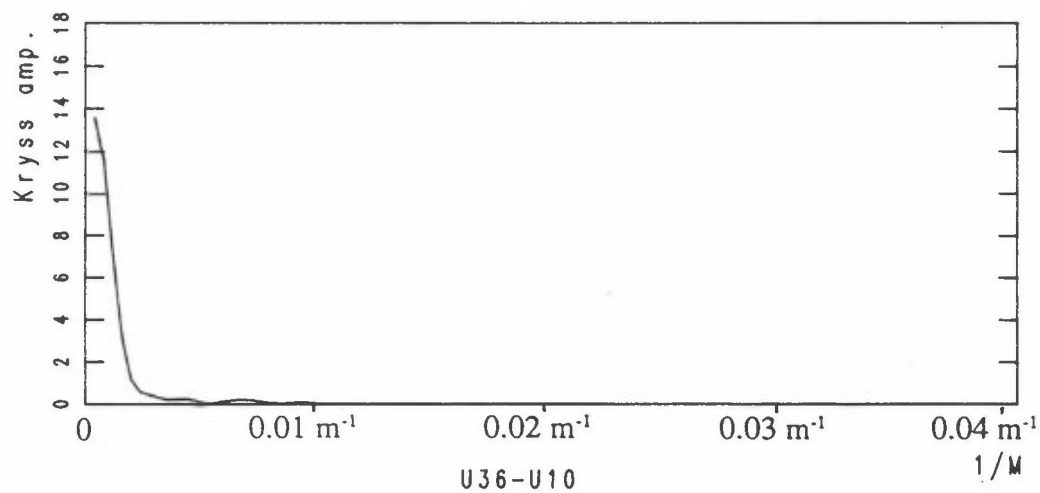
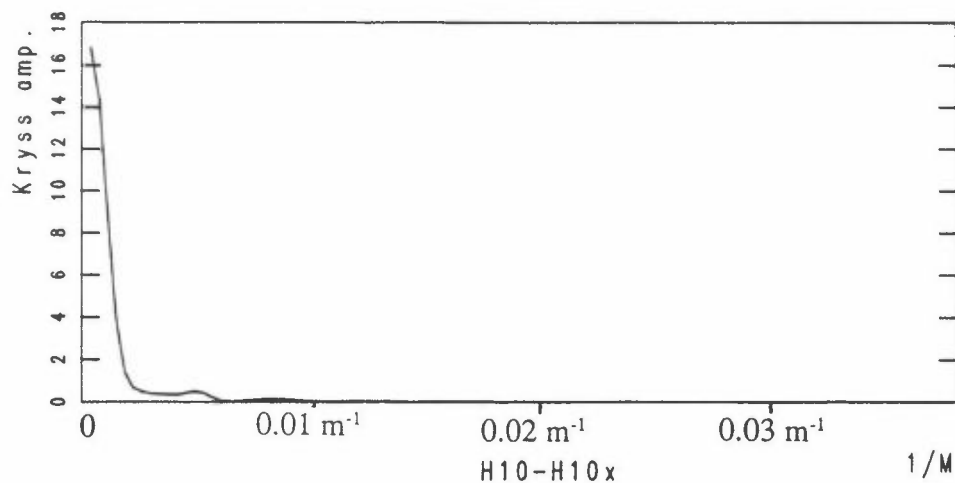
H10-W10



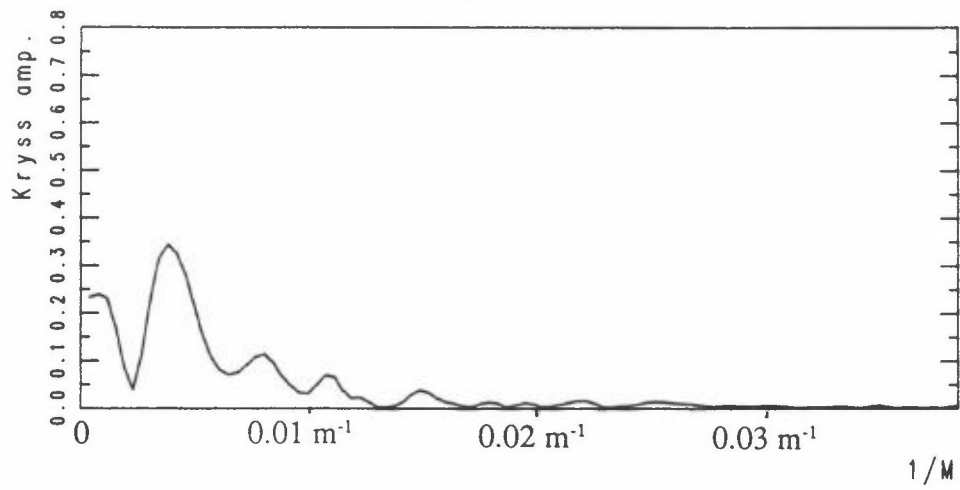
U10-W10



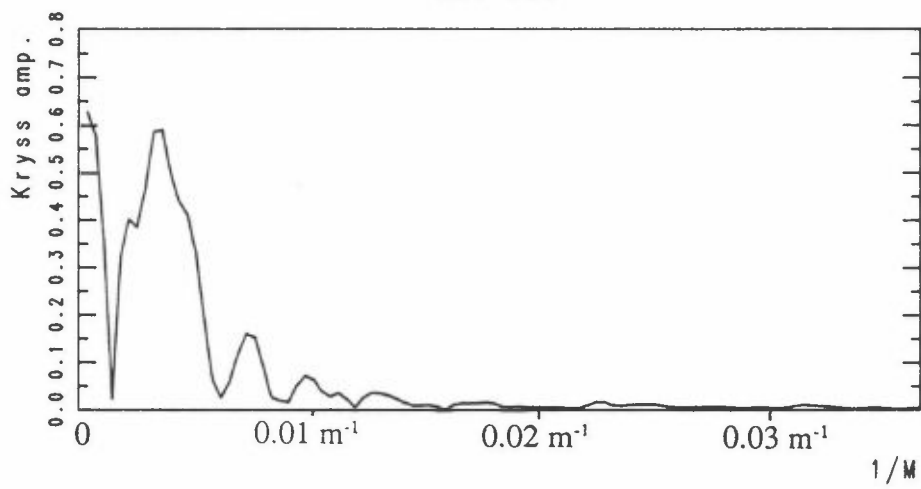
9. mars 1990 kl. 2040
H36-H10



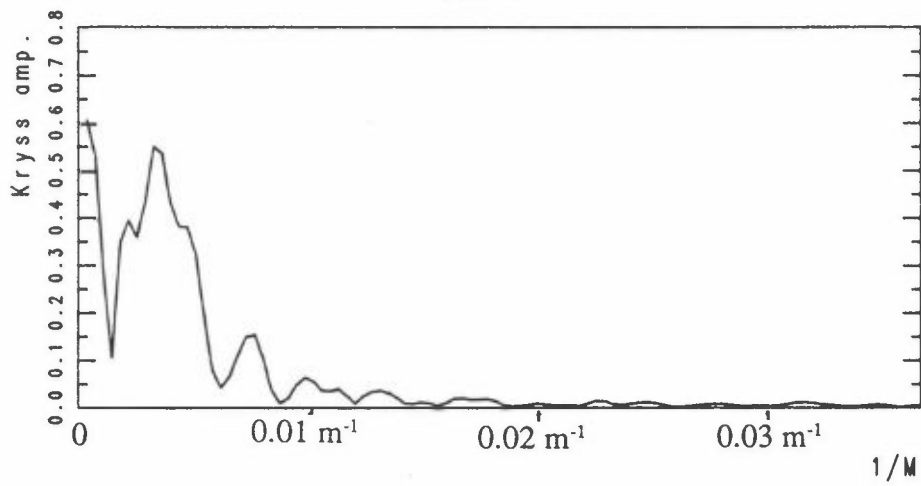
9. mars 1990 kl. 2040
W36-W10



H36-W36

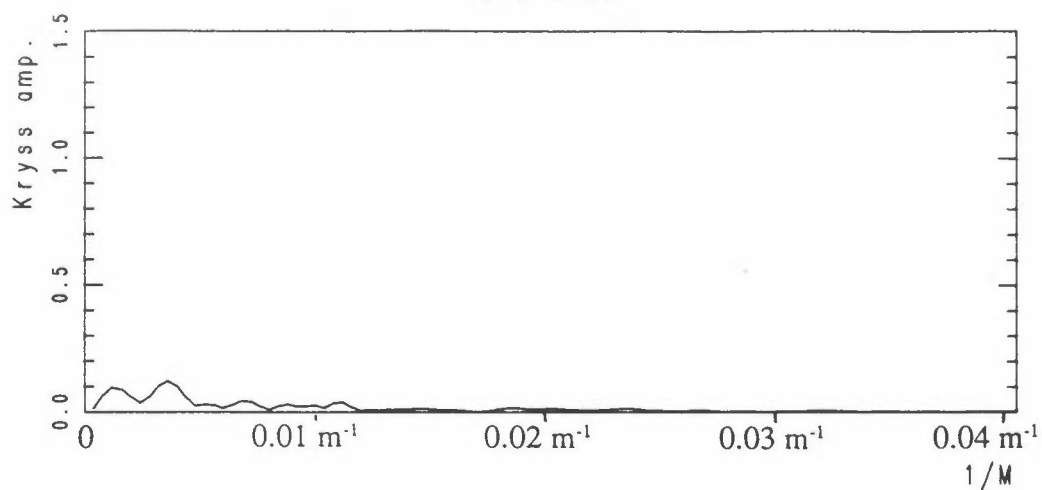


U36-W36

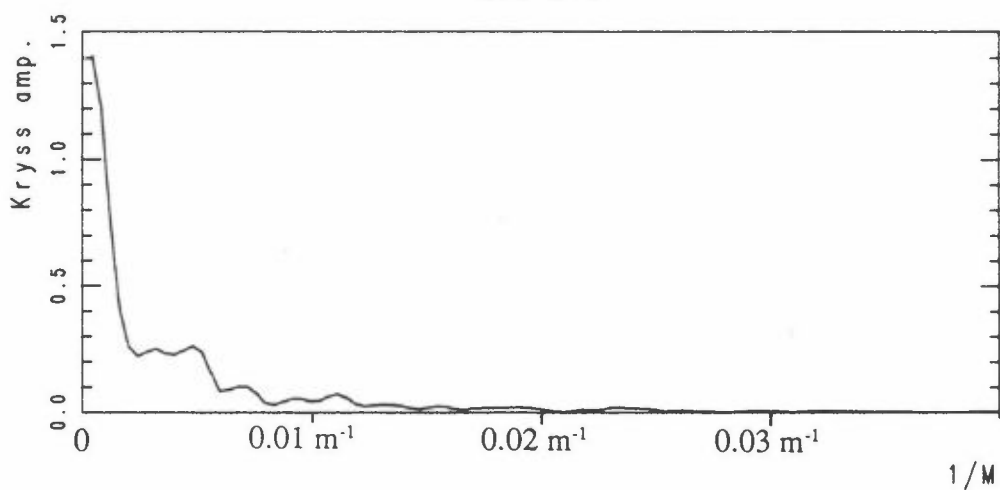


9. mars 1990 kl. 2040

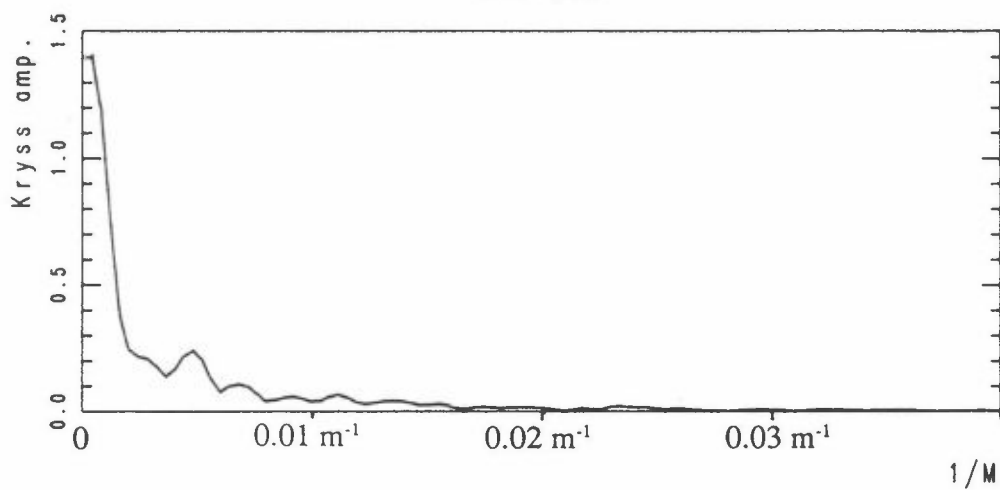
W10-W10x



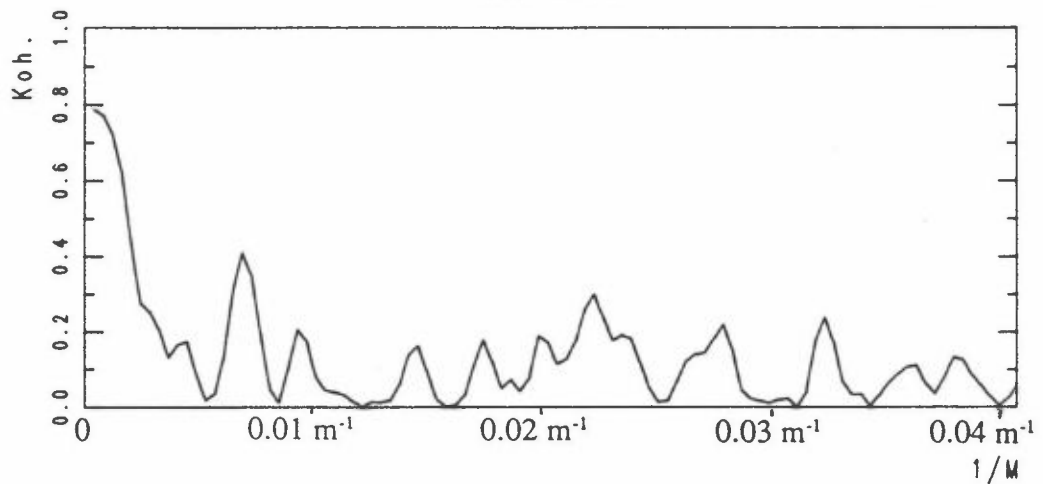
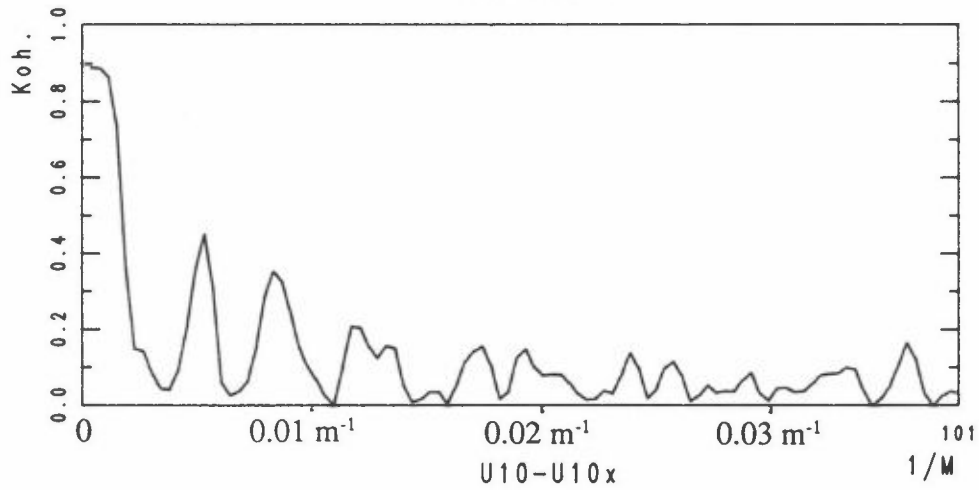
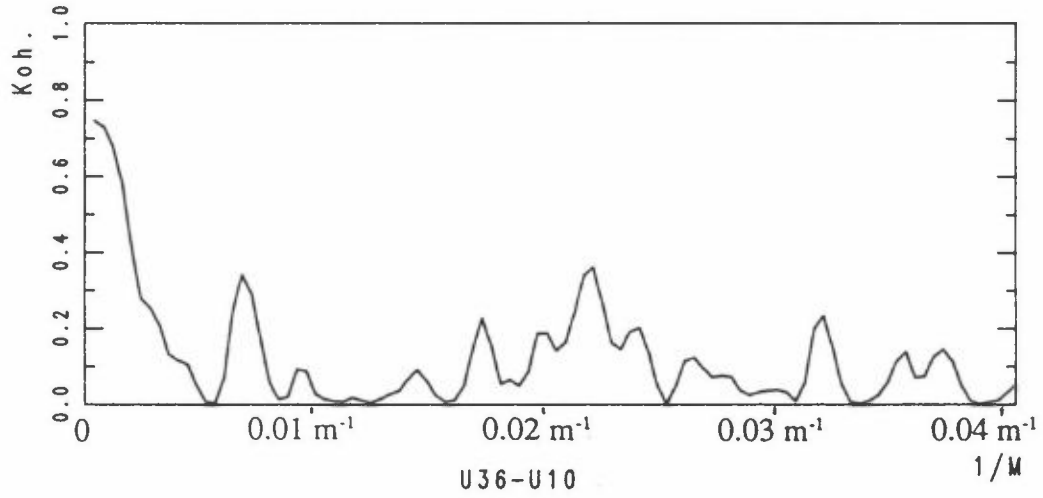
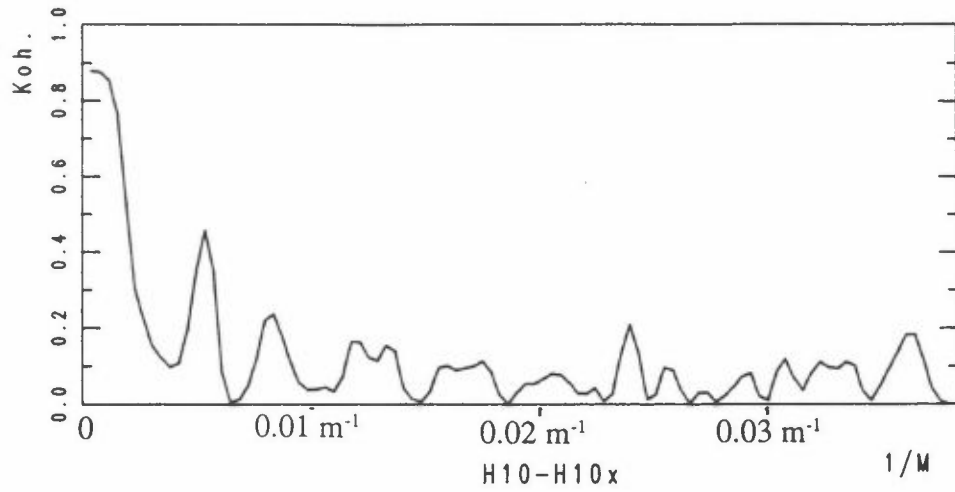
H10-W10



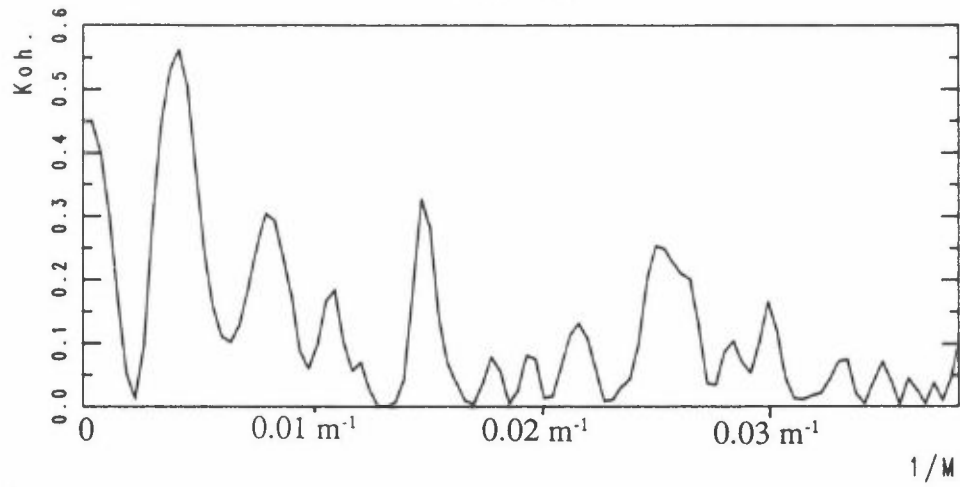
U10-W10



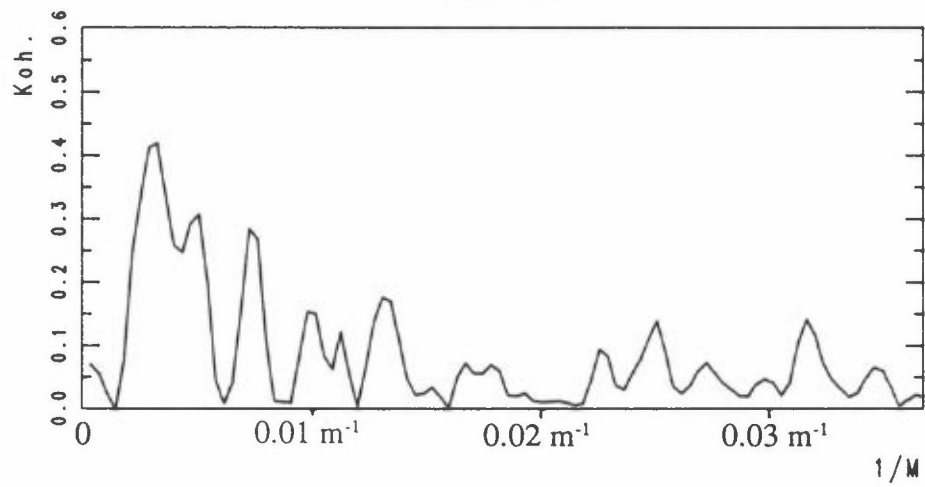
9. mars 1990 kl. 2040
H36-H10



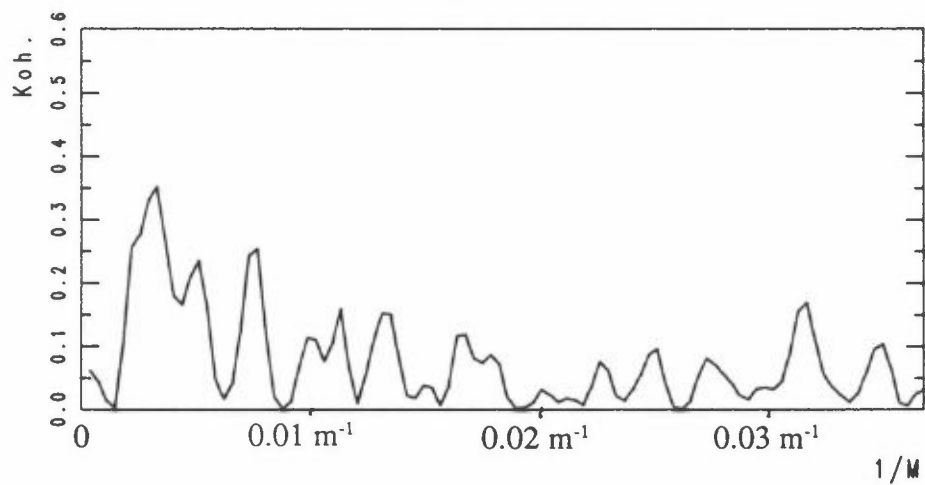
9. mars 1990 kl. 2040
W36-W10



H36-W36

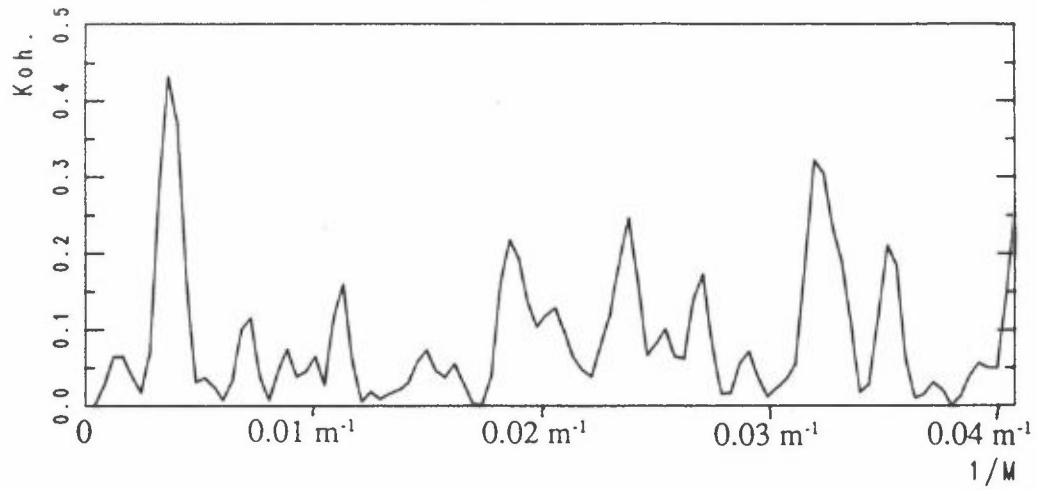


U36-W36

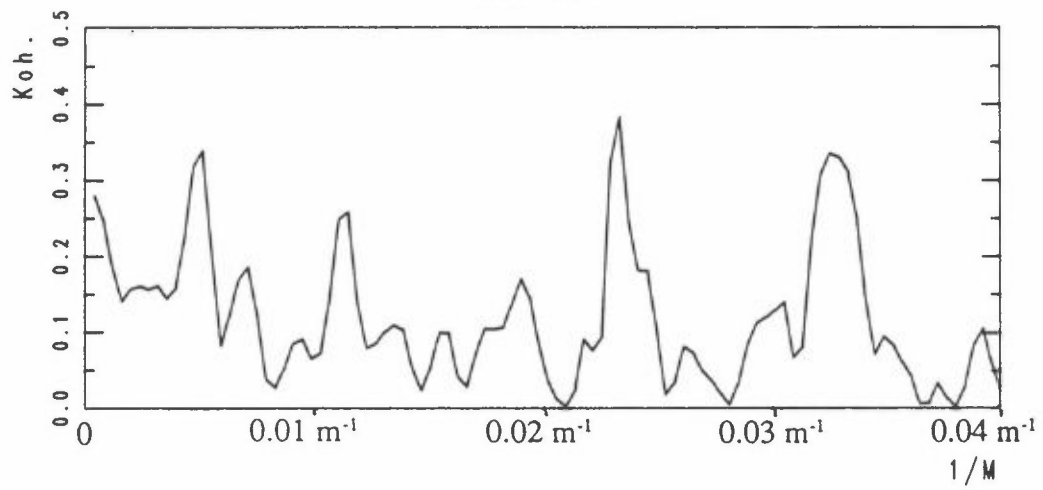


9. mars 1990 kl. 2040

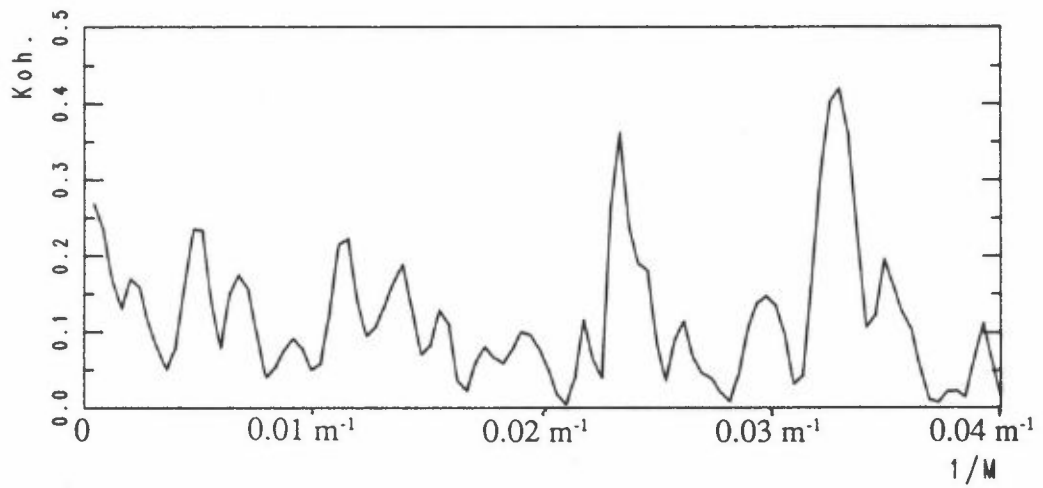
W10-W10x



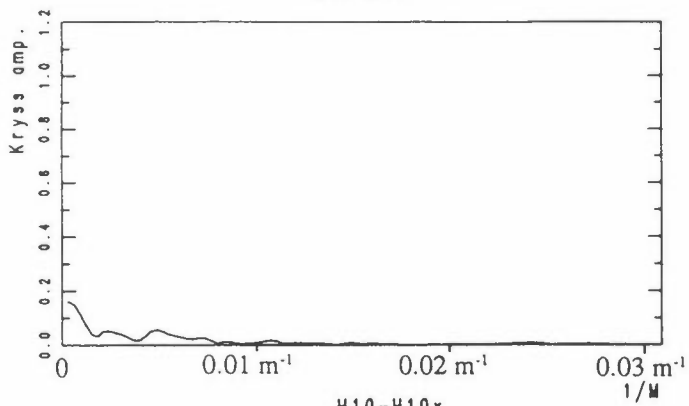
H10-W10



U10-W10

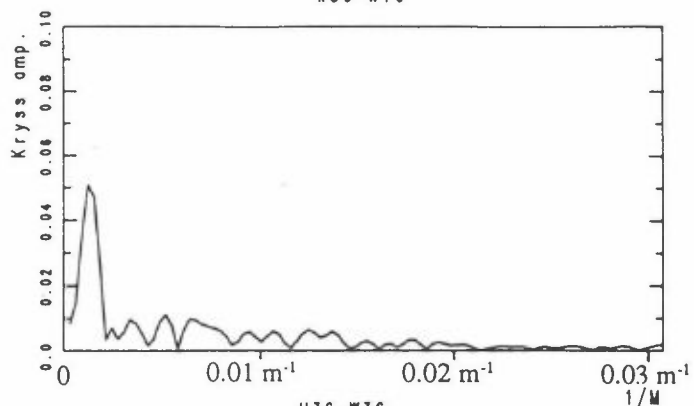


16. mars 1990 kl. 1210
H36-H10

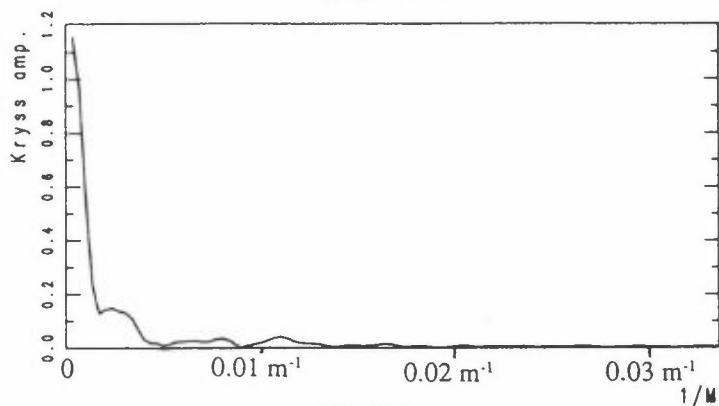


H10-H10x

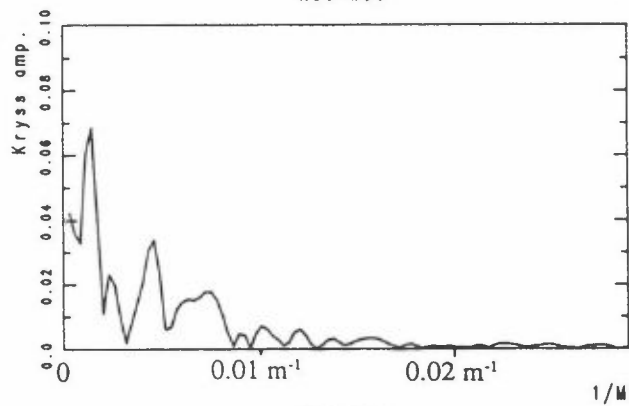
16. mars 1990 kl. 1210
W36-W10



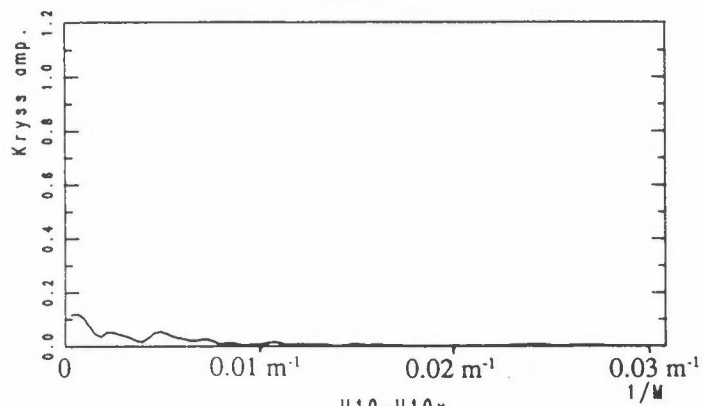
H36-W36



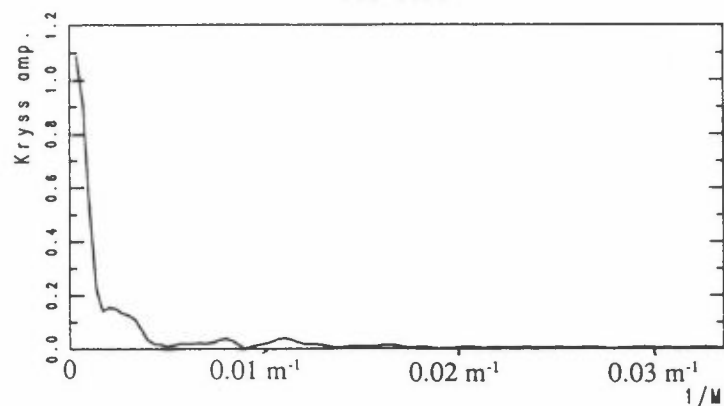
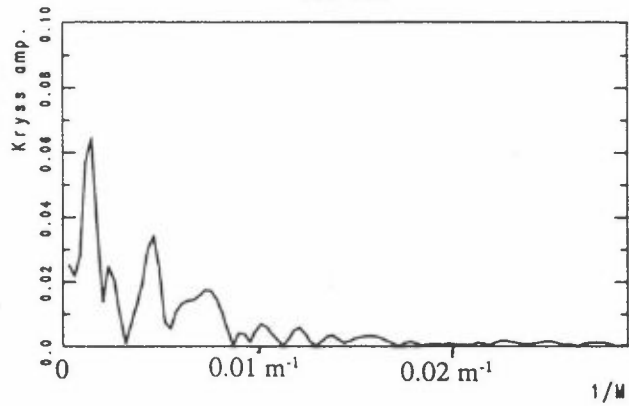
U36-U10



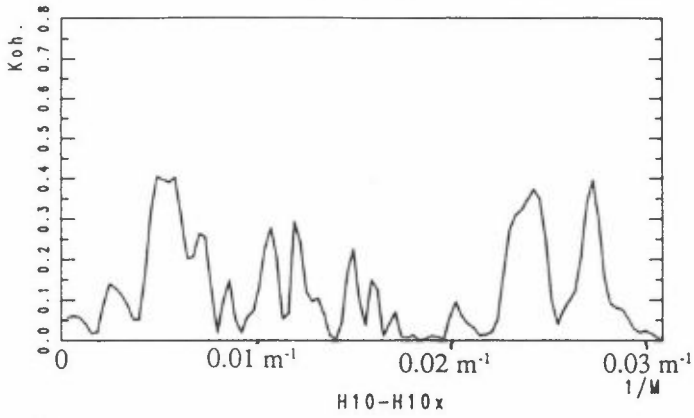
U36-W36



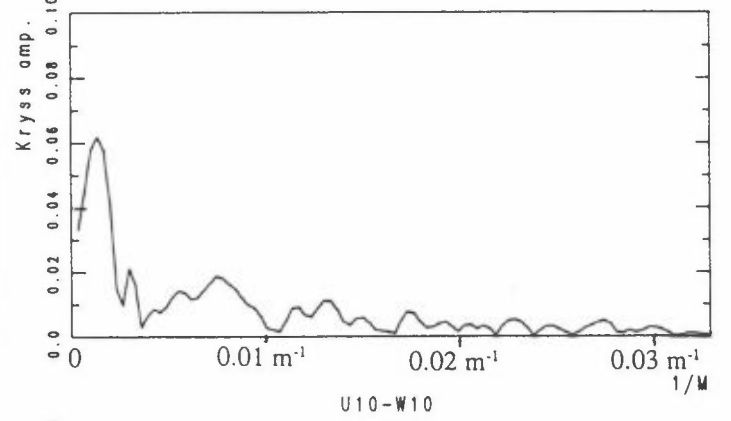
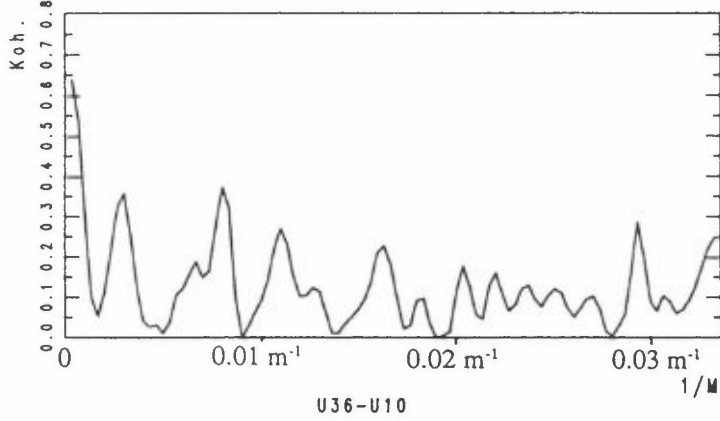
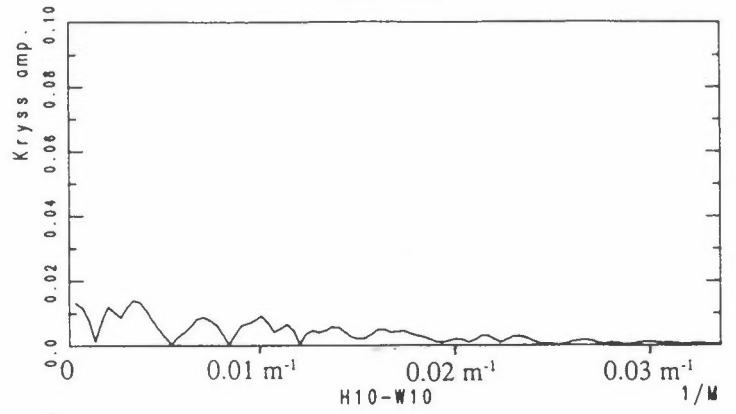
U10-U10x



16. mars 1990 kl. 1210
H36-H10

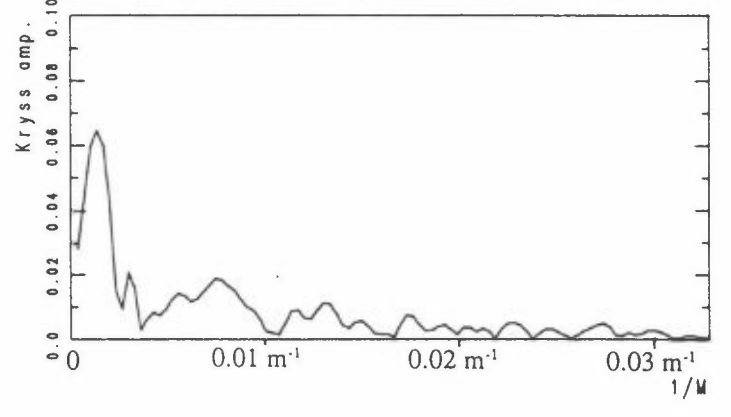
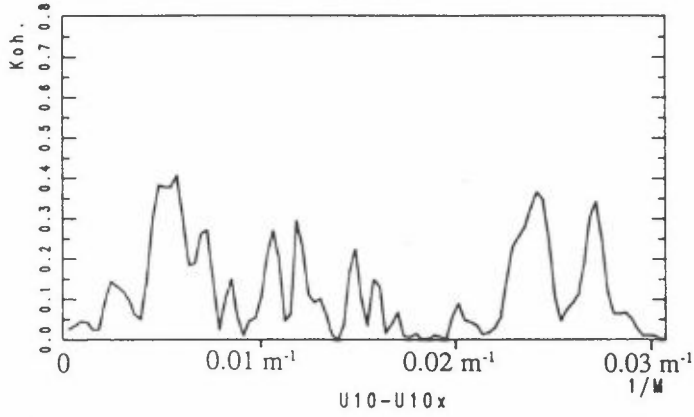


16. mars 1990 kl. 1210
W10-W10x

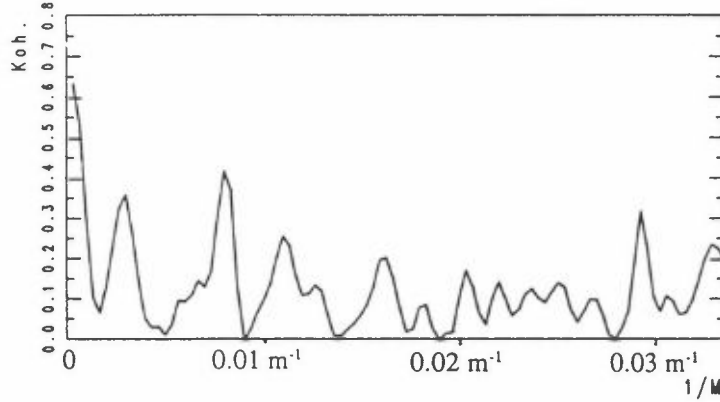


U36-U10

U10-W10

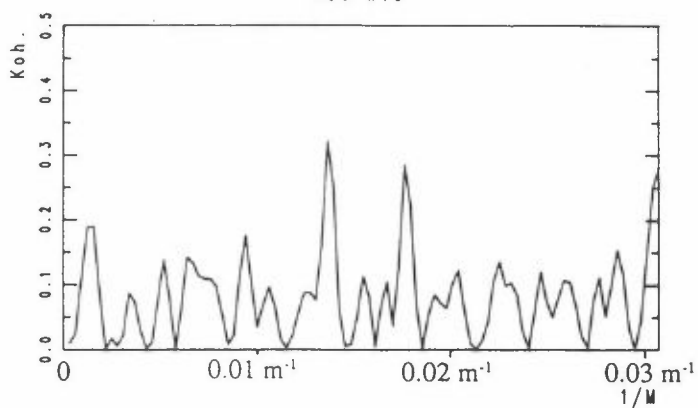


U10-U10x



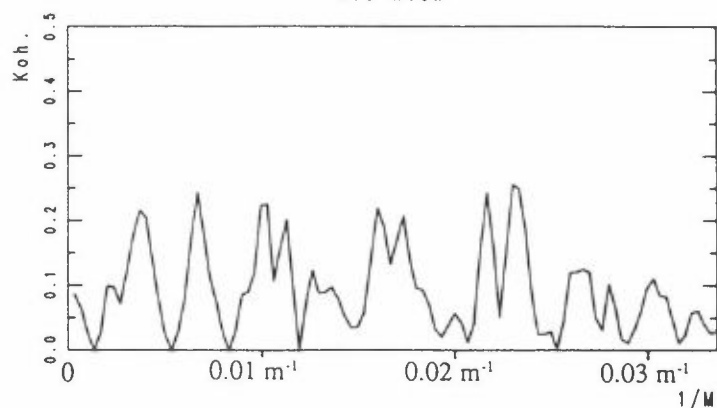
16. mars 1990 kl. 1210

W36-W10

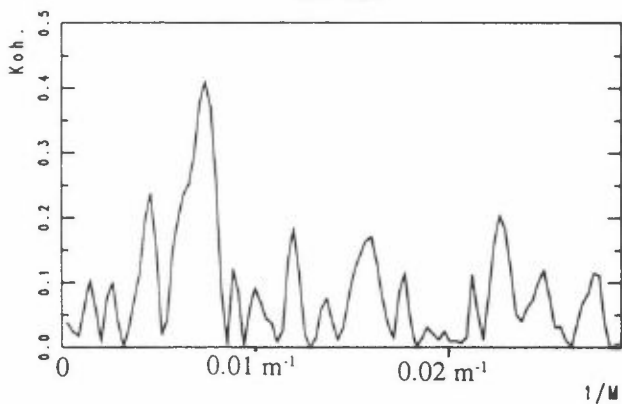


16. mars 1990 kl. 1210

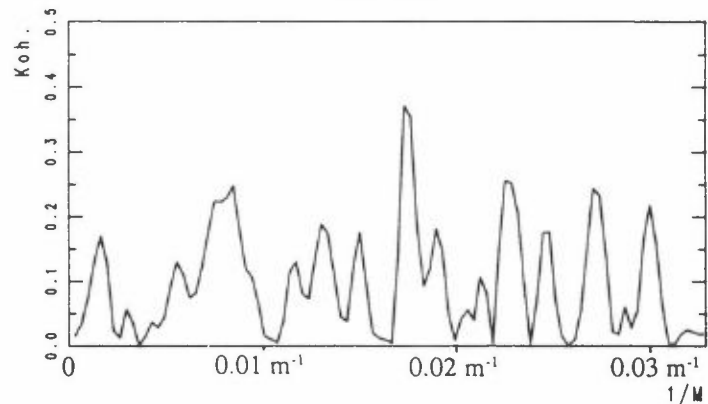
W10-W10x



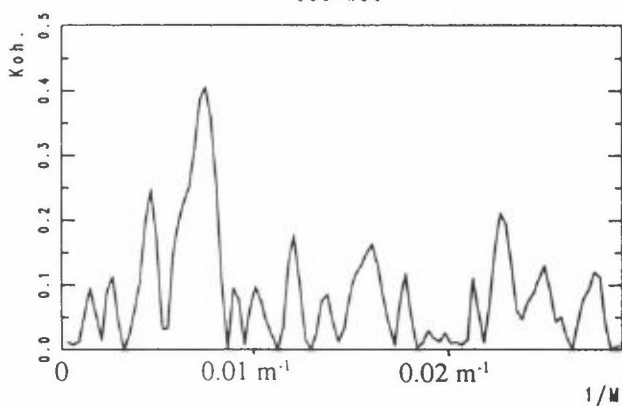
H36-W36



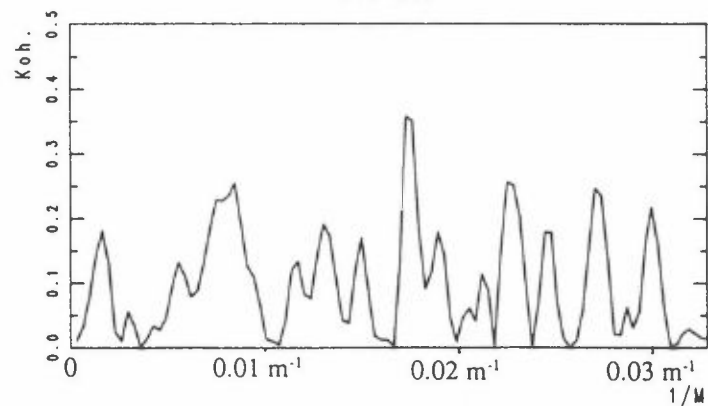
H10-W10



U36-W36



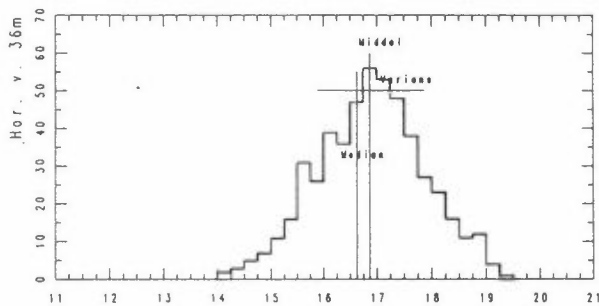
U10-W10



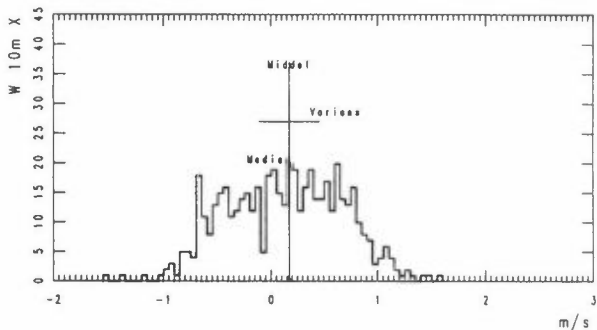
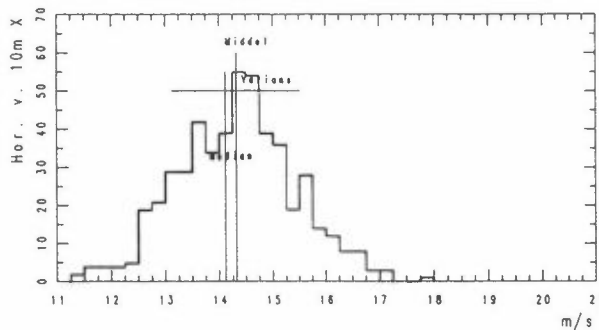
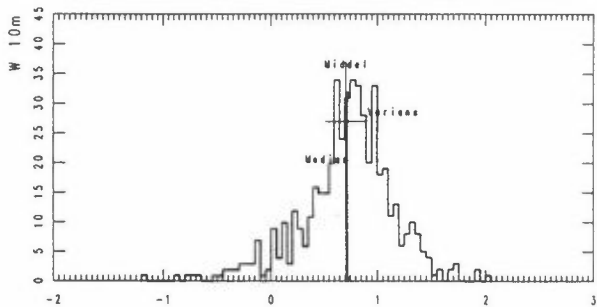
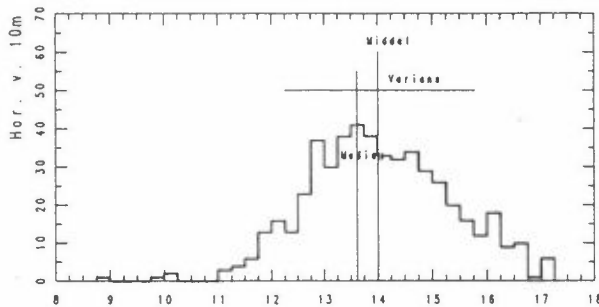
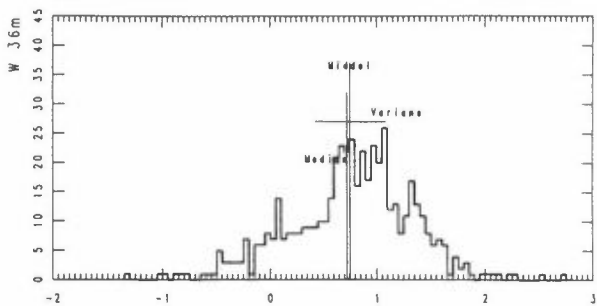
VEDLEGG F

Plott av sannsynlighetsfordelinger

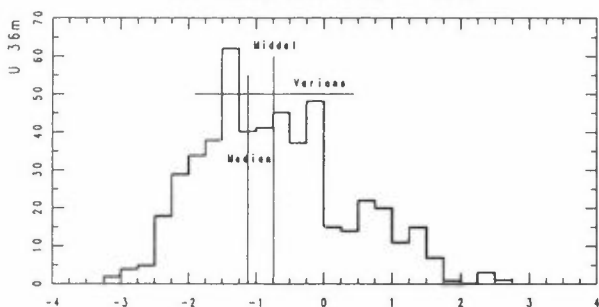
Horizontal vind, 15.01.90, kl 0510



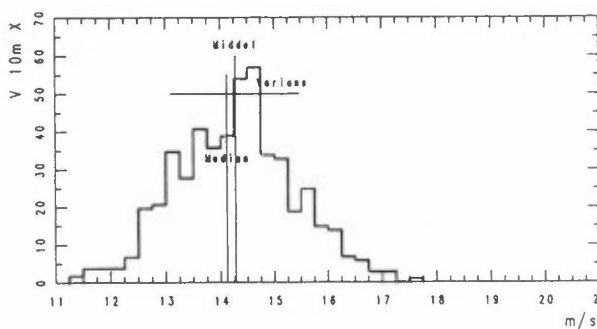
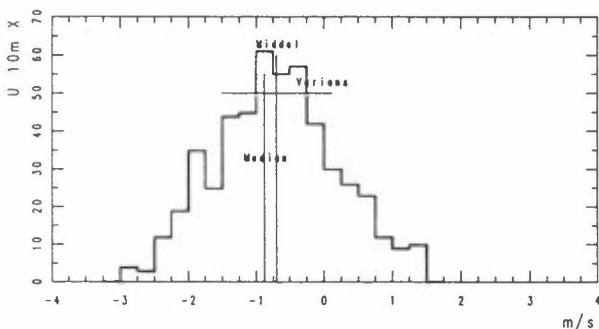
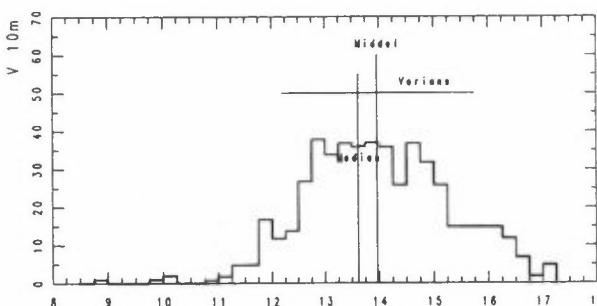
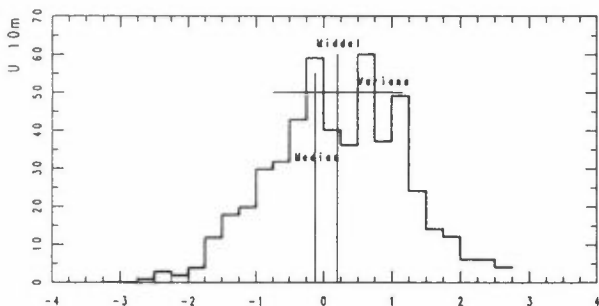
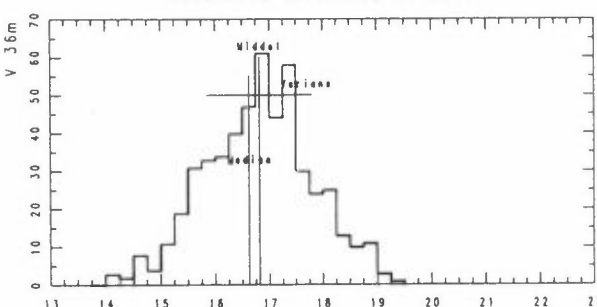
Vertikalt, 15.01.90, kl 0510



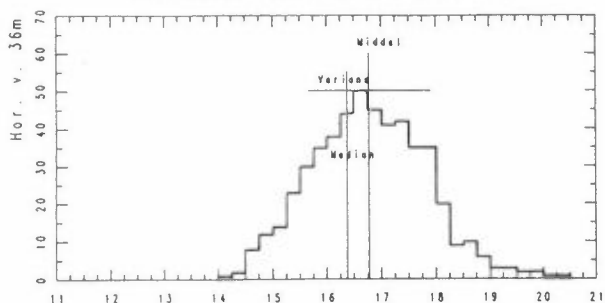
Øst-vest, 15.01.90, kl 0510



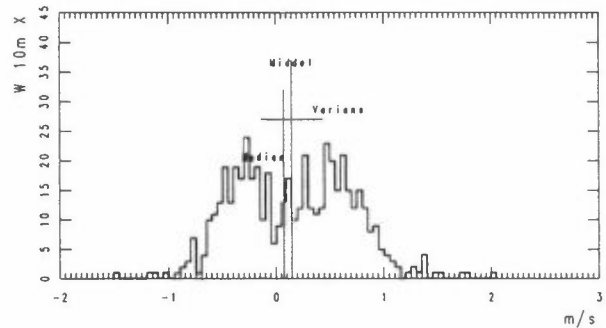
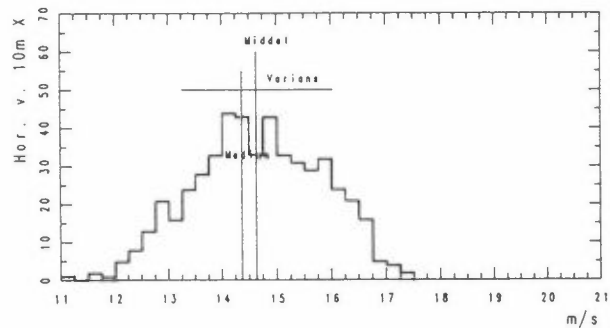
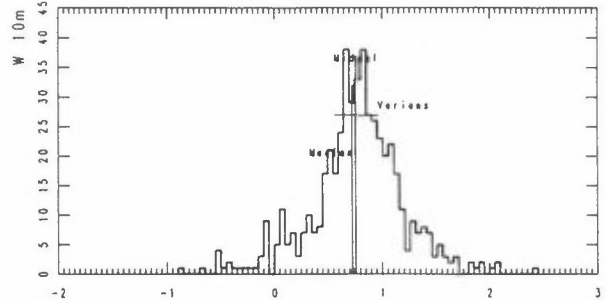
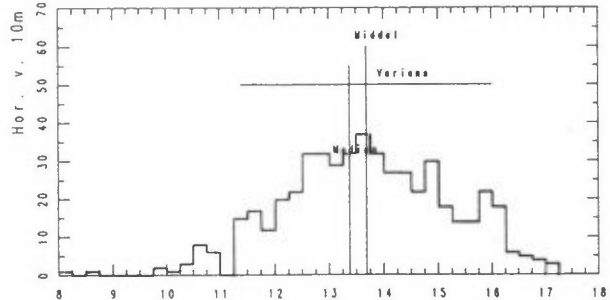
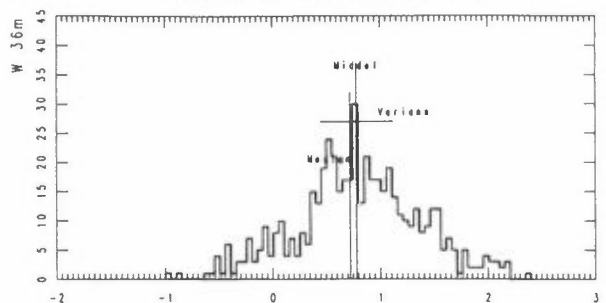
Nord-sør, 15.01.90, kl 0510



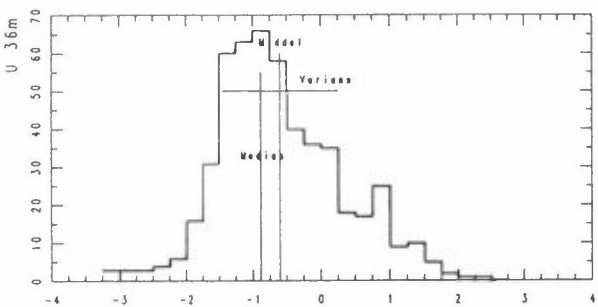
Horizontal vind, 15.01.90, kl 0520



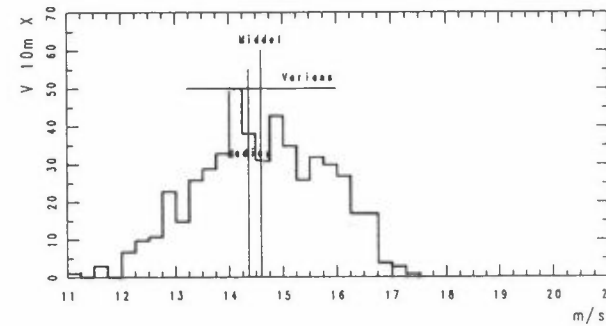
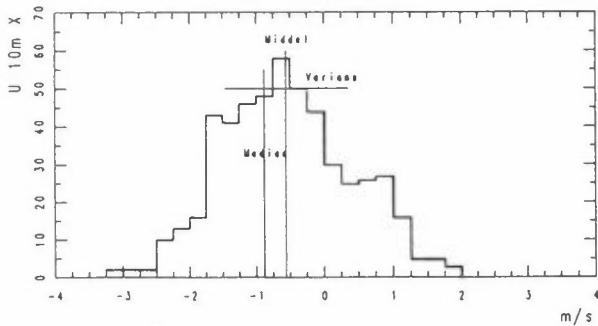
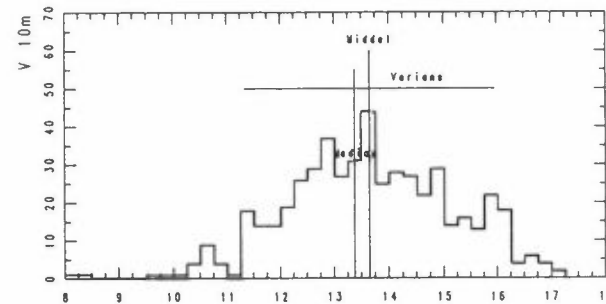
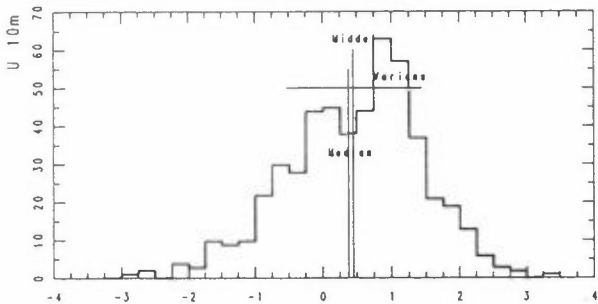
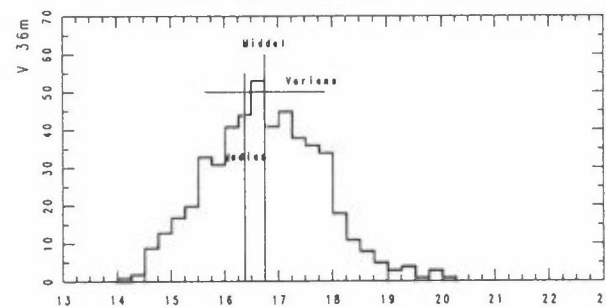
Vertikall, 15.01.90, kl 0520



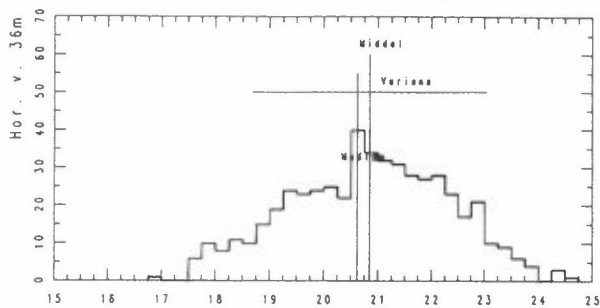
Øst-vest, 15.01.90, kl 0520



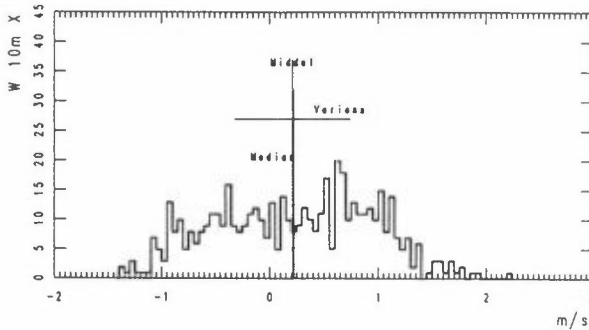
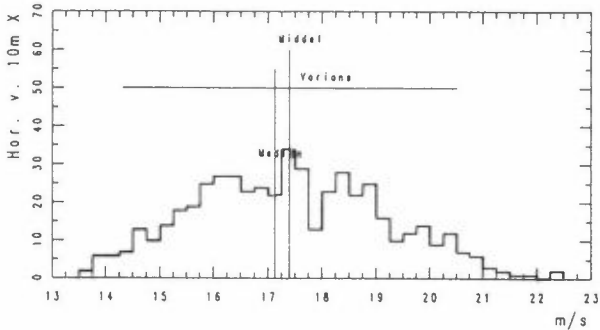
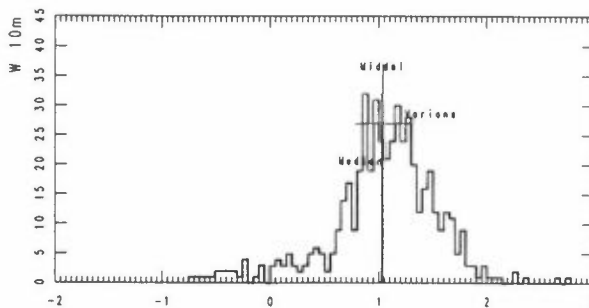
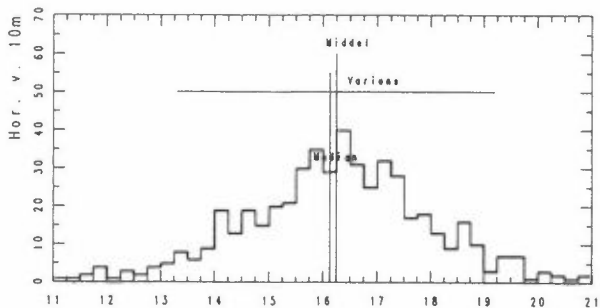
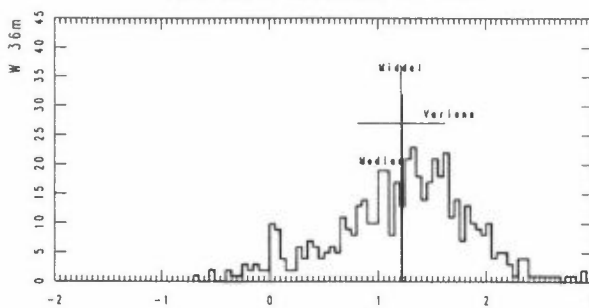
Nord-sør, 15.01.90, kl 0520



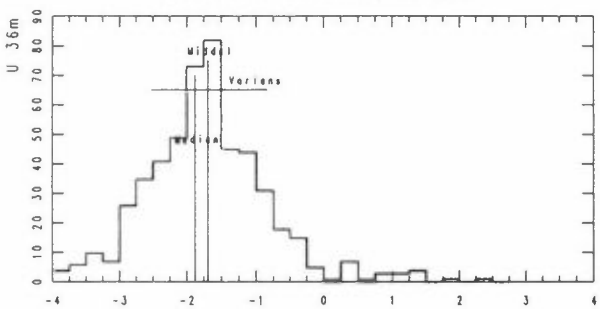
Horisontal vind, 15.01.90, kl 0720



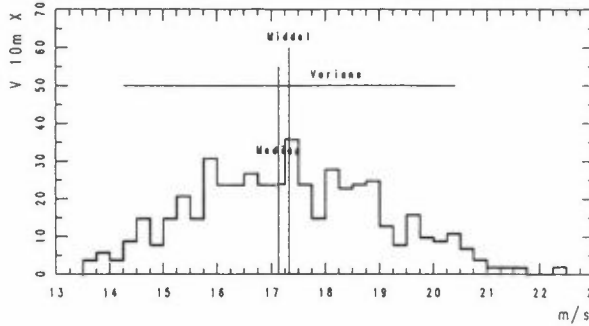
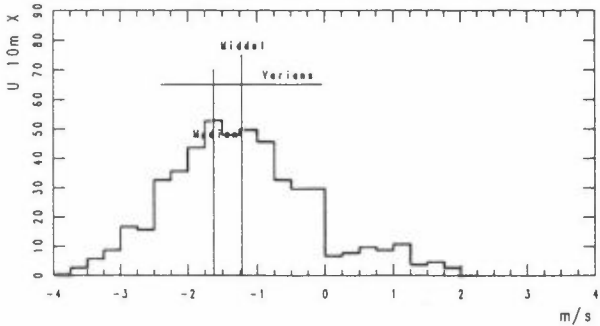
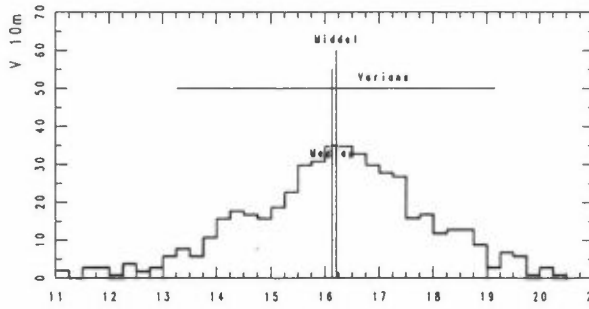
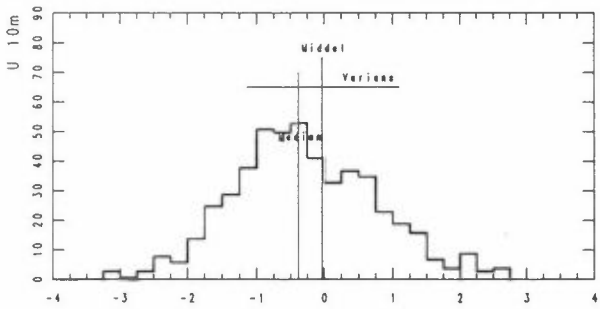
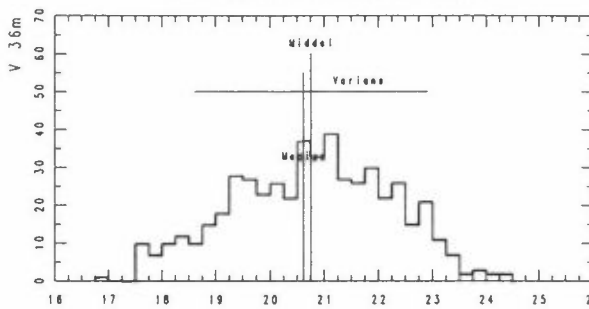
Vertikalt, 15.01.90, kl 0720



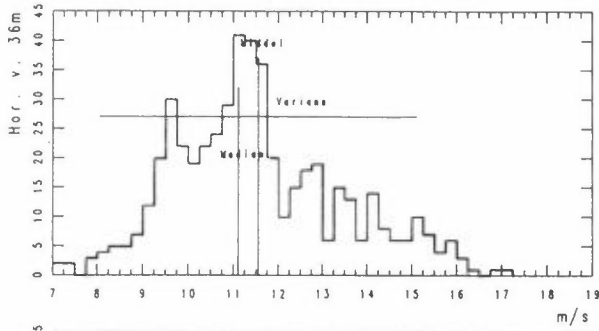
Øst-vest, 15.01.90, kl 0720



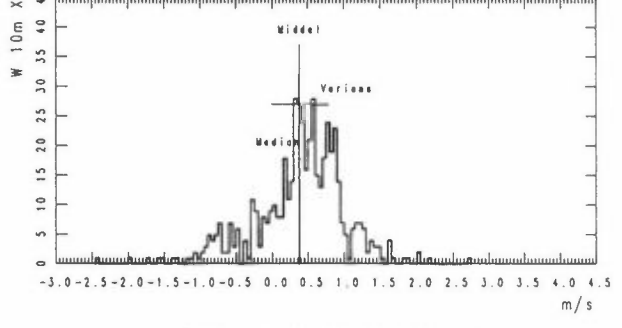
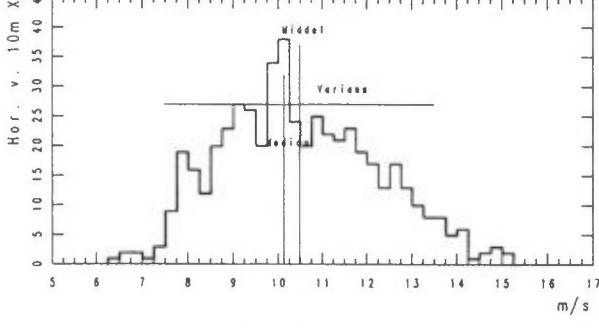
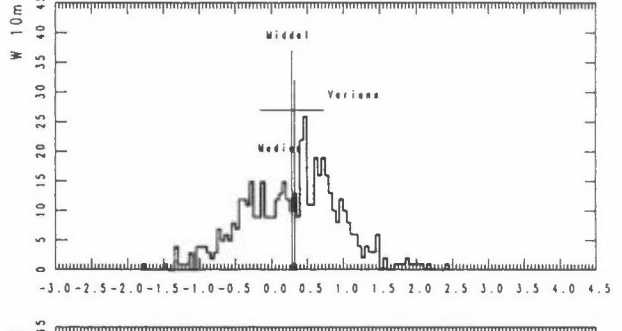
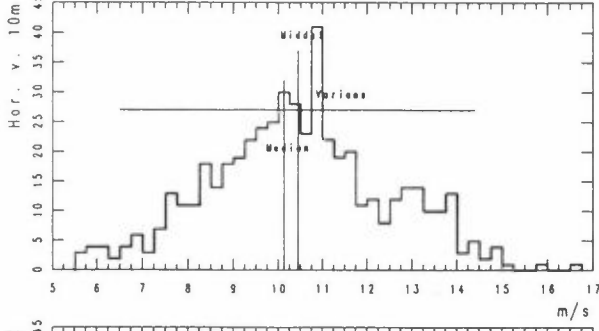
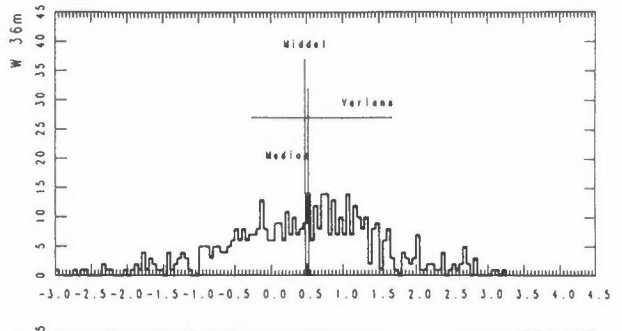
Nord-sør, 15.01.90, kl 0720



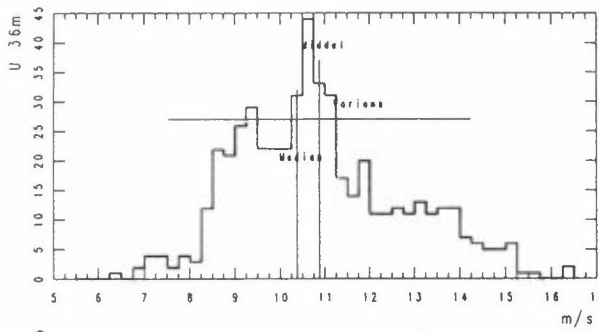
Horizontaal vind, 17.01.90, kl 2250



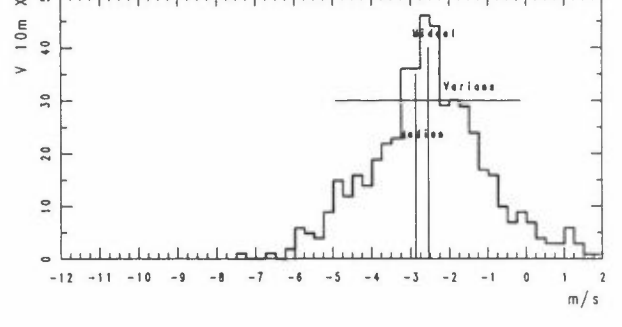
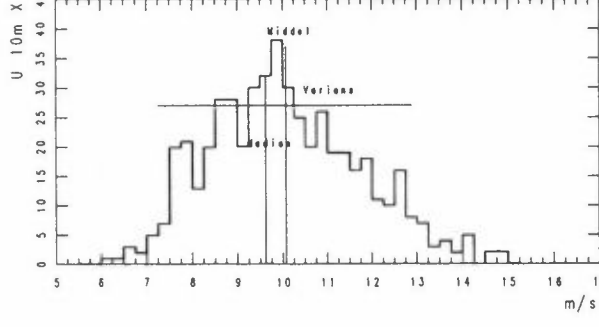
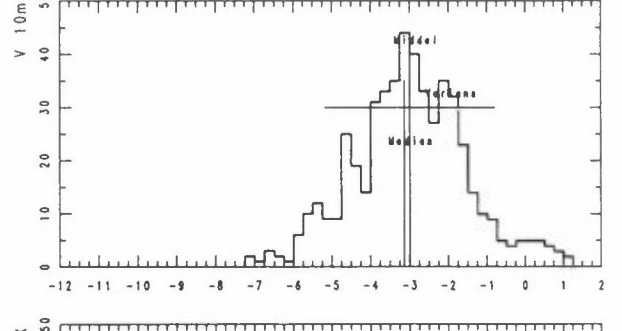
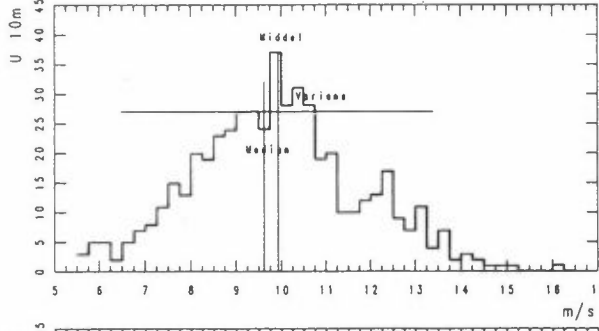
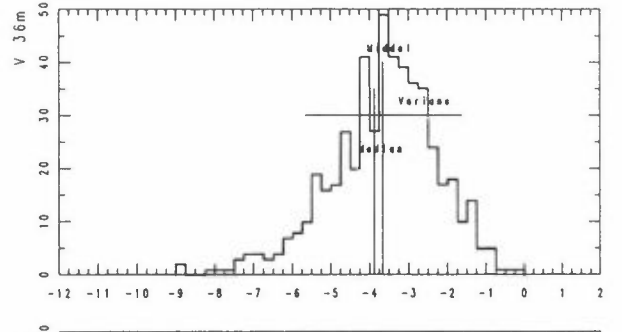
Vertikal, 17.01.90, kl 2250



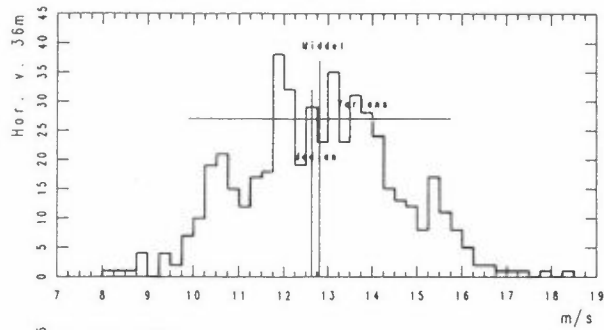
Øst-vest, 17.01.90, kl 2250



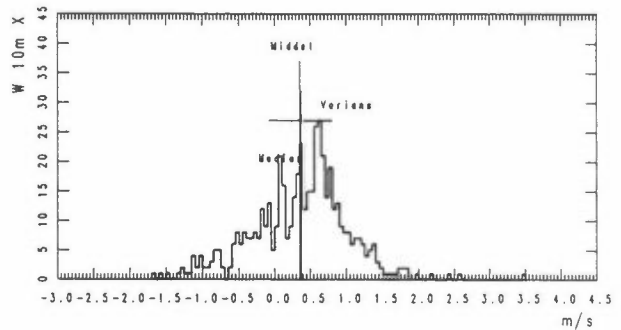
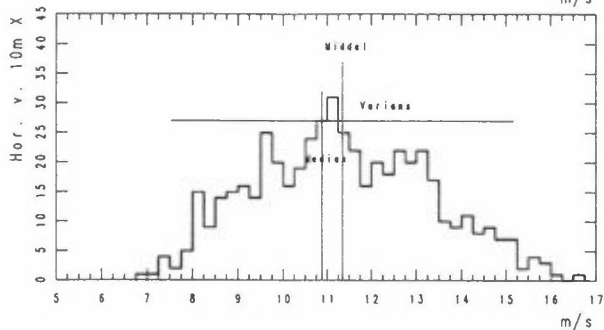
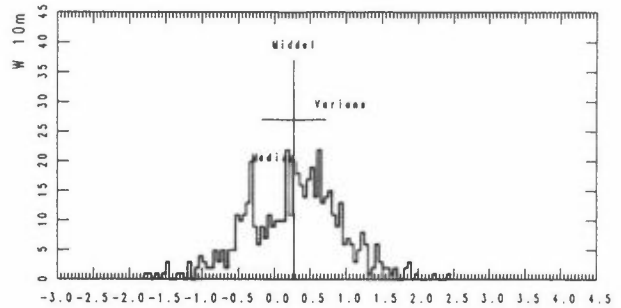
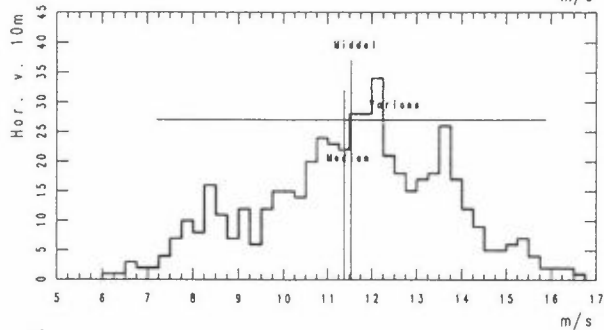
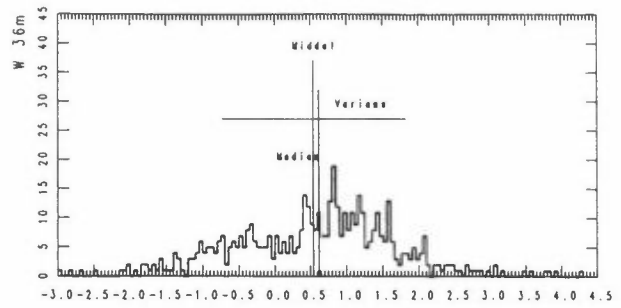
Nord-sør, 17.01.90, kl 2250



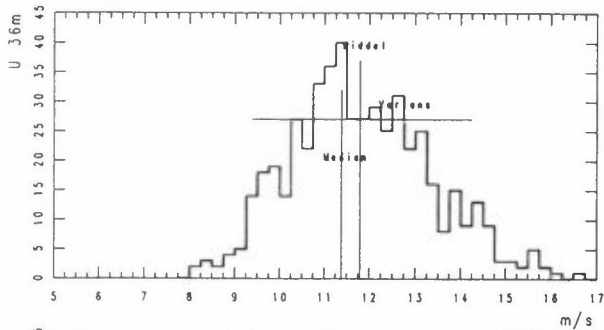
Horizontal vind, 17.01.90, kl 2300



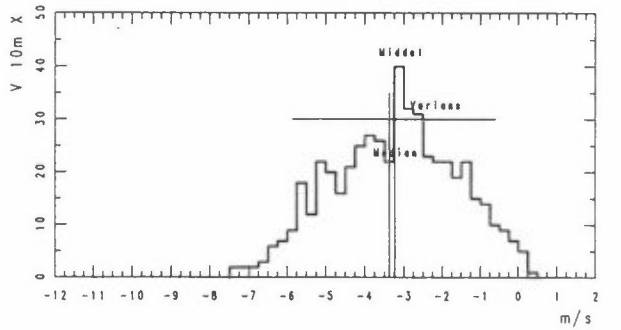
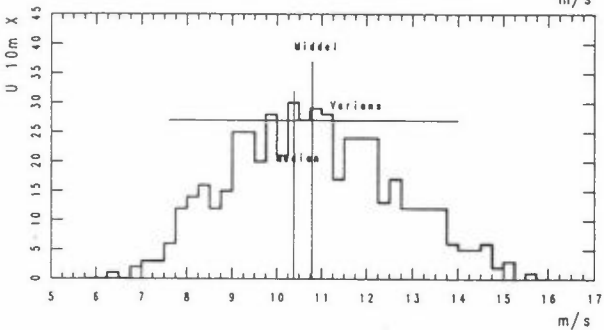
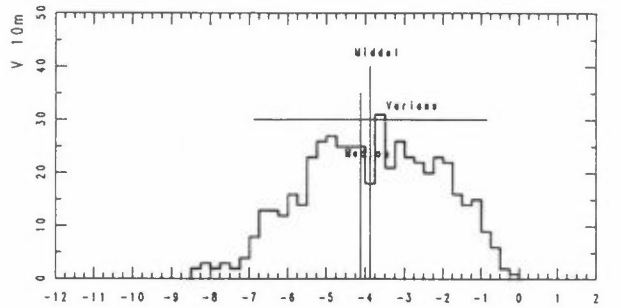
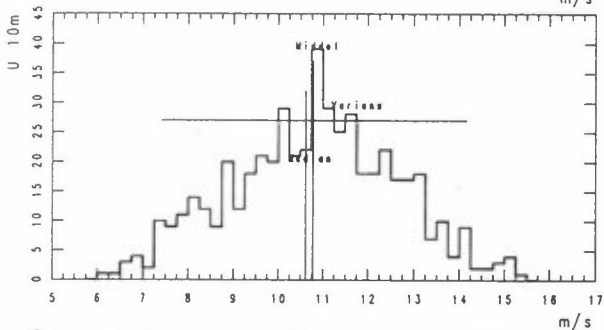
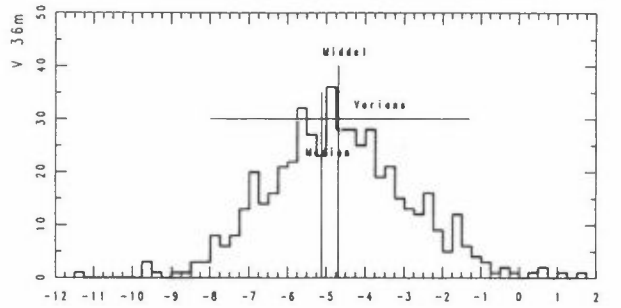
Vertikal, 17.01.90, kl 2300



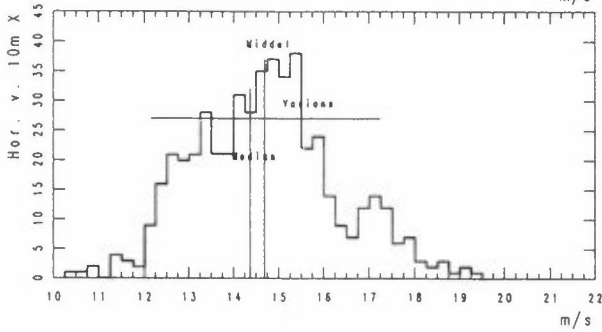
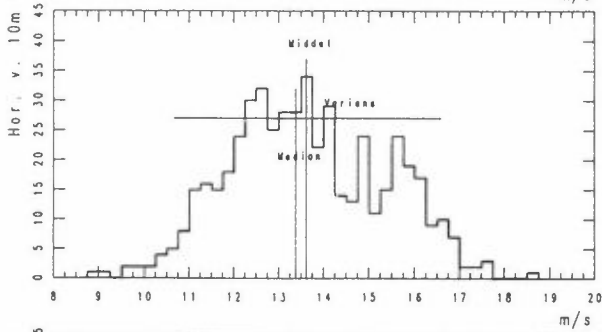
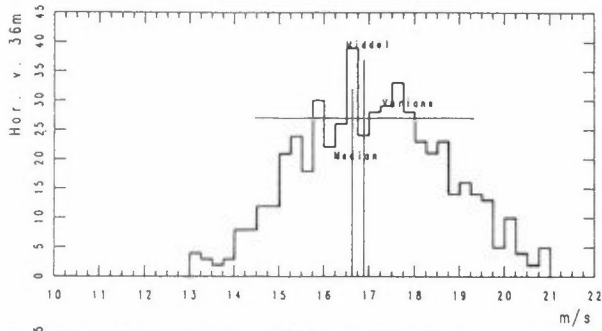
Øst-vest, 17.01.90, kl 2300



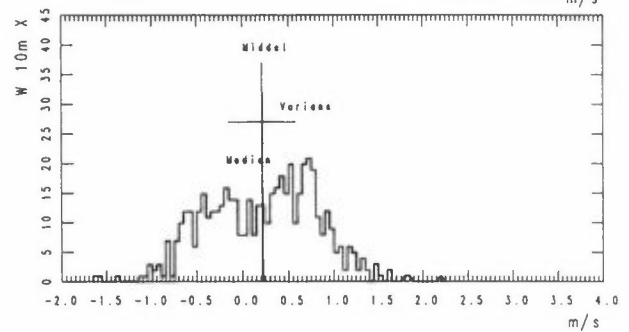
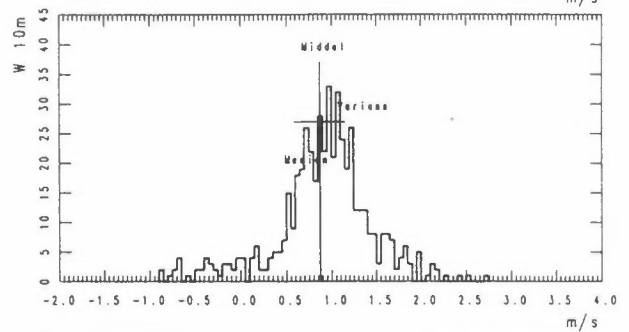
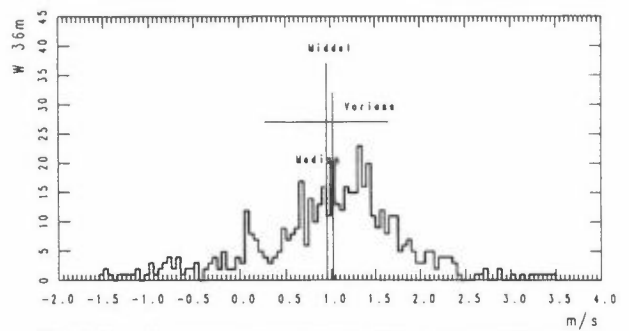
Nord-sør, 17.01.90, kl 2300



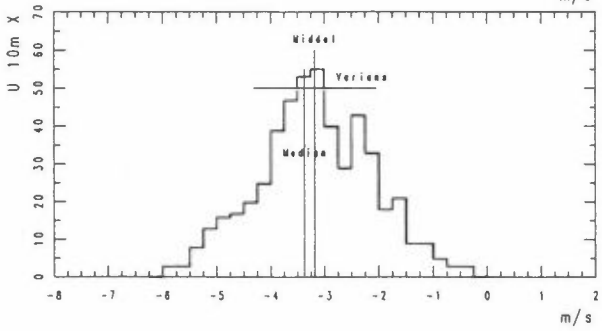
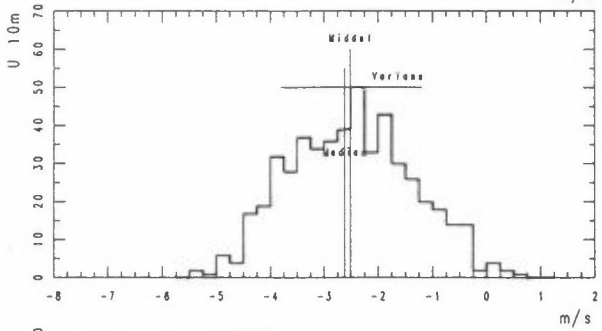
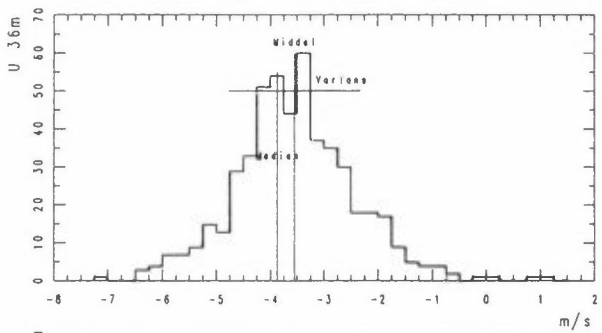
Horisontal vind, 23.01.90, kl 1550



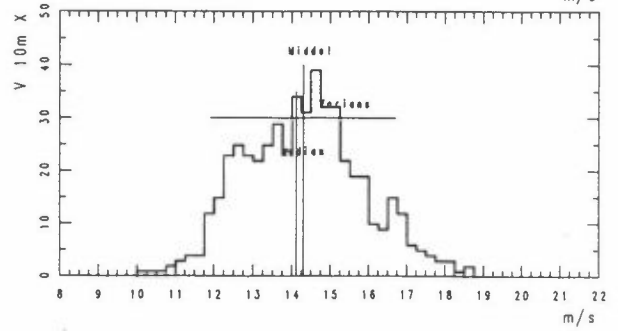
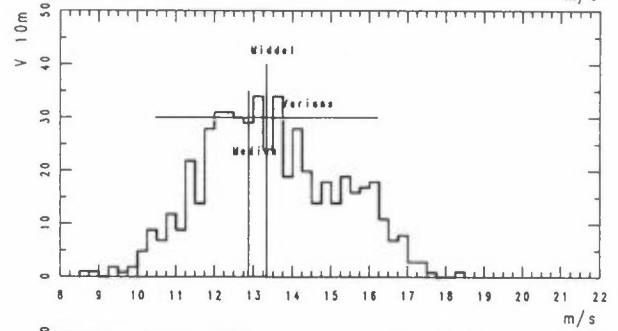
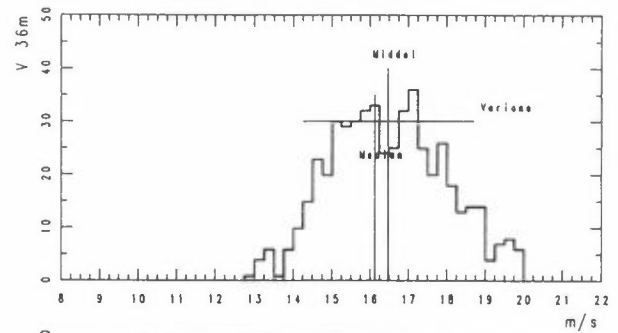
Vertikalt, 23.01.90, kl 1550



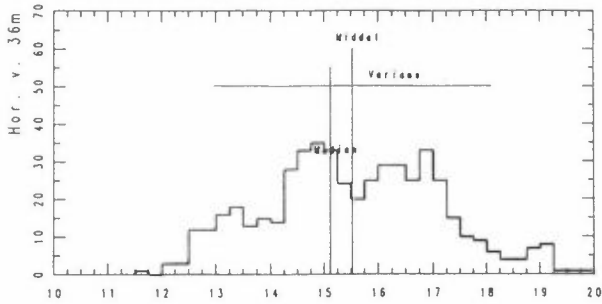
Øst-vest, 23.01.90, kl 1550



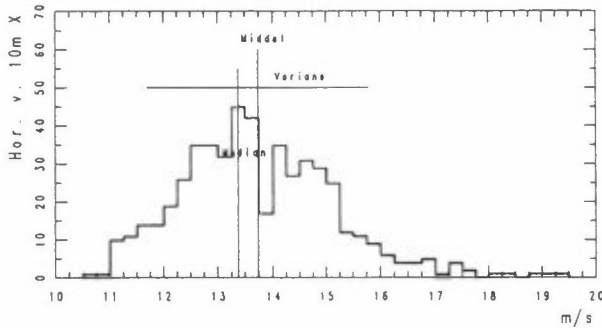
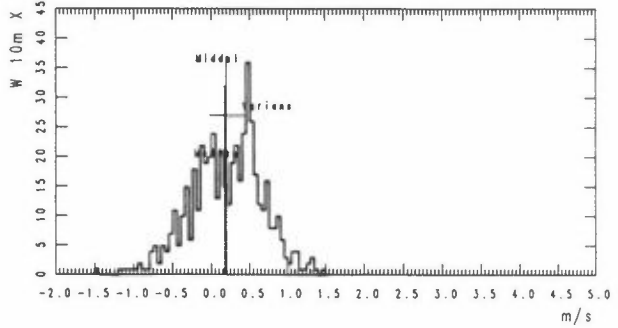
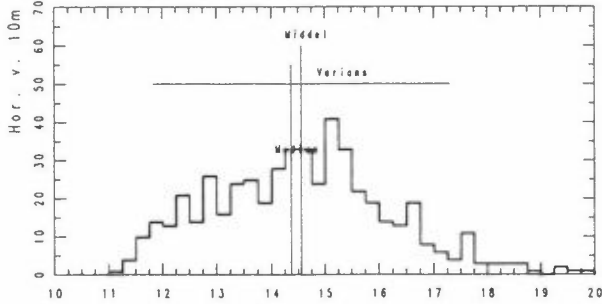
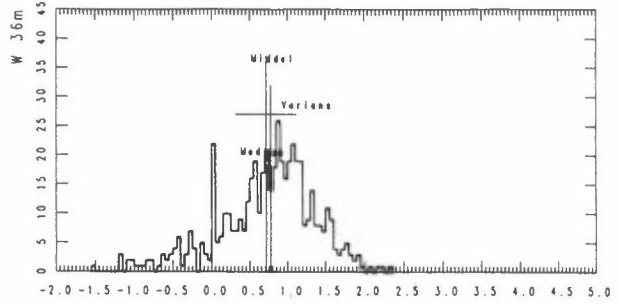
Nord-sør, 23.01.90, kl 1550



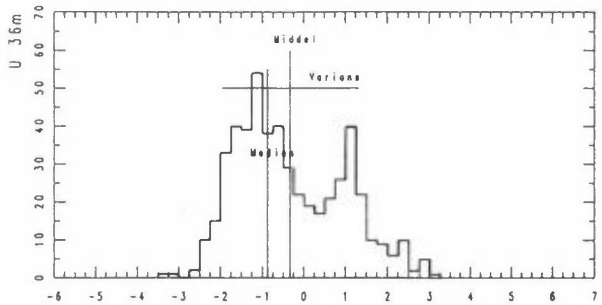
Horizontal vind, 17.02.90, kl 2140



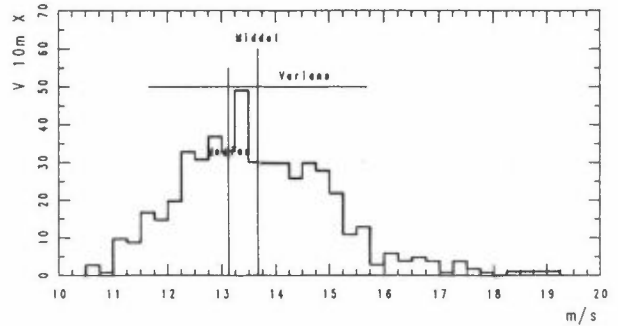
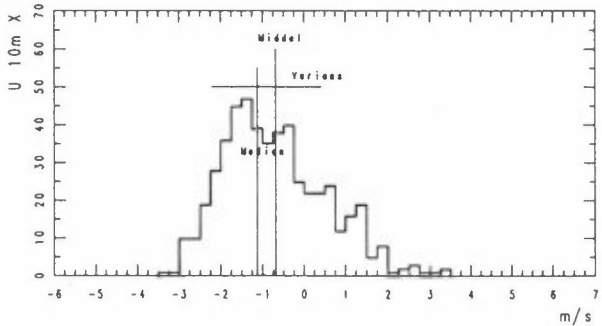
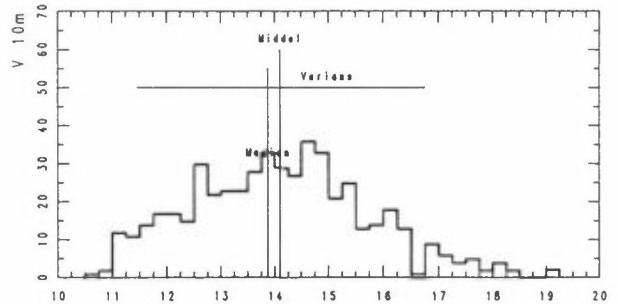
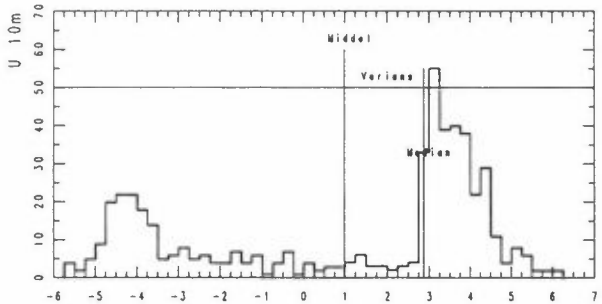
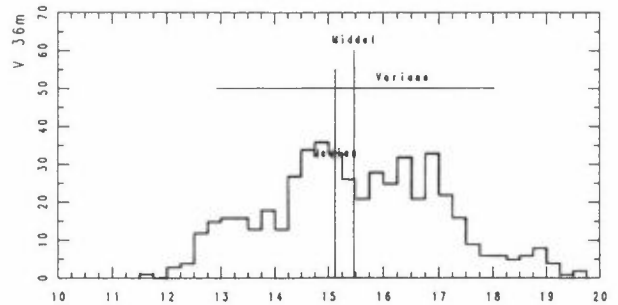
Vertikoll, 17.02.90, kl 2140



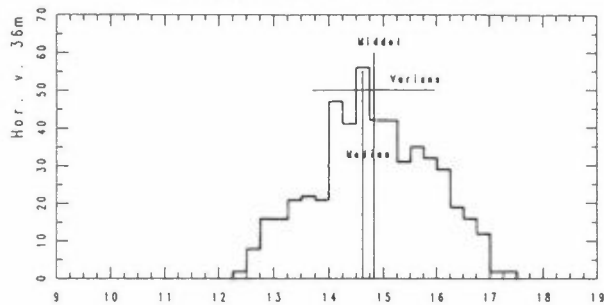
Øst-vest, 17.02.90, kl 2140



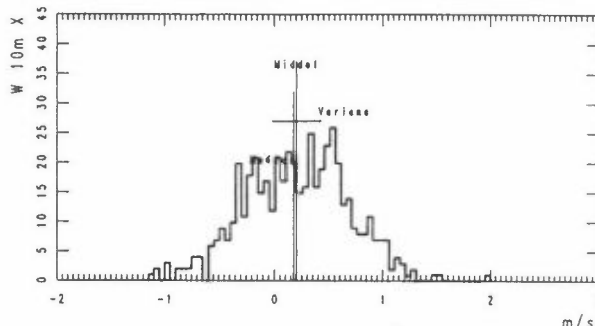
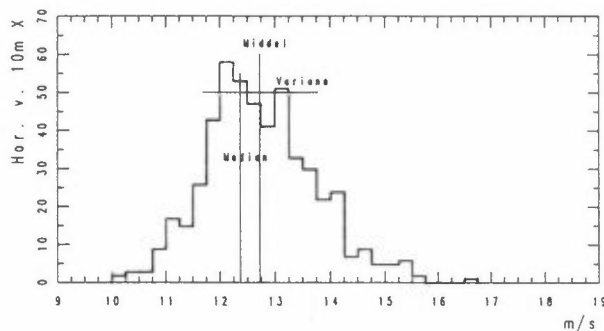
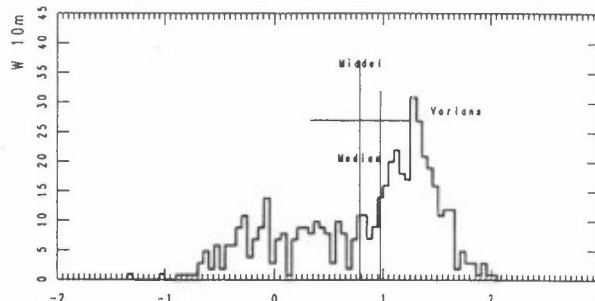
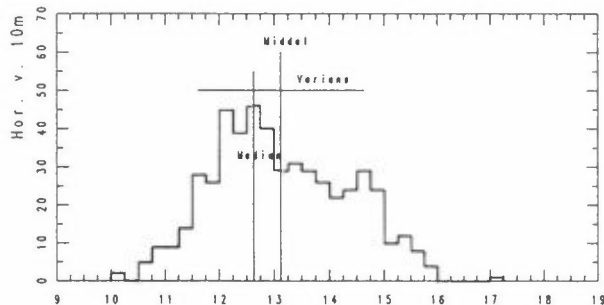
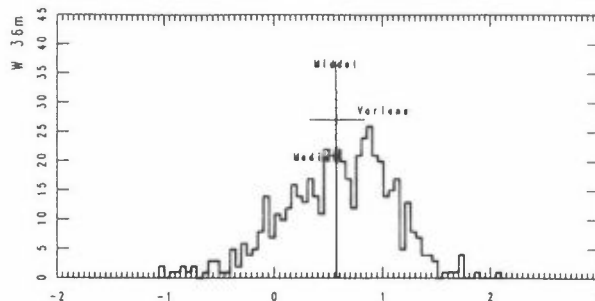
Nord-sør, 17.02.90, kl 2140



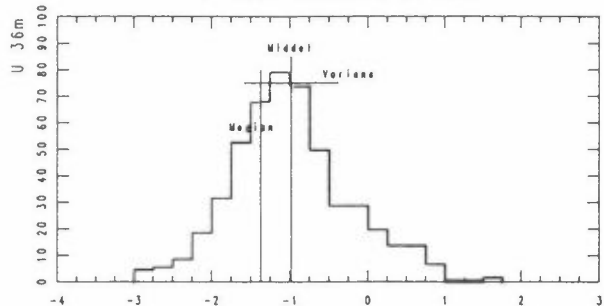
Horizontaal vind, 19.02.90, kl 1530



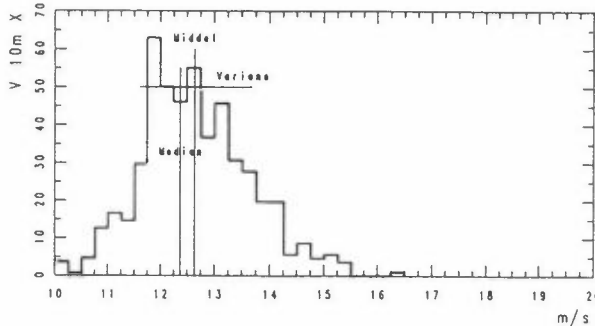
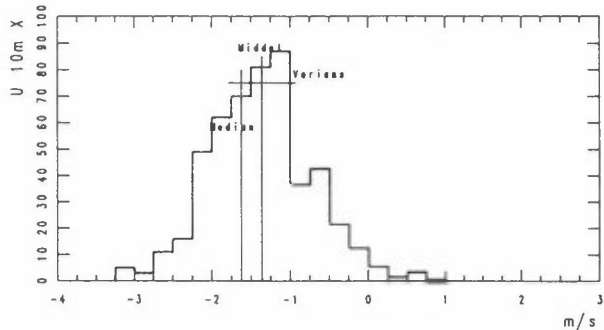
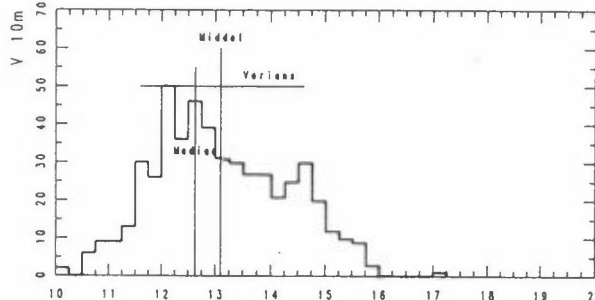
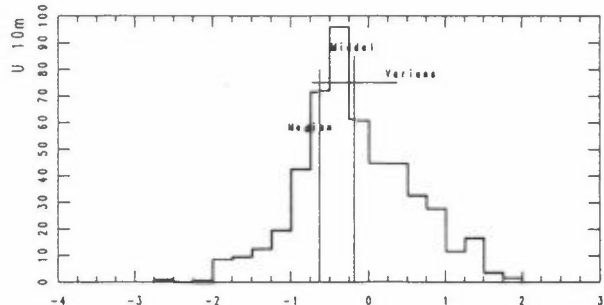
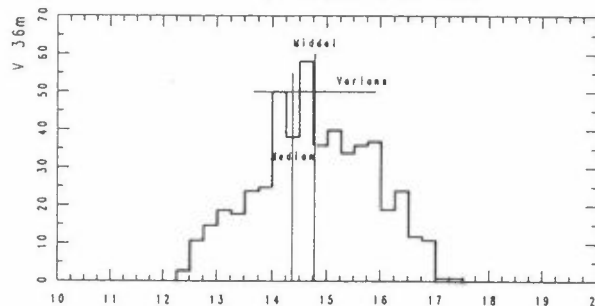
Vertikalt, 19.02.90, kl 1530

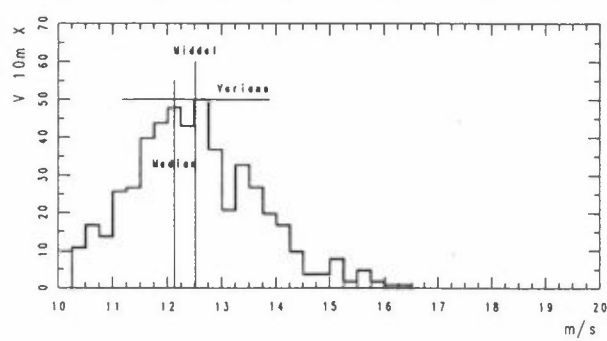
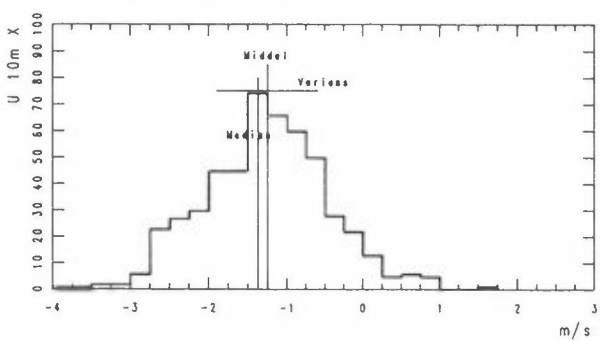
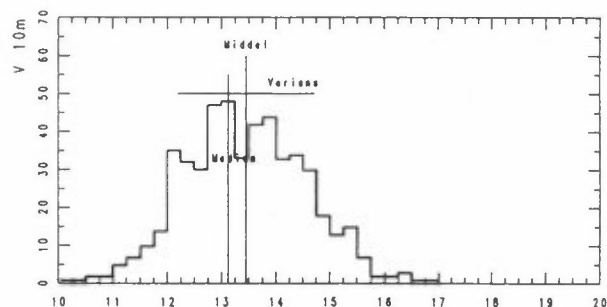
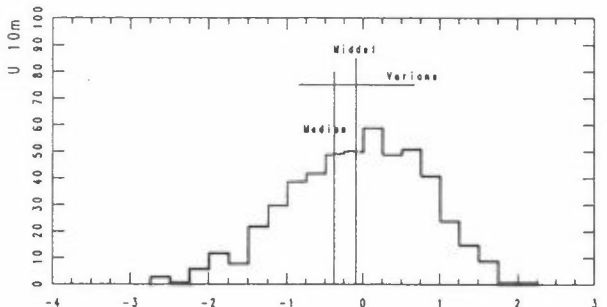
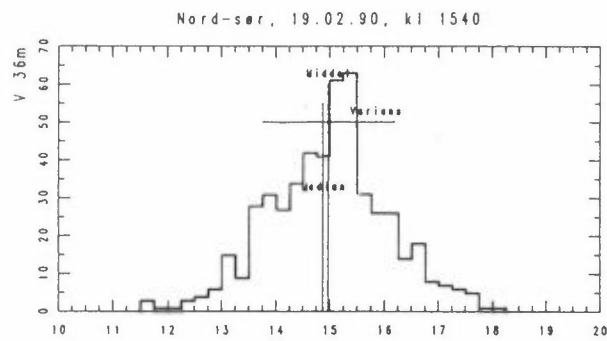
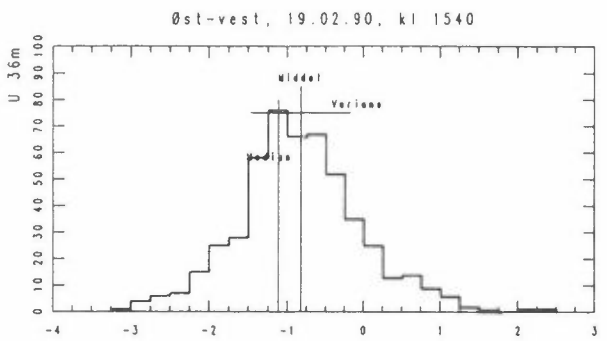
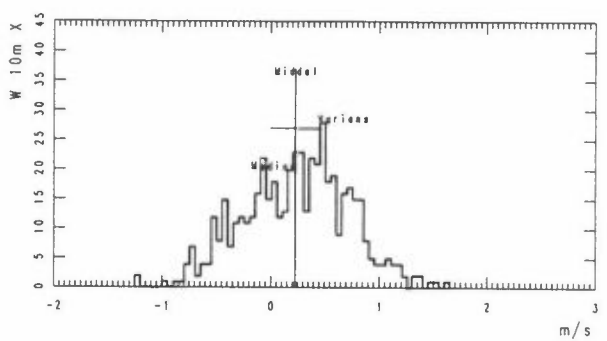
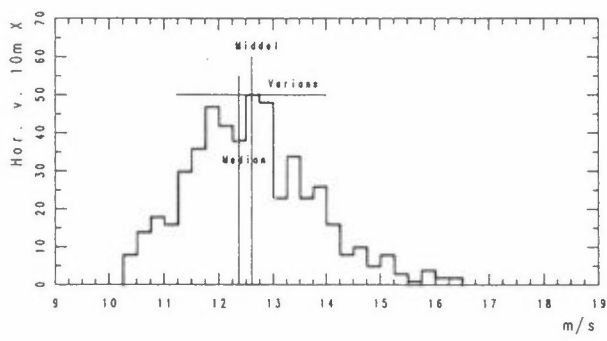
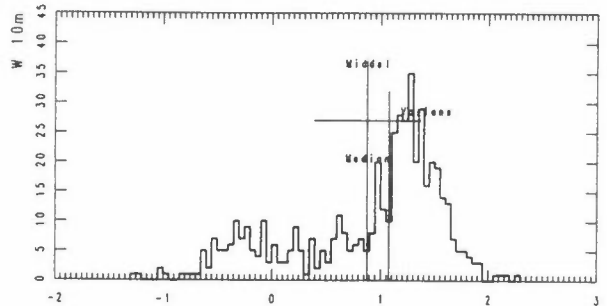
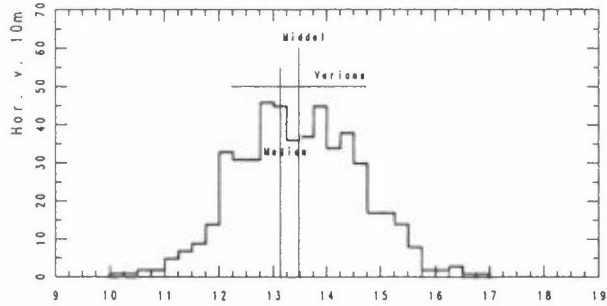
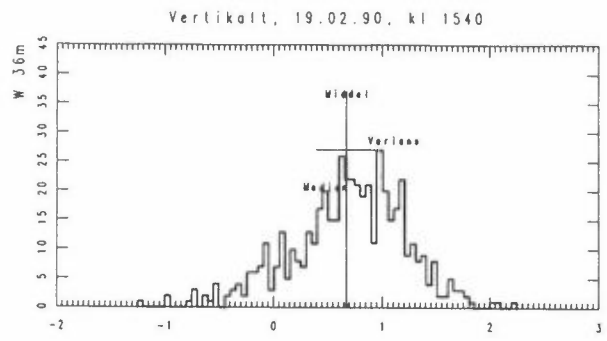
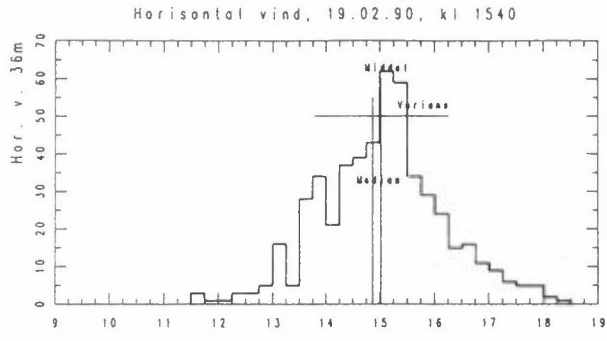


Øst-vest, 19.02.90, kl 1530

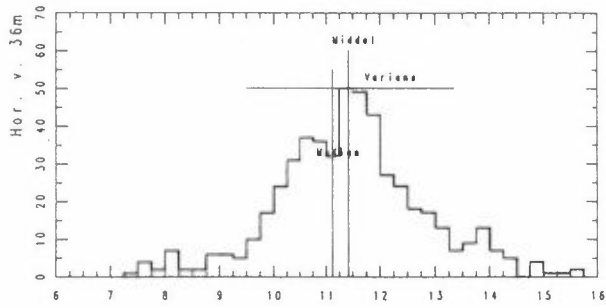


Nord-sør, 19.02.90, kl 1530

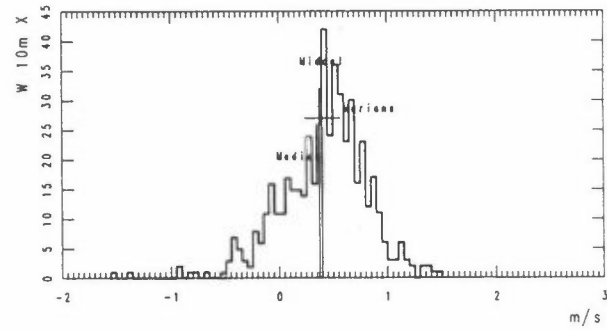
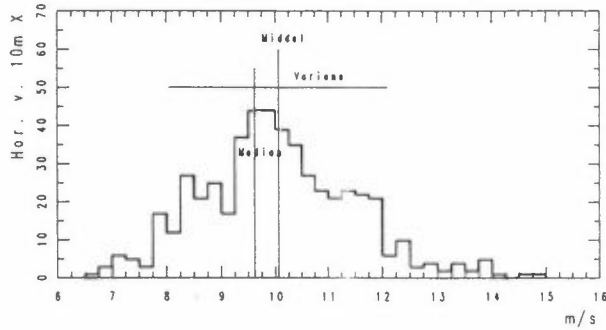
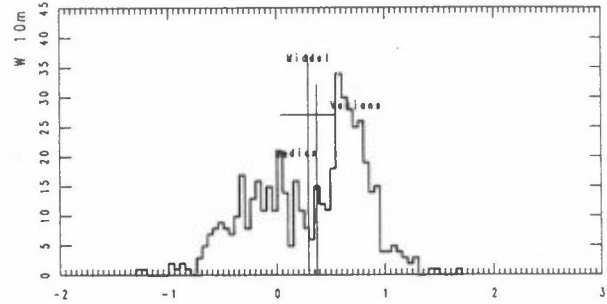
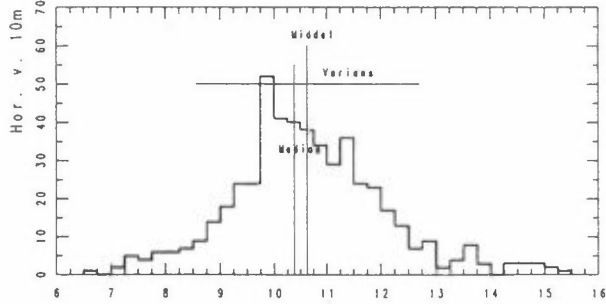
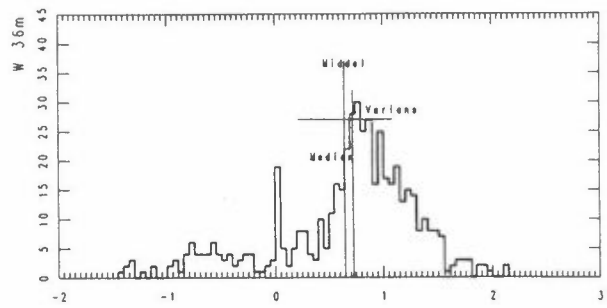




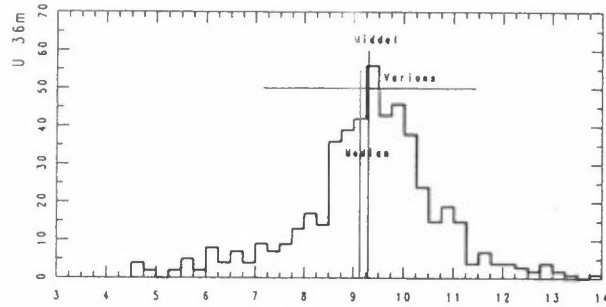
Horisontal vind, 04.03.90, kl 1350



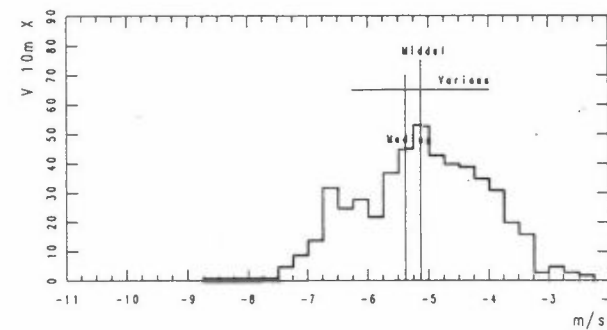
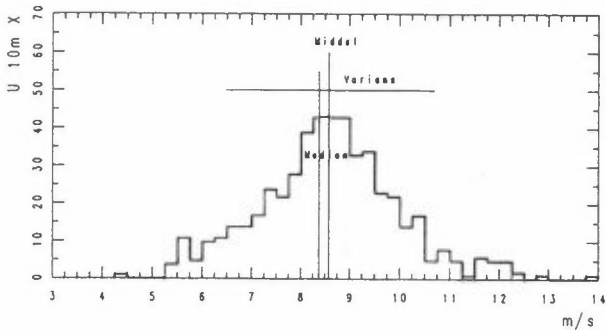
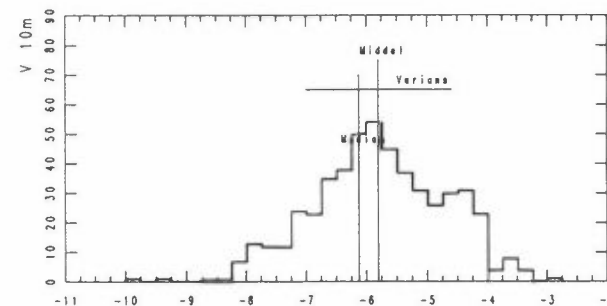
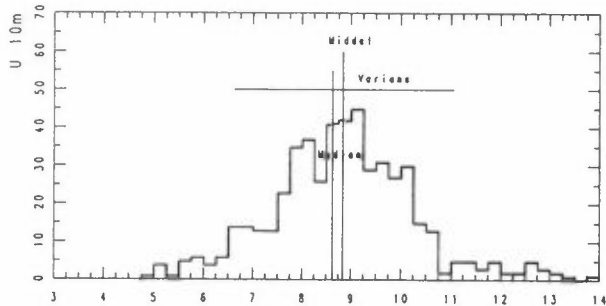
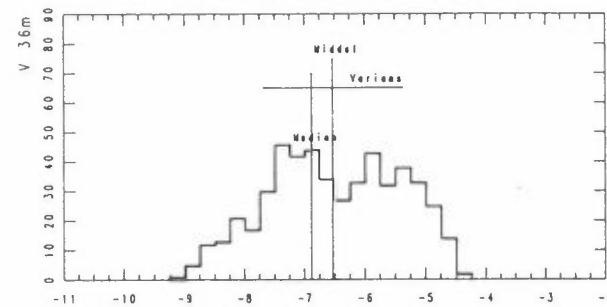
Vertikall, 04.03.90, kl 1350



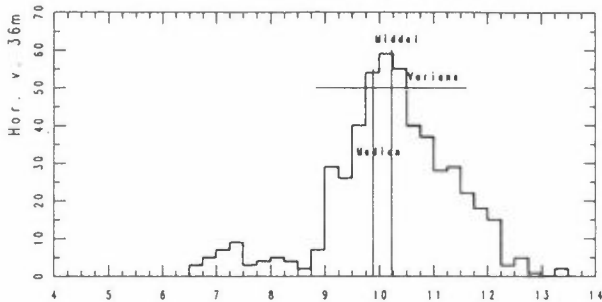
Øst-vest, 04.03.90, kl 1350



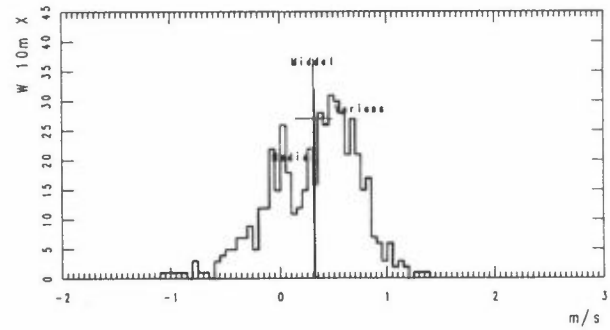
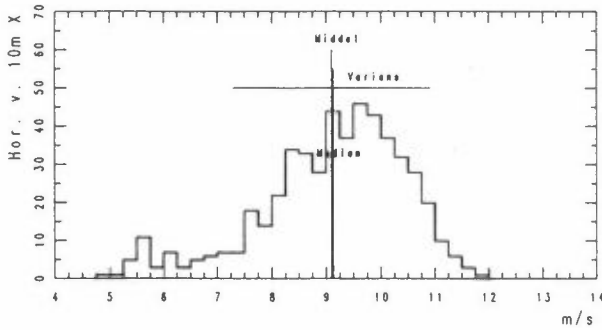
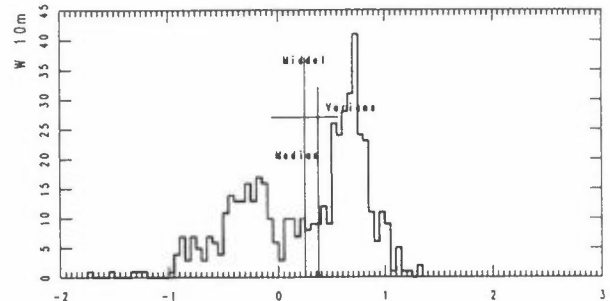
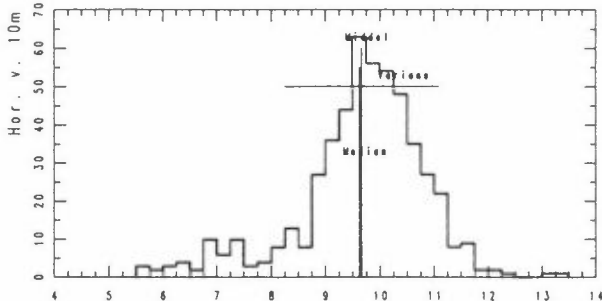
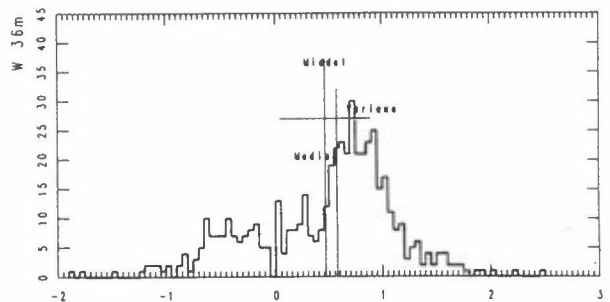
Nord-sør, 04.03.90, kl 1350



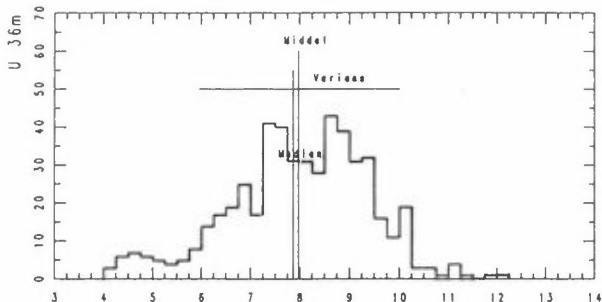
Horisontal vind, 04.03.90, kl 1400



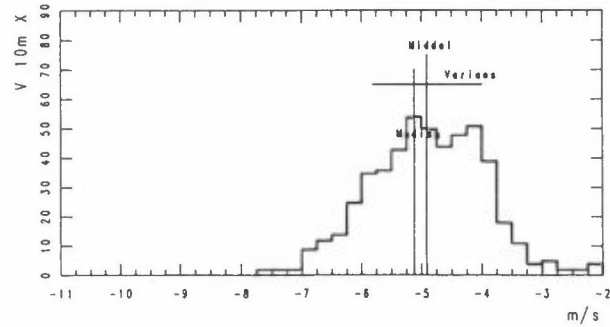
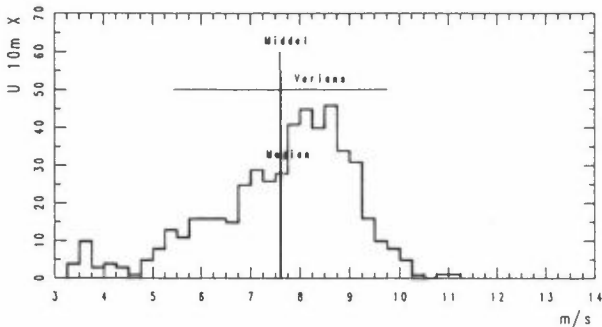
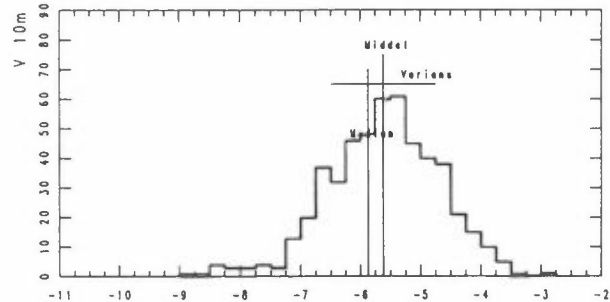
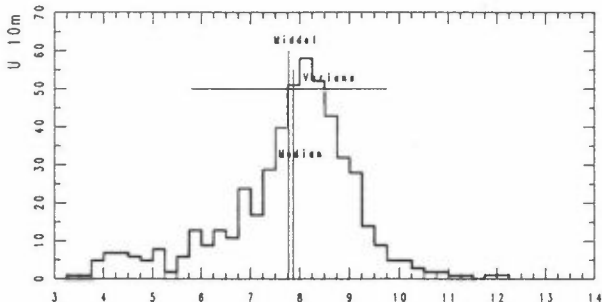
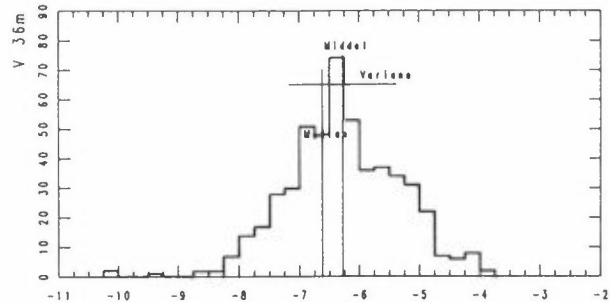
Vertikalt, 04.03.90, kl 1400



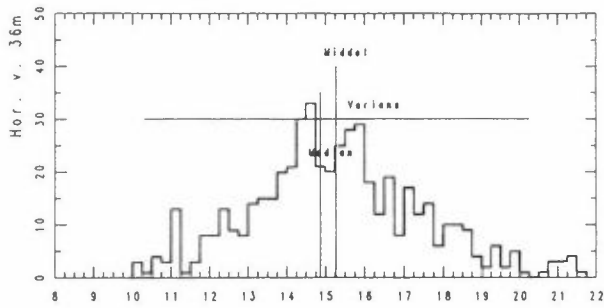
Øst-vest, 04.03.90, kl 1400



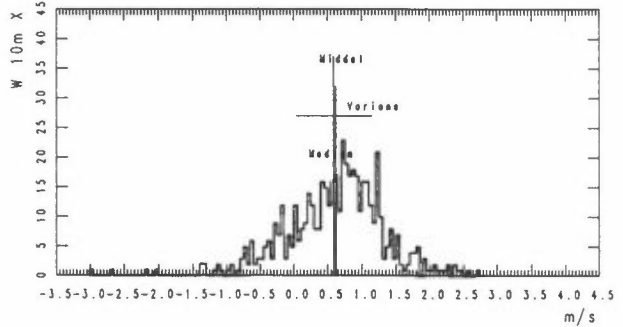
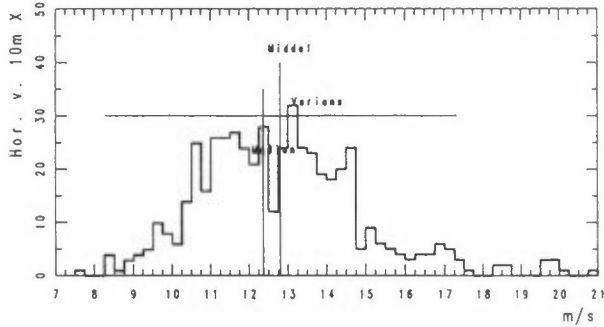
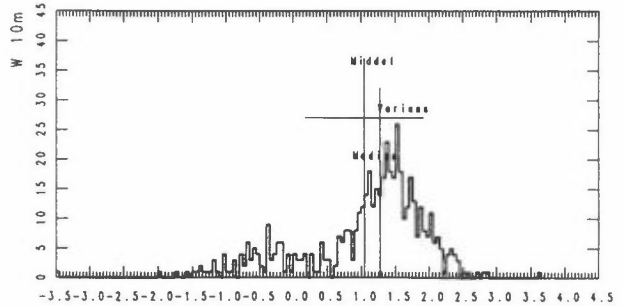
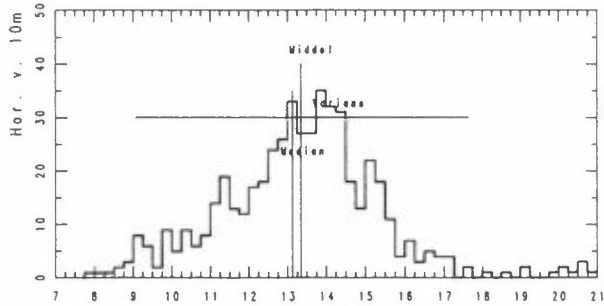
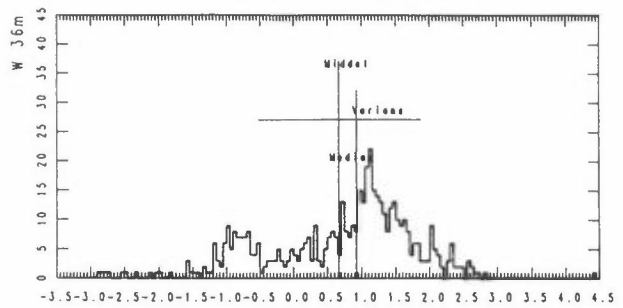
Nord-sør, 04.03.90, kl 1400



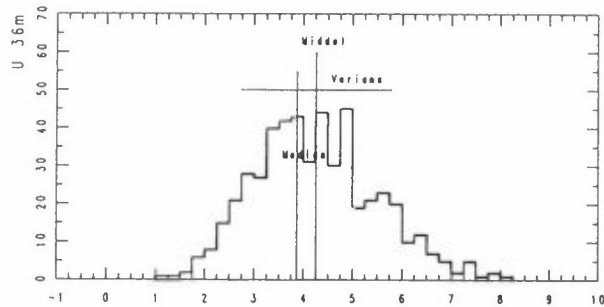
Horisontal vind, 09.03.90, kl 2030



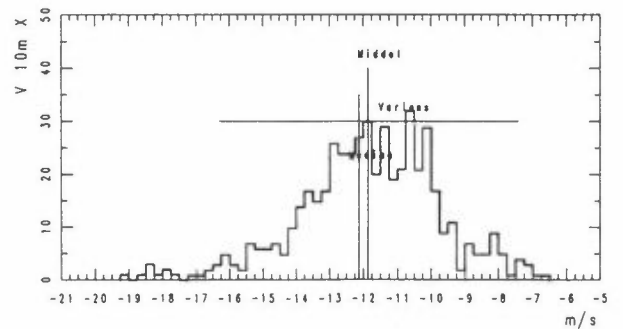
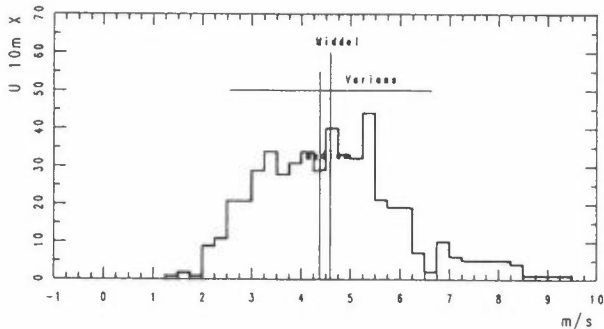
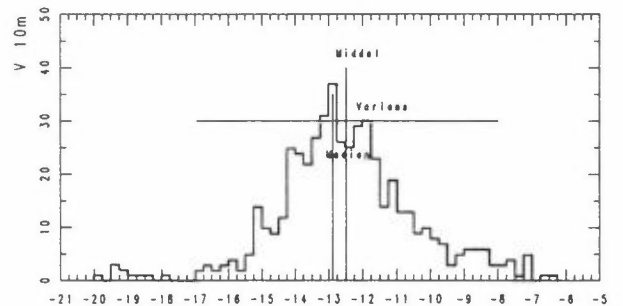
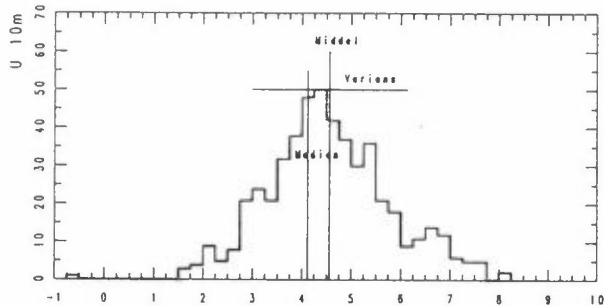
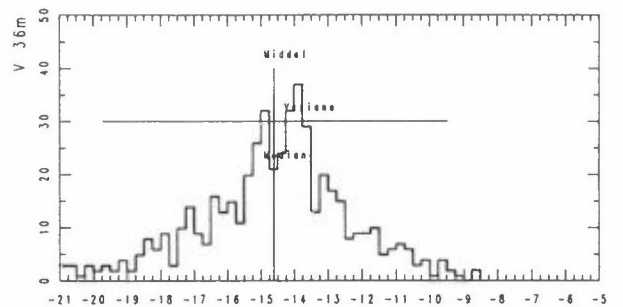
Vertikalt, 09.03.90, kl 2030



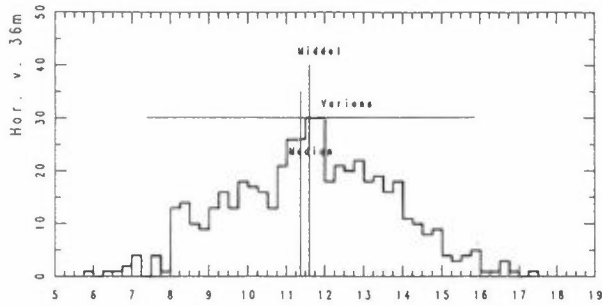
Øst-vest, 09.03.90, kl 2030



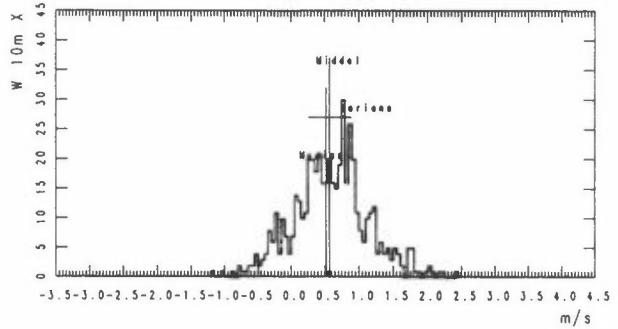
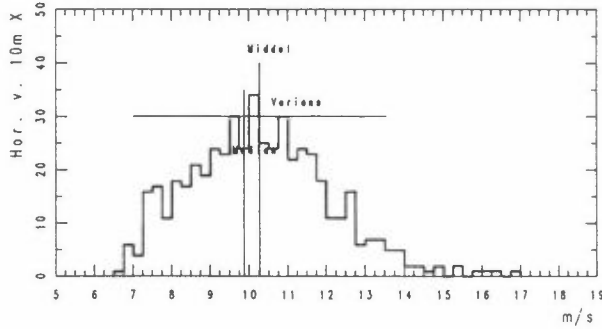
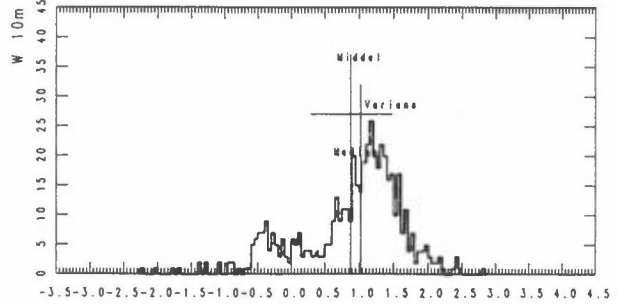
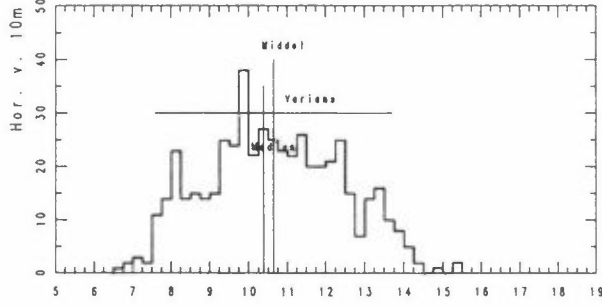
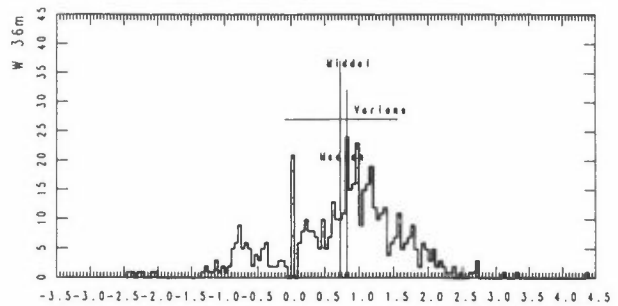
Nord-sør, 09.03.90, kl 2030



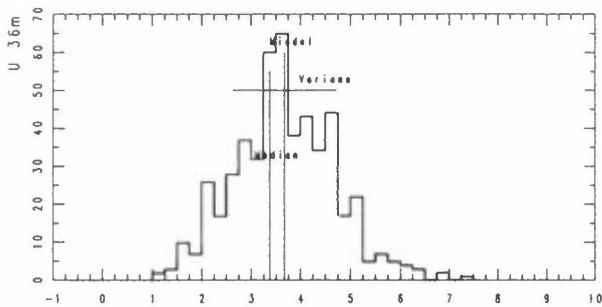
Horizontaal vind, 09.03.90, kl 2040



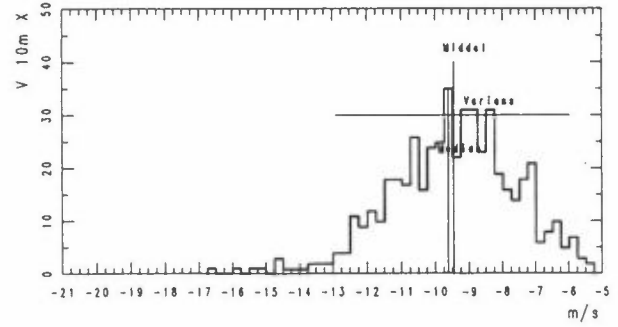
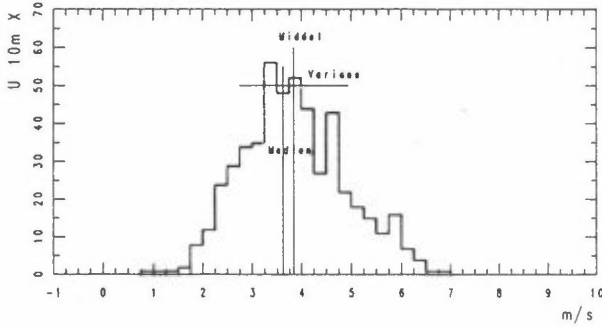
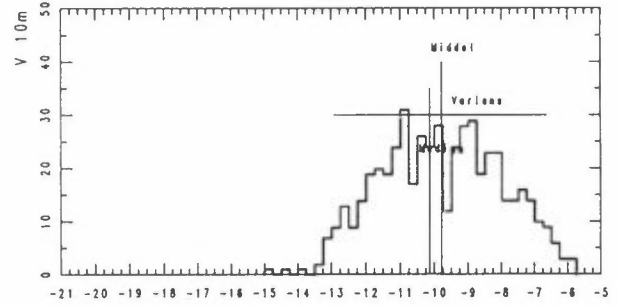
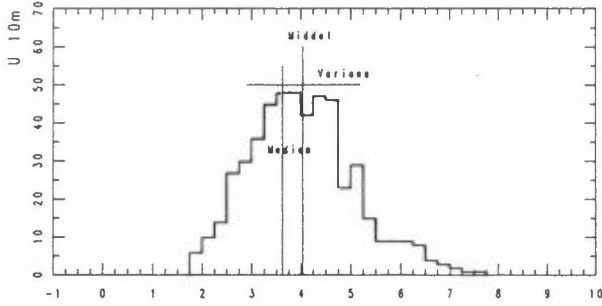
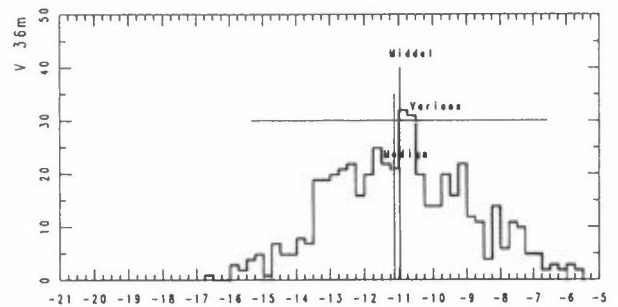
Vertikalt, 09.03.90, kl 2040



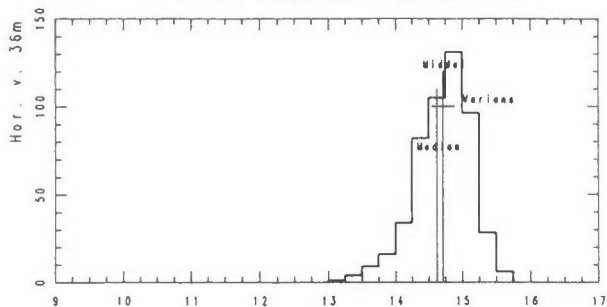
Øst-vest, 09.03.90, kl 2040



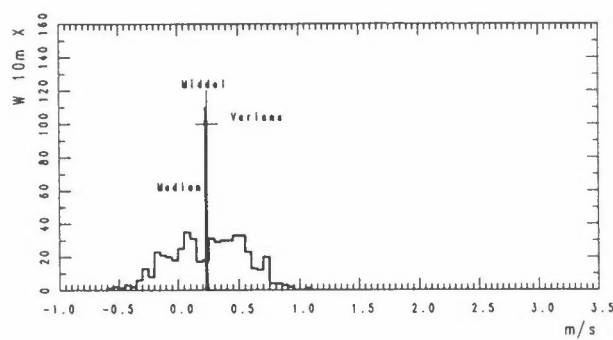
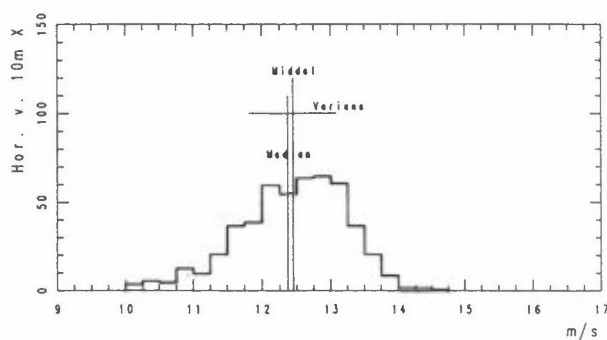
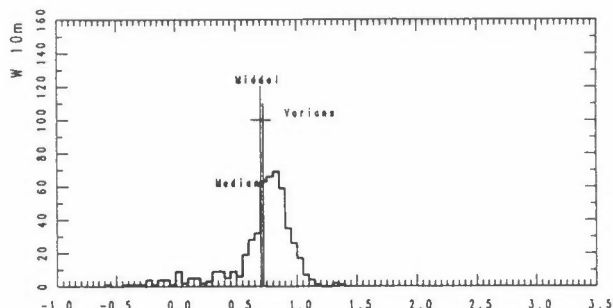
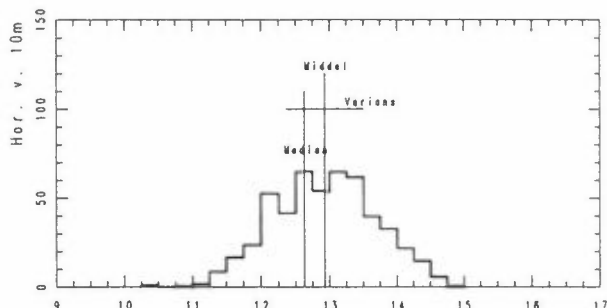
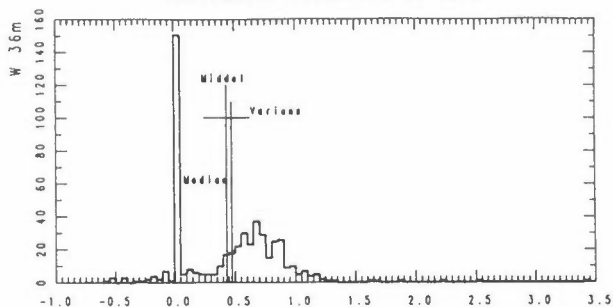
Nord-sør, 09.03.90, kl 2040



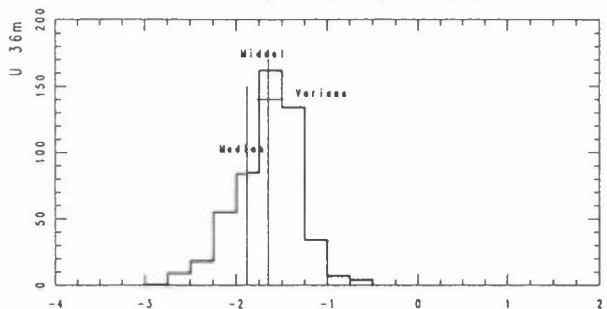
Horisontal vind, 16.03.90, kl 1210



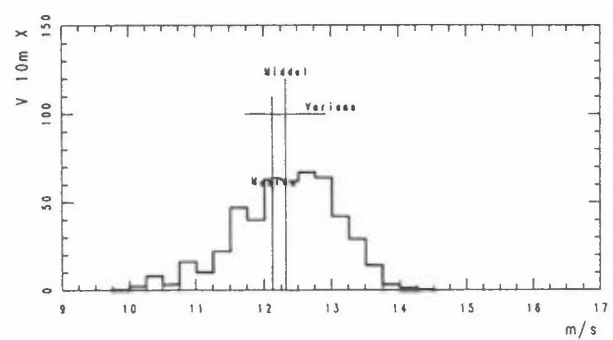
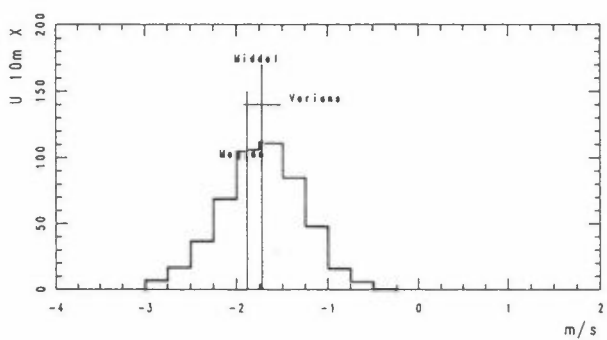
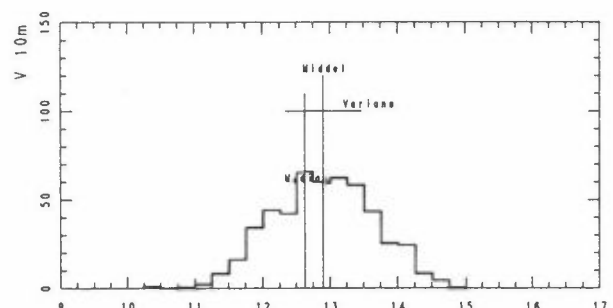
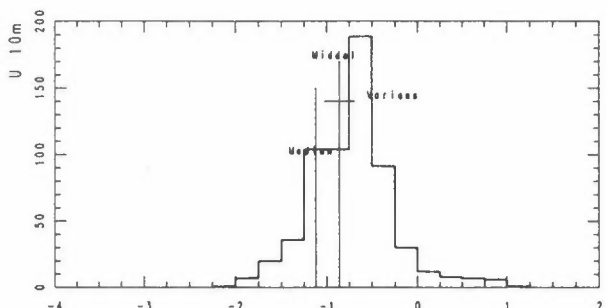
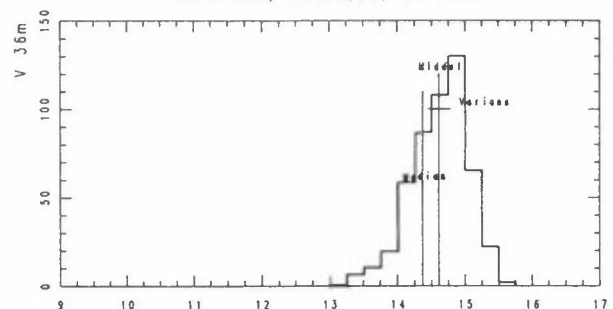
Vertikalt, 16.03.90, kl 1210



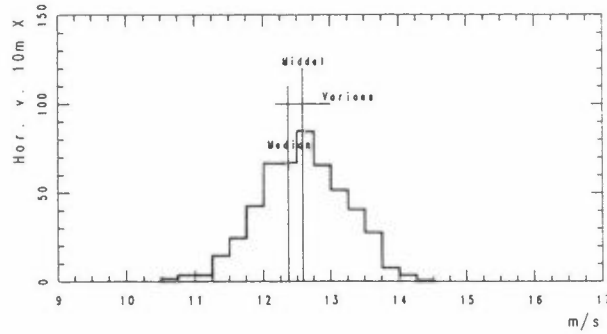
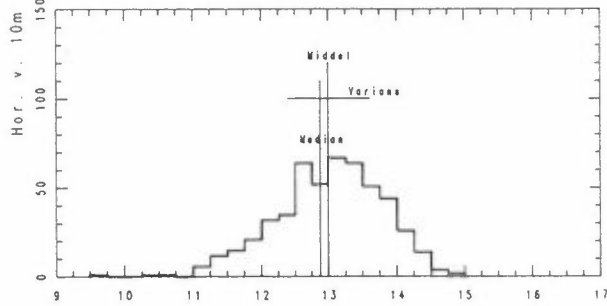
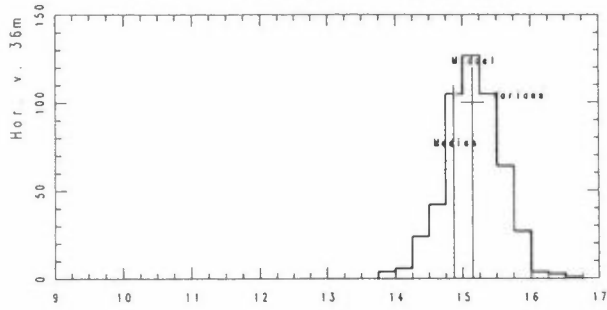
Øst-vest, 16.03.90, kl 1210



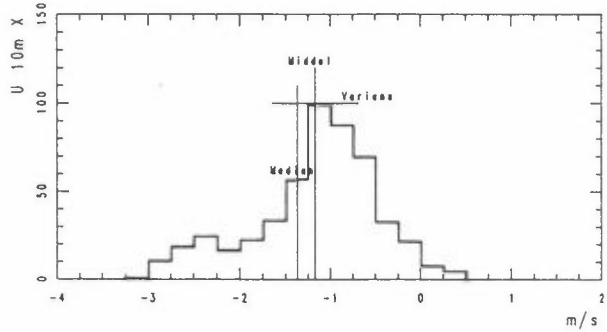
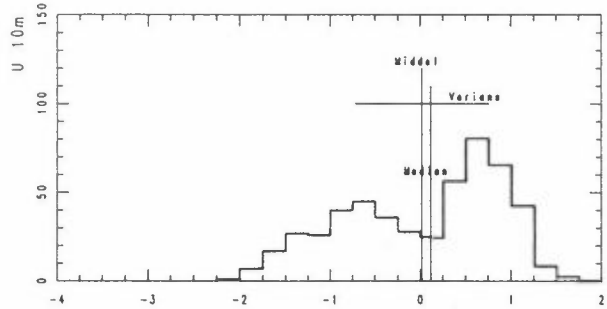
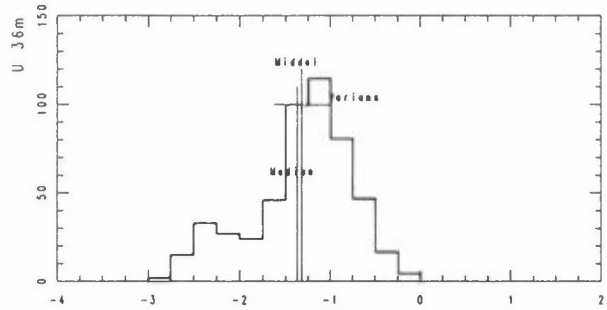
Nord-sør, 16.03.90, kl 1210



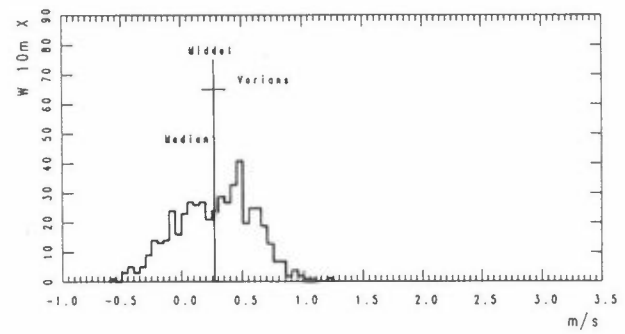
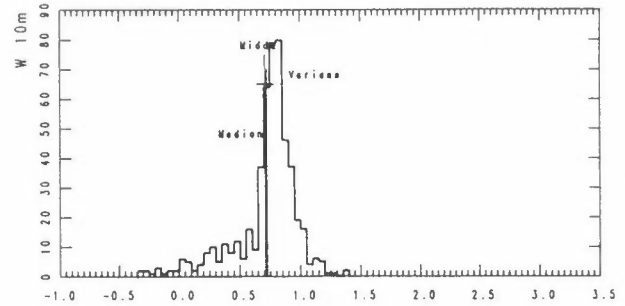
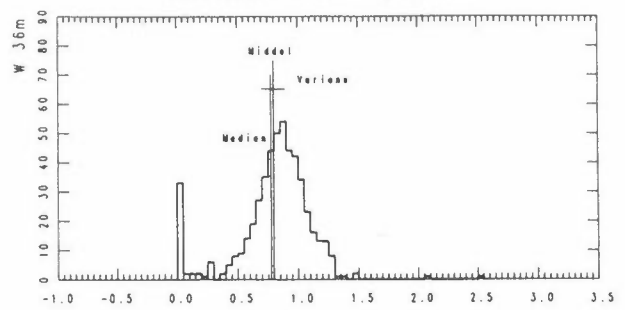
Horisontal vind, 16.03.90, kl 1220



Øst-vest, 16.03.90, kl 1220



Vertikalt, 16.03.90, kl 1220



Nord-sør, 16.03.90, kl 1220

