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METEOROLOGISCH INSTITUUT**

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De persistentie op zeer korte termijn van
lage bewolking op enkele Nederlandse vliegvelden.

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De persistentie op zeer korte termijn van
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1. Inleiding

Meteorologische voorlichtingsdiensten op burgervliegvelden verstrekken halfuurlijks een "trend-forecast". Deze geeft de verwachte verandering binnen de komende twee uur in bepaalde, voor de luchtvaart vitale, weerselementen.

Een dergelijk element is bewolking, indien die zich op of onder 1500 ft bevindt en $\frac{4}{8}$ of meer van de hemel bedekt. In zo'n situatie moet de trend-forecast aangeven of een verandering in het bewolkingsbeeld (in hoogte en/of bedekkingsgraad) wordt verwacht en hoe het beeld dan zal zijn. Hierbij worden de volgende hoogtegrenzen gehanteerd: 100 - 200 - 300 - 500 - 1000 en 1500 ft. (Het gebruik van "feet" is in de luchtvaart zo ingeburgerd, dat deze grootheid hier gebruikt blijft).

De meteoroloog beschikt nauwelijks over hulpmiddelen bij het opstellen van deze zeer-korte-termijn verwachtingen. Het waarnemingsnetwerk is voor dit doel in veel gevallen te wijdmazig: binnen de afstand tussen twee stations kunnen zich dikwijls grote verschillen in hoogte en hoeveelheid van bewolking voordoen. De beschikbare klimatologische frequentietabellen [1] geven de kans op optreden van een bepaalde bewolkings-toestand, maar uiteraard niet de duur ervan. Juist dit laatste gegeven is voor de meteoroloog interessant.

Het leek daarom zinvol na te gaan hoe het bewolkingsbeeld in de genoemde categorie in het verleden is veranderd één, respectievelijk twee uur na waarneming. Bij gelijkblijvende klimatologische omstandigheden kan aan de resultaten een zekere voorspellende waarde worden toegekend.

2. Het materiaal

Gebruik is gemaakt van de uurlijkse synops tussen 1 maart 1949 en 31 december 1977 voor Schiphol, Eelde en Beek en tussen 1 maart 1957 en 31 december 1977 voor Zestienhoven.

Tot de aanschaf van ceilometers werden de wolkenhoogten geschat, of gemeten met behulp van loodsballonnen of wolkenlicht.

Tabel I geeft de data van ingebruikneming van de ceilometers.

	Ceilometer sinds:
Beek	april 1979
Eelde	augustus 1966
Schiphol	mei 1967
Zestienhoven	april 1964

Tabel I. Data van ingebruikstelling ceilometers.

In dit onderzoek is geen onderscheid gemaakt tussen geschatte en gemeten wolkenhoogten.

3. Bewerking

- Per vliegveld is voor ieder uur van het jaar nagegaan
- hoe vaak er op dat uur $4/8$ of meer bewolking was op of onder 1500 ft;
 - hoe de situatie één resp. twee uur later was: "beter", "slechter" of "gelijk".

Onder "beter" is verstaan:

- de bedekkingsgraad is afgenomen tot $3/8$ of minder en/of
- de bewolking is naar een hogere hoogtegrens gegaan (in vrijwel alle gevallen was dat de naasthogere).

De betekenis van "slechter" en "gelijk" is op overeenkomstige manier gedefinieerd. Verslechtering vond bijna altijd plaats naar de naastlagere hoogtegrens.

Teneinde het materiaal niet te veel te versnipperen, is bewolking t u s s e n twee wolkengrenzen geacht zich op de o n d e r s t e te bevinden.

Op deze manier is elke waarneming met 4/8 of meer bewolking op of onder 1500 ft onderscheiden naar tijdstip, hoogte en opgetreden verandering na één resp. twee uur.

Om de seizoensinvloed in rekening te brengen, is het gegevensbestand verdeeld in een zomer- en een winterhalfjaar; voor een verdere onderverdeling was het aantal beschikbare waarnemingen te klein. Onder "zomer" wordt hier de periode 27 maart t/m 25 september verstaan.

Teneinde ook de dagelijkse gang te honoreren zijn de waarnemings-tijden omgezet in uren voor of na zonsopkomst/-ondergang.

De uren 0 t/m 12 zijn gekoppeld aan zonsopkomst, de overige aan zonsondergang. De nodige gegevens zijn ontleend aan de Getijtafels van Rijkswaterstaat. Alle tijden zijn afgerond naar het dichtstbijzijnde hele uur (tabel II).

Zomer (27 maart t/m 25 september)

Zonsopkomst	GMT	Zonsondergang	GMT
27 mrt t/m 21 apr.	5	27 mrt t/m 11 apr.	18
22 apr. t/m 27 mei	4	12 apr. t/m 17 mei	19
28 mei t/m 7 juli	3	18 mei t/m 2 aug.	20
8 juli t/m 20 aug.	4	3 aug. t/m 31 aug.	19
21 aug. t/m 25 sep.	5	1 sep. t/m 25 sep.	18

Winter (26 september t/m 26 maart)

Zonsopkomst	GMT	Zonsondergang	GMT
26 sep. t/m 30 okt.	6	26 sep. t/m 23 okt.	17
31 okt. t/m 4 dec.	7	24 okt. t/m 2 feb.	16
5 dec. t/m 25 jan.	8	3 feb. t/m 7 mrt	17
26 jan. t/m 27 feb.	7	8 mrt t/m 26 mrt	18
28 feb. t/m 26 mrt	6		

Tabel II. Omzetting van tijden van zonsopkomst en -ondergang naar hele uren GMT.

De bewerkingsprocedure is eerst toegepast op alle waarnemingen van het betreffende vliegveld. Vervolgens zijn waarnemingen waarin weercijfers voorkwamen die betrekking hebben op neerslag geschrapd, waarna de procedure nog eens is uitgevoerd. (Een behandeling van de gevallen met neerslag afzonderlijk was onmogelijk door het daartoe te geringe aantal). Beide resultaten worden gepresenteerd in grafiekvorm, respectievelijk onder "alles" en "droog". De gegevens zijn, indien gewenst, ook beschikbaar in tabelvorm.

4. De grafieken

Er zijn per vliegveld twee series grafieken vervaardigd: een serie voor het komende uur (" + 1 uur ") en één voor het daaropvolgende uur (" + 2 uur ").

Per uurserie zijn er vier blokken, achtereenvolgens voor zomer/zonop, zomer/zononder, winter/zonop en winter/zononder. In ieder blok ten slotte zijn twaalf grafiekjes ondergebracht, zes voor "droge" situaties en zes voor situaties gerubriceerd onder "alles" voor de verschillende hoogten.

Op de horizontale as zijn de uren vóór (-) of ná (+) zonsopkomst/-ondergang aangegeven. Langs de verticale as is de kans vermeld in procenten op persistentie (blauw, □), verbetering (groen, △) of verslechtering (rood, v). De grafieken zijn afgekapt bij zes uur vóór en zes uur na zonsopkomst/-ondergang.

Sommige grafieken zijn enigszins "springerig"; de gegevens hebben dan betrekking op een (te) klein aantal waarnemingen.

Iedere grafiek bevat ten slotte midden bovenaan de data, die het aangegeven seizoen begrenzen en de naar GMT vertaalde tijden van zonsopkomst of -ondergang.

5. Werken met de grafieken

Indien er 4/8 of meer bewolking wordt gerapporteerd met een wolkenbasis van 1500 ft of minder, kan als volgt met de grafieken worden gewerkt:

1. Selecteer uit de uurserie " + 1 uur " de juiste grafiek, winter/zononder, winter/zonop, zomer/zononder of zomer/zonop.
2. Kies, afhankelijk van de weerssituatie, "alles" of "droog".
3. Zoek de grafiek behorende bij de waargenomen wolkenhoogte (bewolking tussen twee standaardniveaus wordt geacht zich op het onderste niveau te bevinden).
4. Vertaal de tijd van uitgifte van de trendforecast in uren vóór of ná zonsopkomst/-ondergang. Hierbij geldt dat de uren 0 t/m 12 GMT zijn gekoppeld aan zonsopkomst, de overige aan zonsondergang.
5. De kanspercentages voor het v o l g e n d e uur op persistentie (blauw, □), verbetering (groen, Δ) en verslechtering (rood, ∇) zijn nu af te lezen.

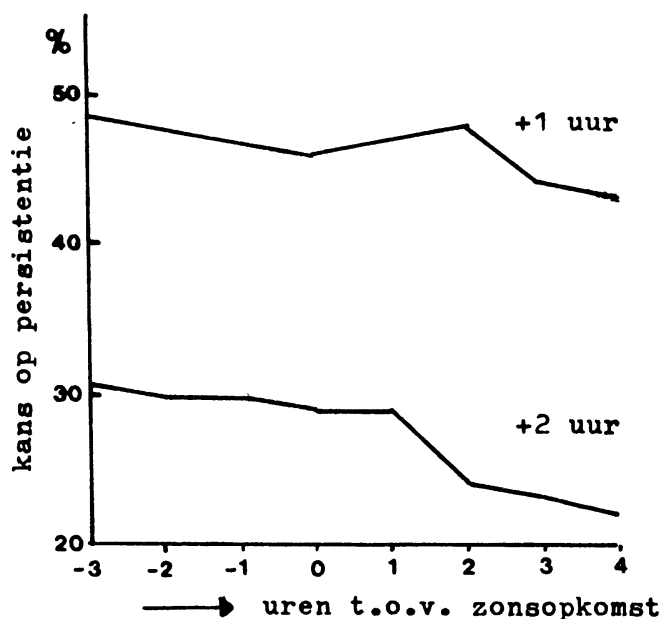
Om de kanspercentages voor over twee uur te verkrijgen, wordt hetzelfde gedaan met de uurserie " + 2 uur ".

6. Bespreking van enkele resultaten

Bewolking tot 1500 ft is in het algemeen niet bijzonder persistent; daarbij neemt de persistentie af met toenemende verwachtingsperiode.

In fig. 1 is uitgezet de over alle stations en alle bewolkingshoogten gemiddelde persistentie over één en over twee uur.

De figuur heeft betrekking op het zomerseizoen rond zonsopkomst. Het verschil in persistentie over deze verwachtingstermijnen is overigens in zomer en winter zowel bij de overgang dag-nacht als omgekeerd ongeveer even groot. Uit fig. 1 is af te leiden dat tot één uur na zonsopkomst gemiddeld in één van de drie gevallen de aanwezige bewolking twee uur later nog onveranderd aanwezig is. Daarna neemt de persistentie snel af.

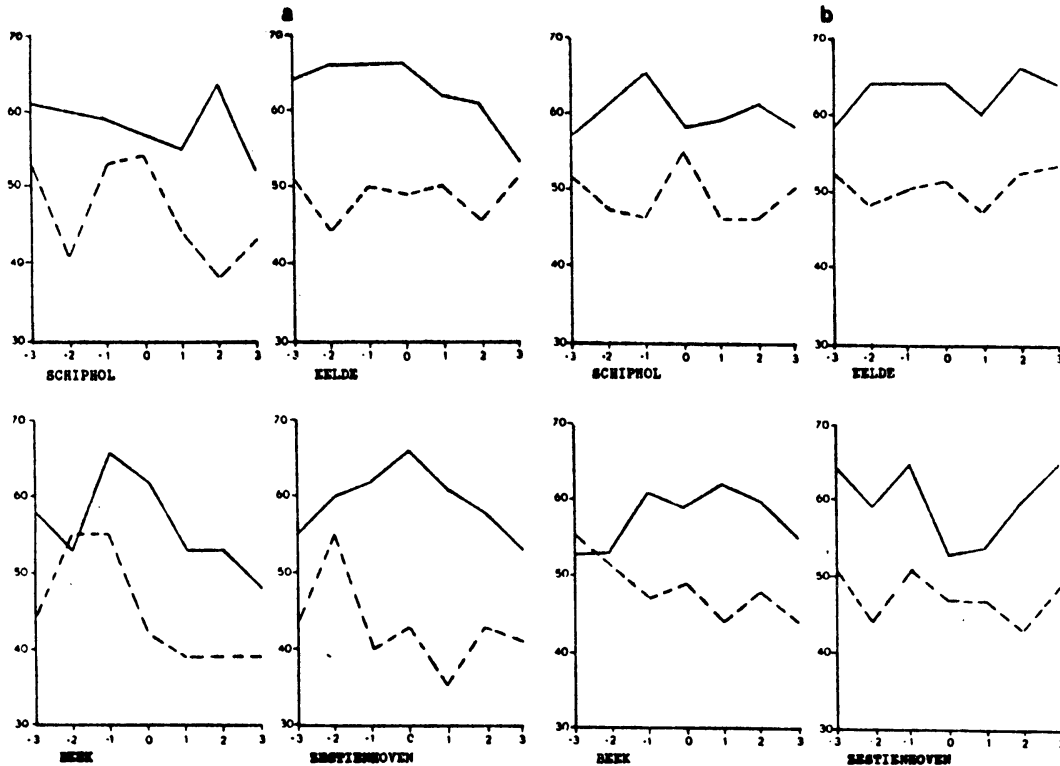


Figuur 1. Gemiddelde persistentie over één en over twee uur (zomer, zonsopkomst, zonder neerslag, alle hoogten en alle stations).

Dat de persistentie afneemt met het langer worden van de verwachtingsperiode, is uiteraard een afspiegeling van de (gemiddeld) beperkte duur van elke bewolkingstoestand.

Het meest persistent is bewolking in de hoogteklasse 500-1000 ft. Ook de klasse 300-500 ft is tamelijk persistent, zij het in mindere mate. Dit verschil in persistentie is vermoedelijk voor het grootste deel toe te schrijven aan het verschil in laagdikte.

Veel minder persistent is de klasse 1000-1500 ft. In fig. 2 zijn als voorbeeld de percentages persistentie weergegeven voor bewolking in de klassen 500-1000 ft en 1000-1500 ft. Het verschil in persistentie wordt nu kennelijk veroorzaakt door het verschil in synoptische omstandigheden waaronder de twee klassen voorkomen. Bewolking tussen 1000 en 1500 ft treedt overwegend op in kortdurende overgangssituaties: tijdens de nadering van een neerslaggebied, tijdens de vorming of het oplossen van cumulus, etc. Bewolking tussen 500 en 1000 ft is meer gebonden

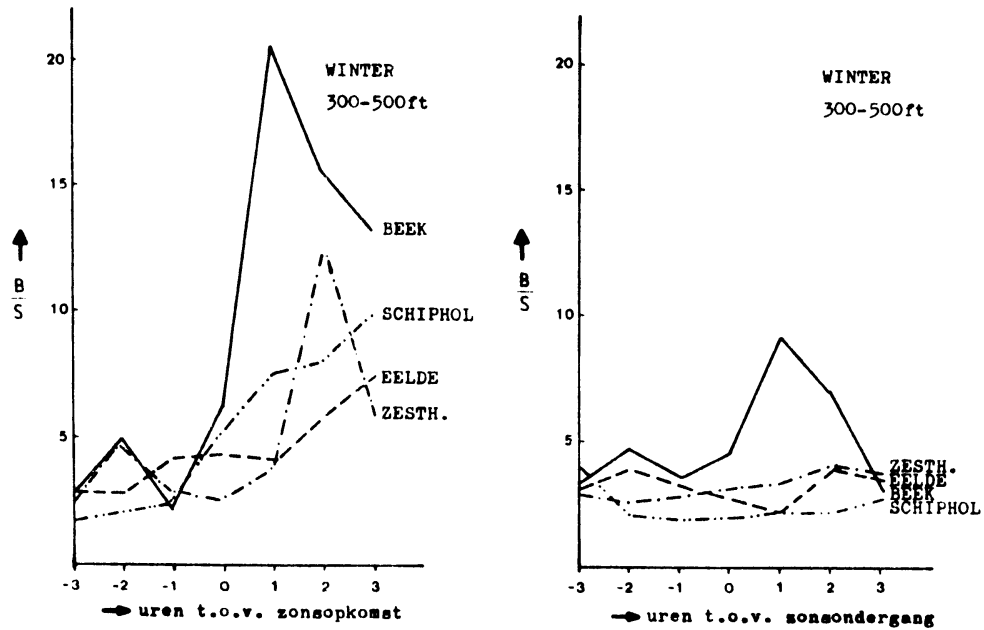


Figuur 2. Percentage persistentie tot het volgende uur in gevallen zonder neerslag rond zonsopkomst, van bewolking tussen 500 en 1000 ft (getrokken) en tussen 1000 en 1500 ft (gestreept). a) zomer, b) winter.

aan weerssystemen van langere duur, zoals uitgebreide neerslaggebieden, warme sectoren en inversies met een grote horizontale uitgestrektheid.

Bewolking in de laagste hoogteklassen is het minst persistent. Geringe persistentie houdt uiteraard grote veranderlijkheid in. Hoe de kansen op verbetering zich verhouden tot de kansen op verslechtering wordt getoond in fig. 3, die betrekking heeft op bewolking tussen 300 en 500 ft, welke in het algemeen een persistentiepercentage onder de 50 vertoont.

De kans op verbetering wordt na zonsopkomst snel veel groter dan die op verslechtering; rond zonsondergang blijft deze verhouding ongeveer gelijk, een niet zonder meer voor de hand liggende zaak.



Figuur 3. Verhouding van het aantal verbeteringen tot het aantal verslechtingen (B/S) tijdens het winterseizoen rond zonsopkomst (a) en zonsondergang (b). Verwachtingstermijn twee uur, bewolking tussen 300 en 500 ft, situaties zonder neerslag.

Ten slotte kan nog worden opgemerkt, dat de hier ter beschikking gekomen klimatologische gegevens zouden kunnen worden gebruikt bij het tot stand brengen van een objectief verificatiesysteem, als daaraan behoefte zou bestaan.

7. Samenvatting

Met gebruikmaking van langjarige reeksen waarnemingen is voor verschillende wolkenhoogteklassen onder 1500 ft nagegaan hoe dikwijls persistentie na één en na twee uur optrad bij een bedekingsgraad van minstens $4/8$. In gevallen van niet-persistentie is bezien waaruit de verandering bestond: een verbetering of een verslechtering, volgens voorgeschreven normen.

De seizoensinvloed is in rekening gebracht door het gegevensbestand te verdelen in een zomer- en een winterserie. De dagelijkse gang is gehonoreerd door de waarnemingstijden te relateren aan de tijden van zonsopkomst en -ondergang. Na behandeling van het gehele bestand is de procedure toegepast op waarnemingen waarin geen neerslag werd vermeld.

Enkele conclusies:

- Bewolking onder 1500 ft is niet bijzonder persistent (gemiddeld); het meest persistent is bewolking tussen 500 en 1000 ft, het minst bewolking onder 300 ft.
- Persistentie over twee uur is belangrijk geringer dan over één uur.
- Geringe persistentie gaat gepaard met een relatief grote kans op verbetering.

Voor elk der vier burgervliegvelden in Nederland zijn grafieken vervaardigd waaruit per seizoen, per uur en per weerssituatie het opgetreden percentage gevallen met persistentie, verbetering en verslechtering is af te lezen. (De gegevens zijn ook in tabelvorm beschikbaar).

Ten slotte is gewezen op de mogelijkheid het materiaal te gebruiken als basis voor een objectief verificatiesysteem.

Dankbetuiging

De samensteller van dit verslag is dank verschuldigd aan de heer J.M. Koopstra, die de computerprogrammering heeft verzorgd.

Referenties

1. Climatological Data of Netherlands Stations.
KNMI Publ. No. 150-9, 1976.

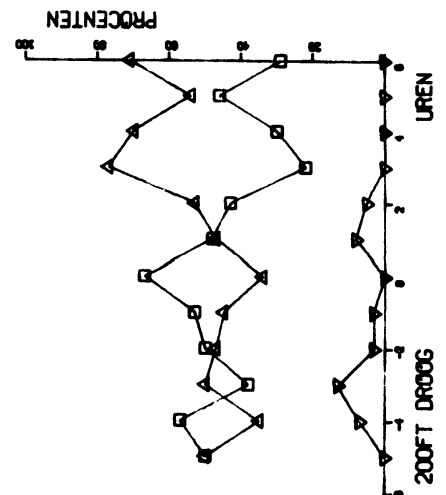
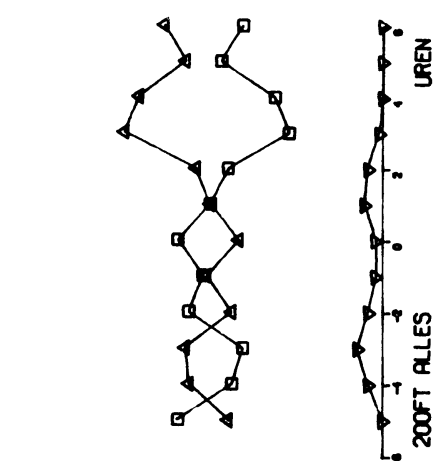
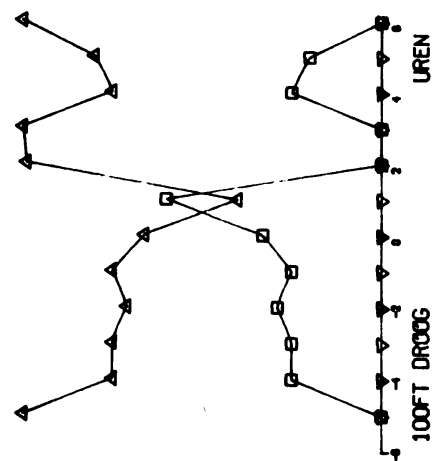
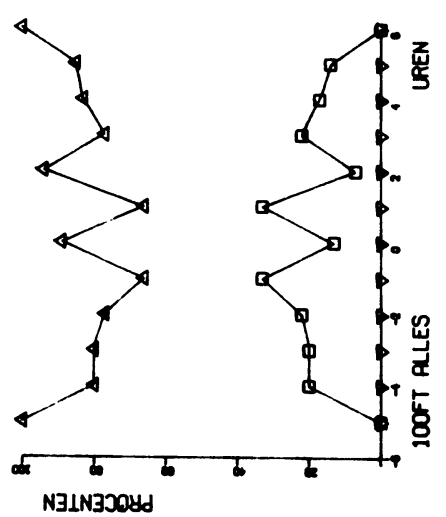
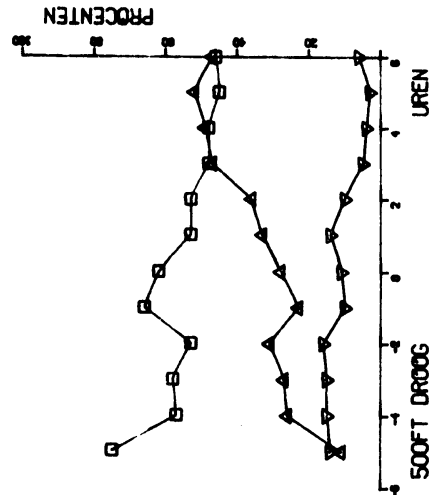
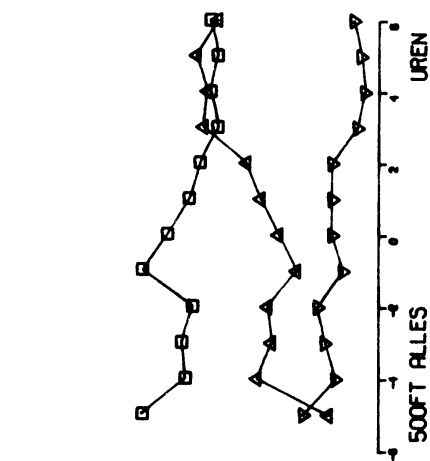
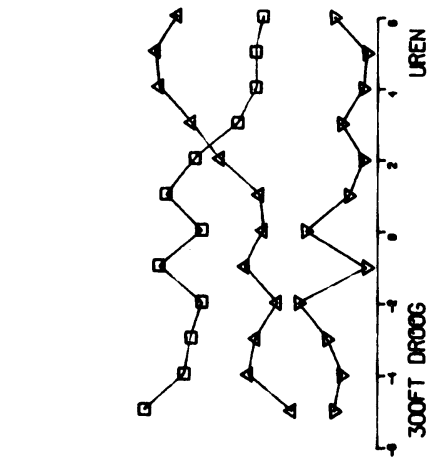
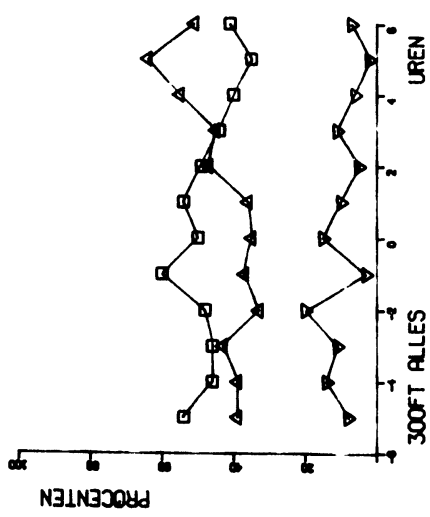
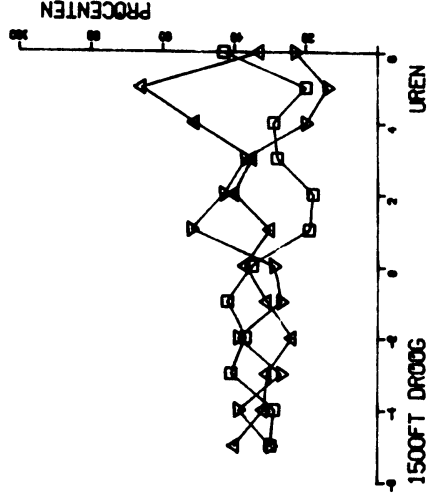
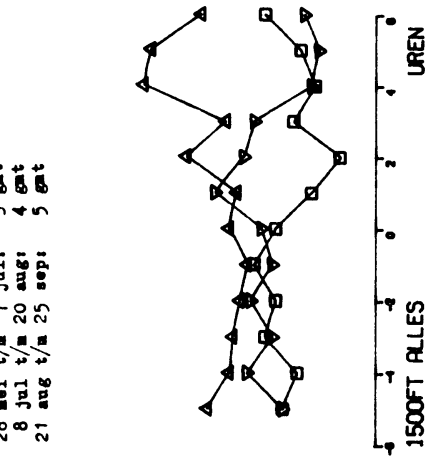
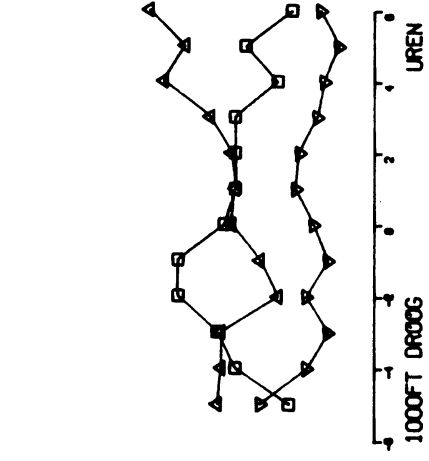
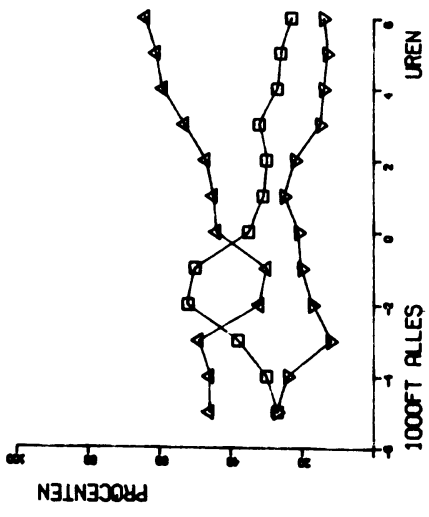
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BEEK

27 mrt t/m 25 sep

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ZOMER ZONOP



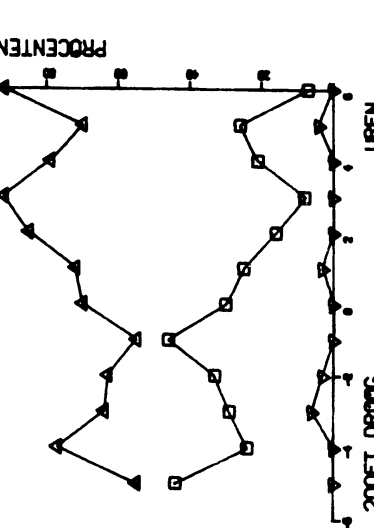
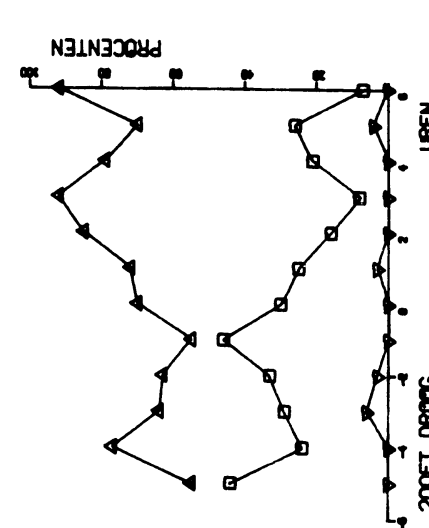
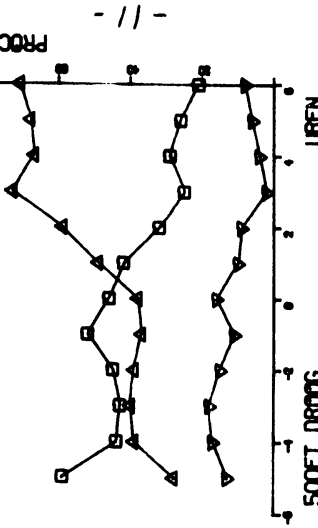
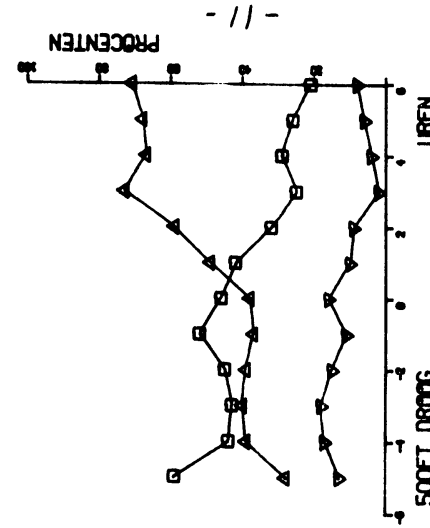
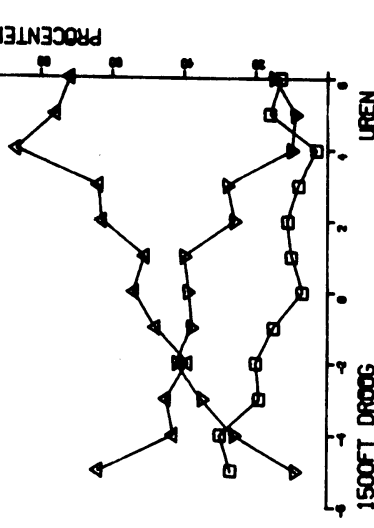
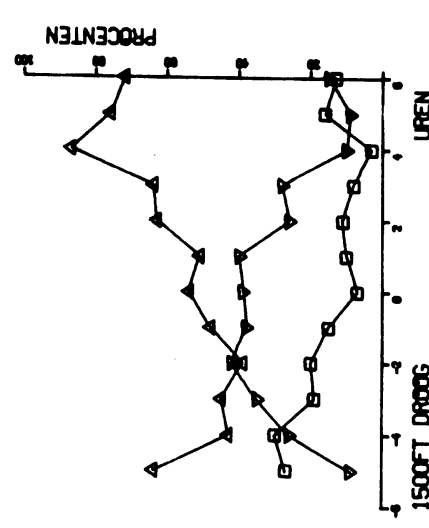
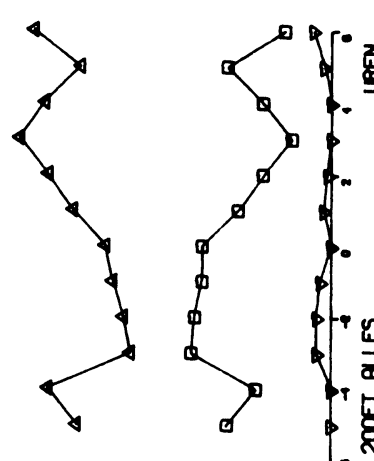
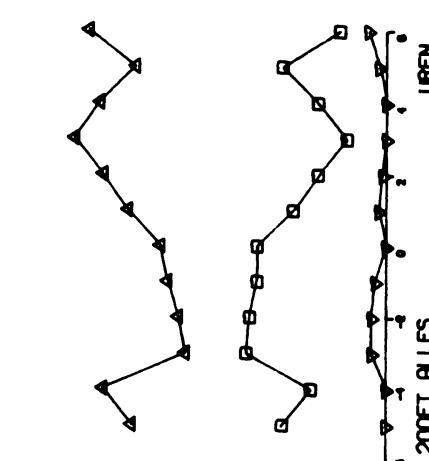
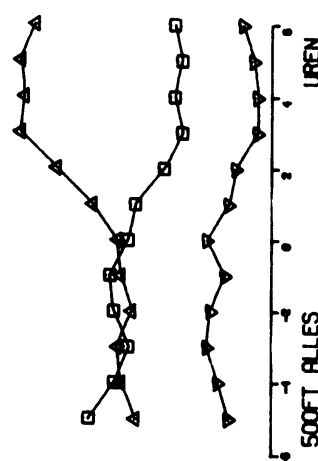
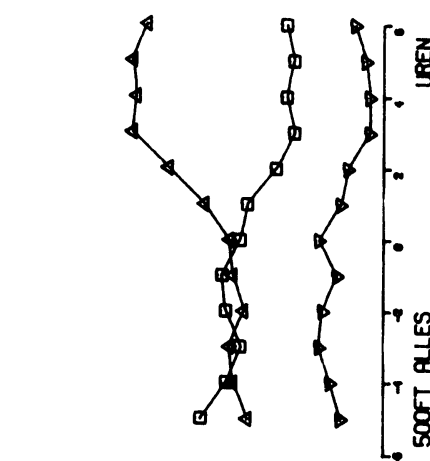
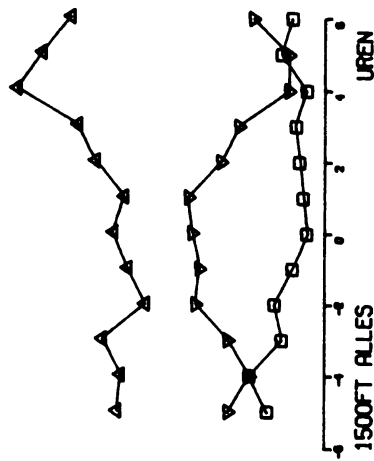
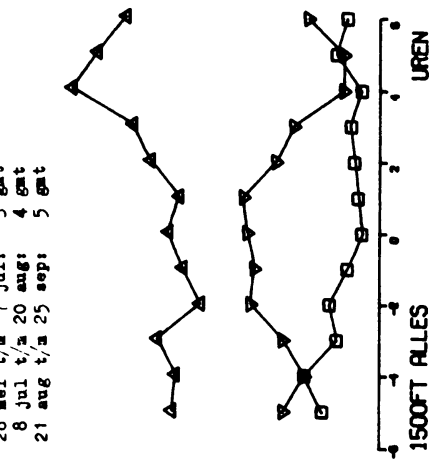
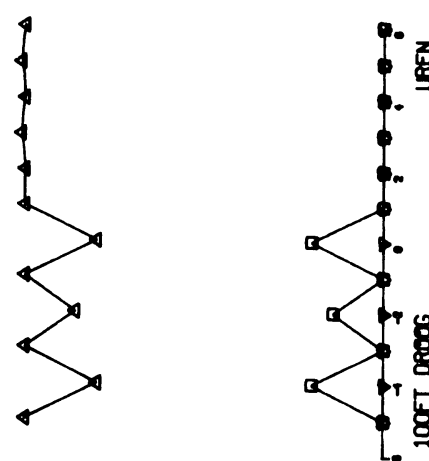
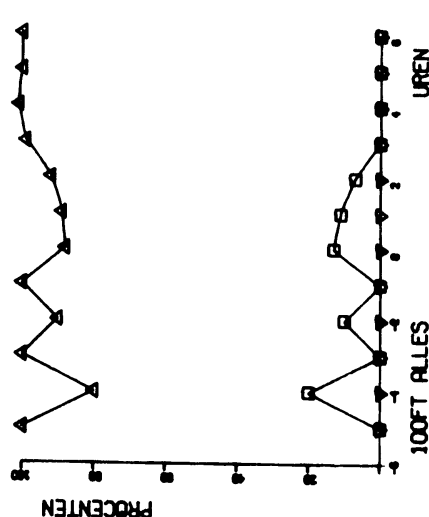
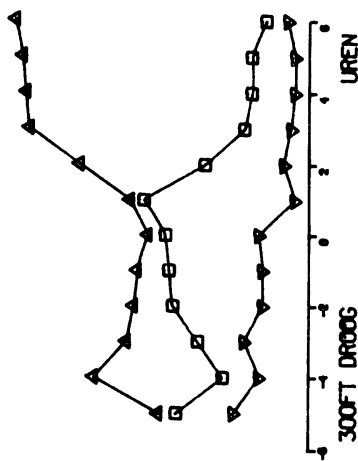
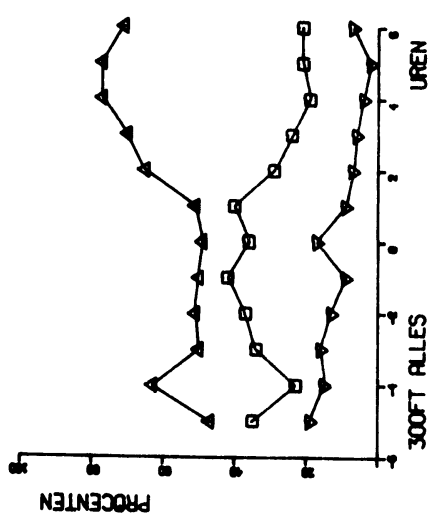
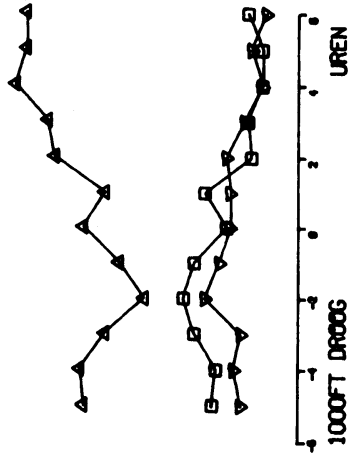
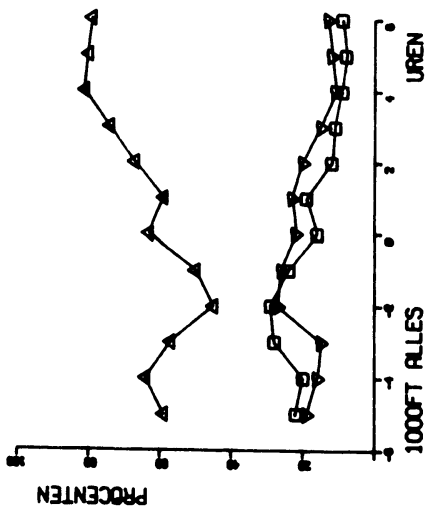
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BEEK

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ZOMER ZONOP



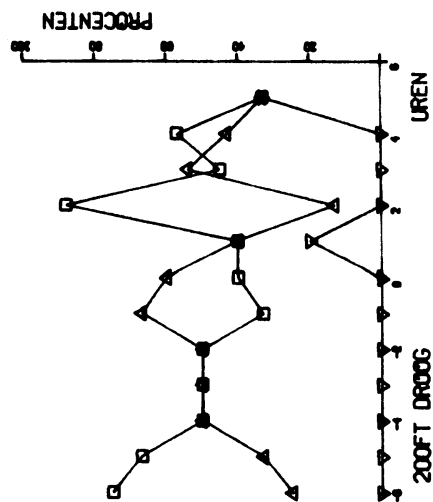
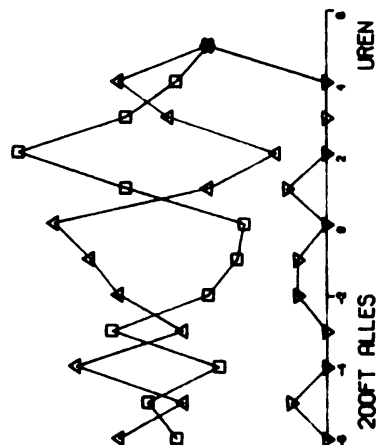
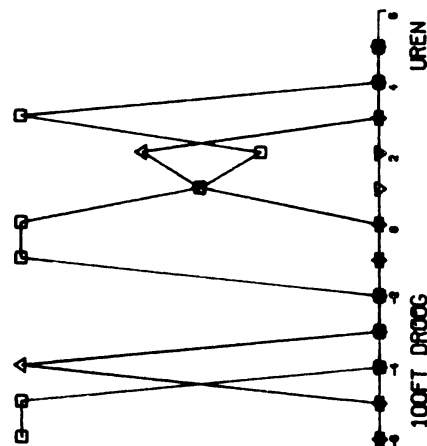
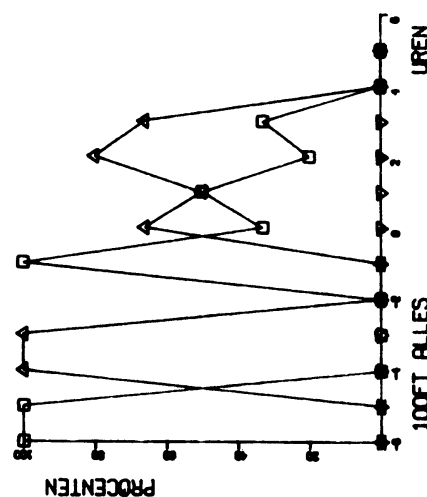
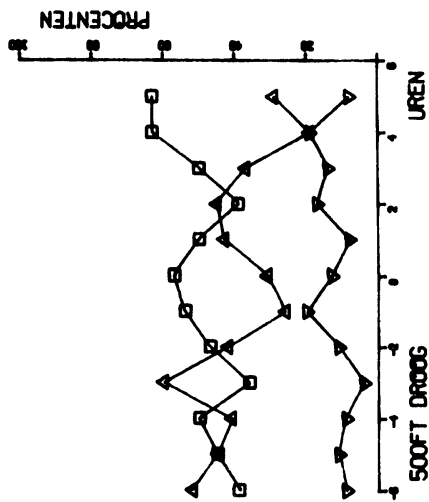
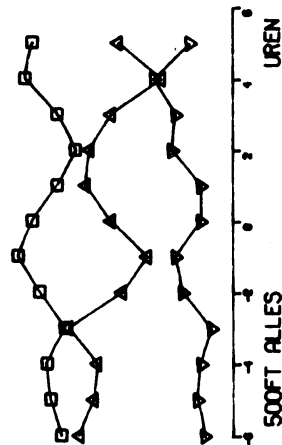
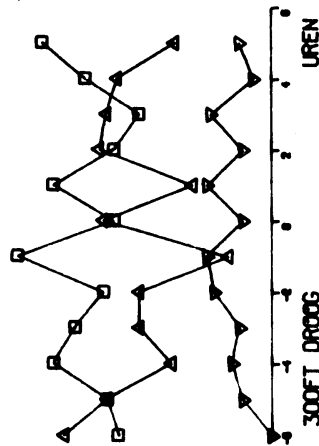
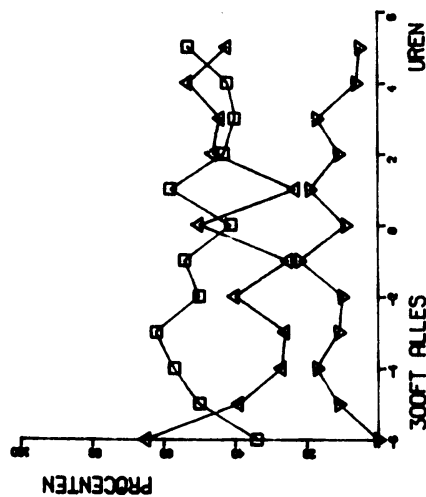
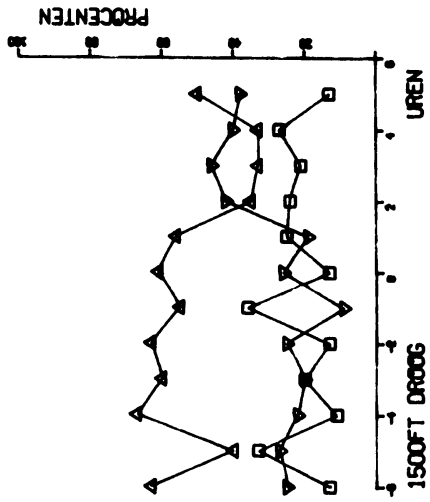
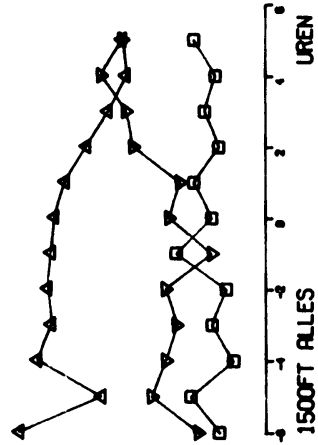
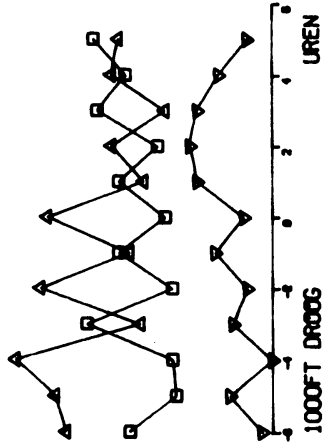
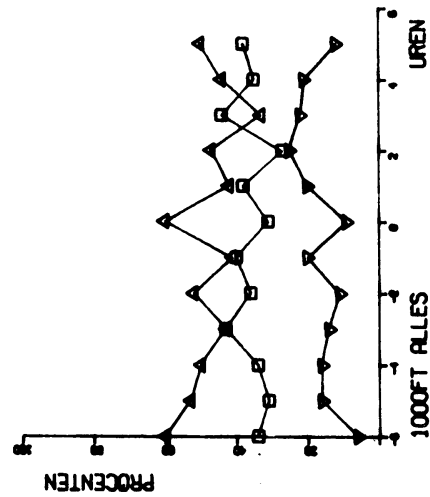
+1 UUR

BEEK

27 mrt t/m 25 sep

27 mrt t/m 11 apr: 18 gnt
 12 apr t/m 17 mei: 19 gnt
 18 mei t/m 2 aug: 20 gnt
 3 aug t/m 31 aug: 19 gnt
 1 sep t/m 25 sep: 18 gnt

ZOMER ZONONDER



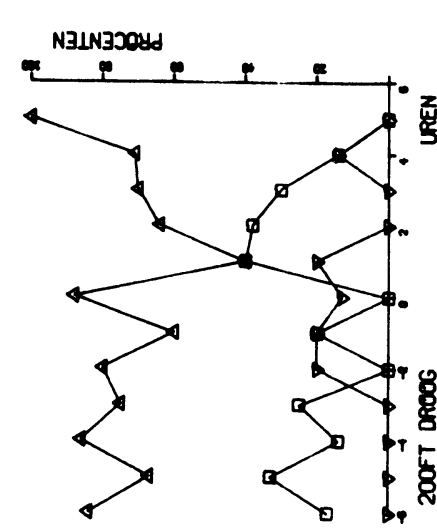
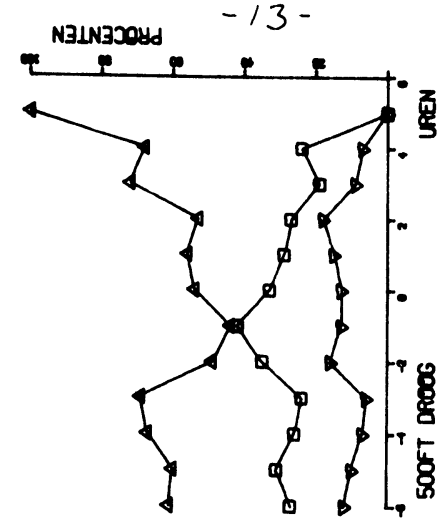
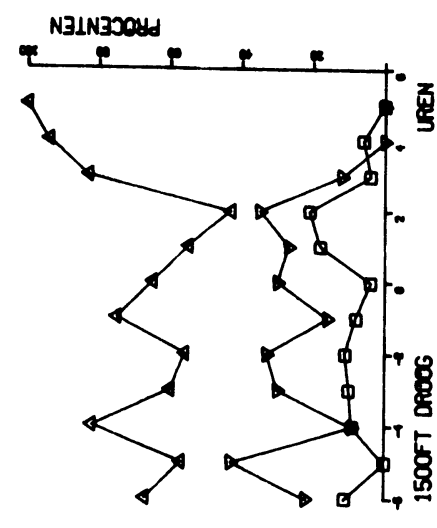
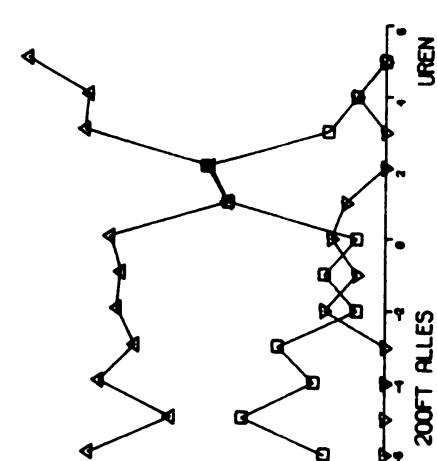
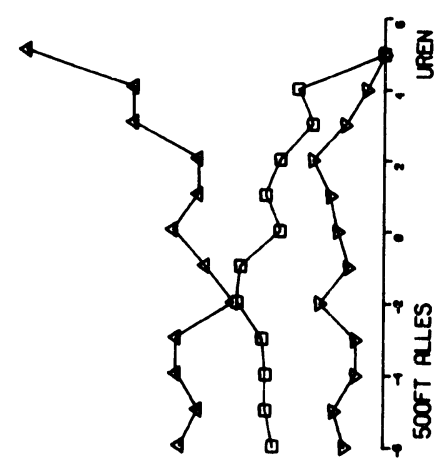
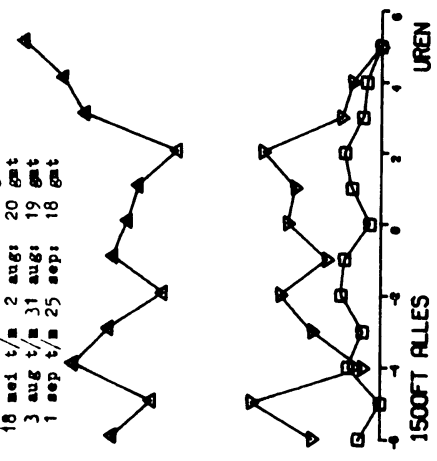
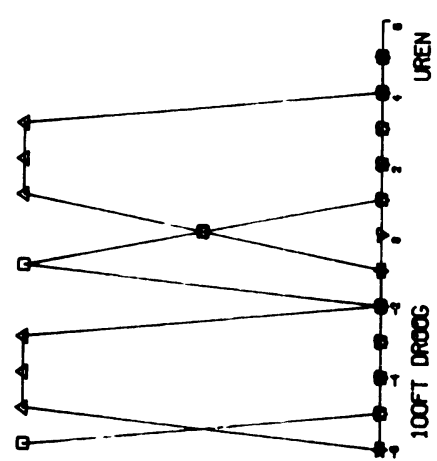
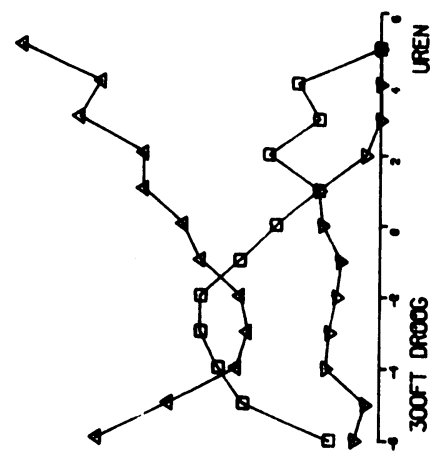
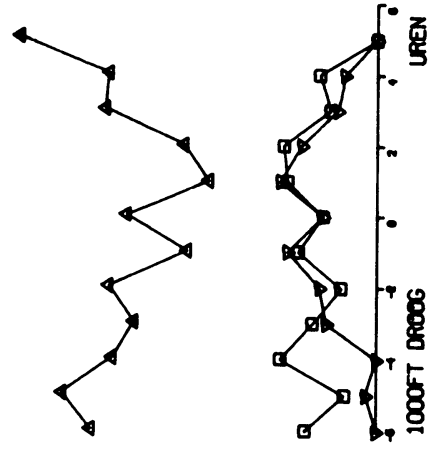
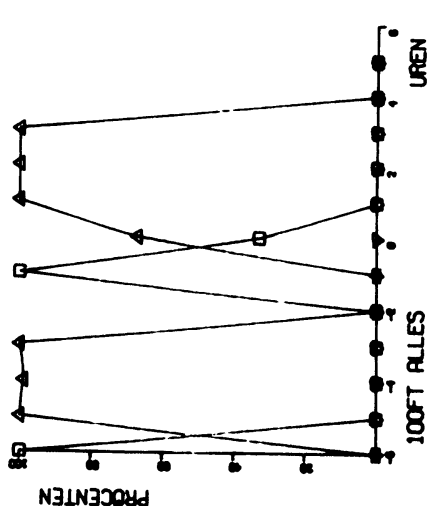
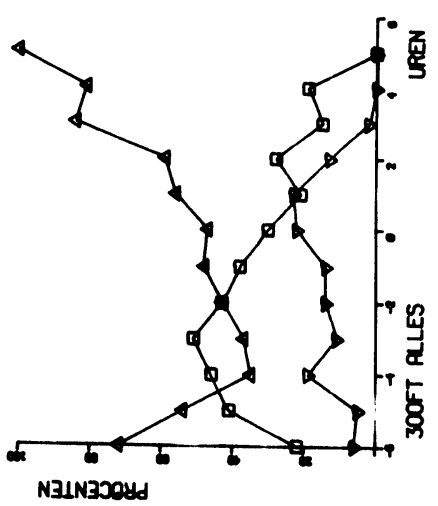
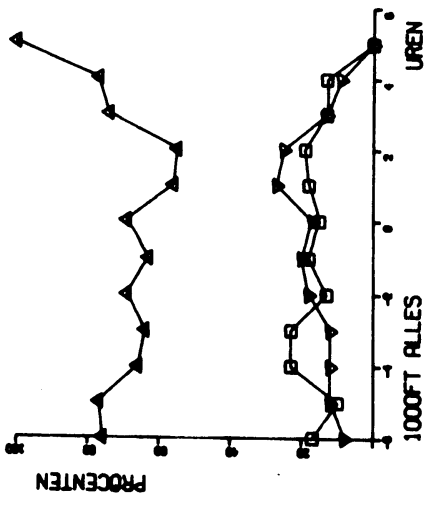
+2 UUR

BEEK

27 mrt t/m 25 sep

27 mrt t/m 11 apr: 18 gmt
 12 apr t/m 17 mei: 19 gmt
 18 mei t/m 2 aug: 20 gmt
 3 aug t/m 31 aug: 19 gmt
 1 sep t/m 25 sep: 18 gmt

ZOMER ZONONDER



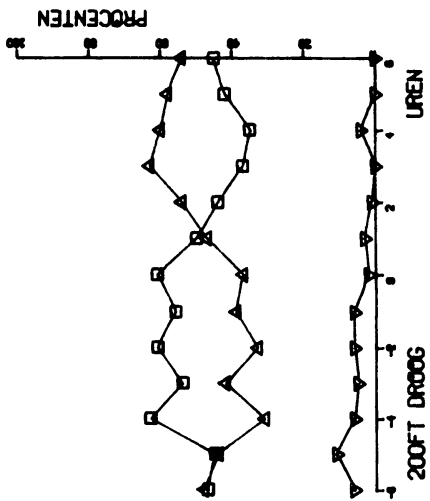
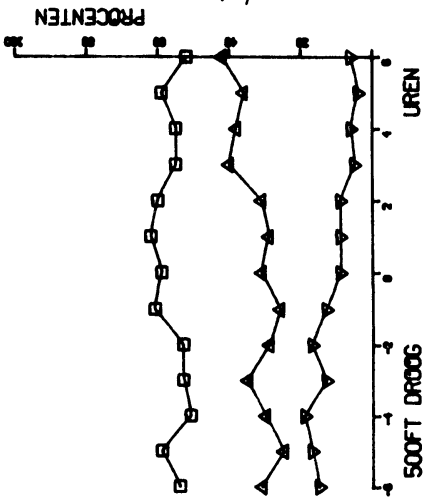
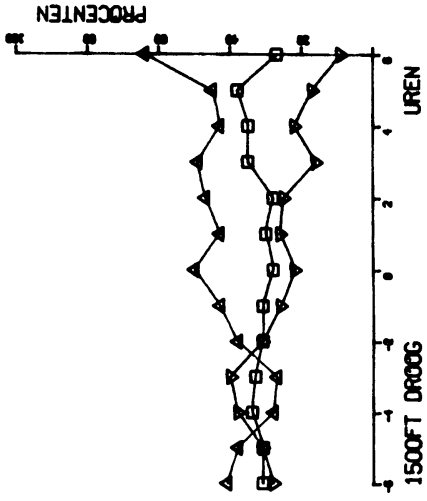
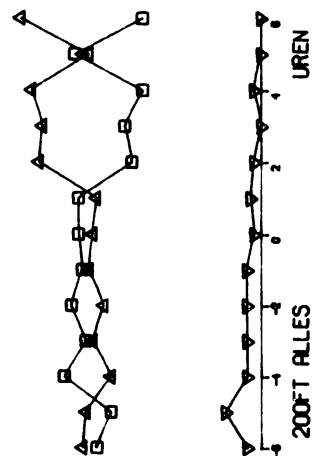
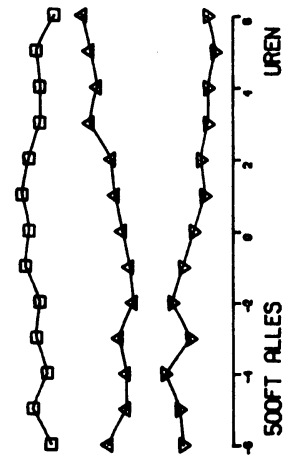
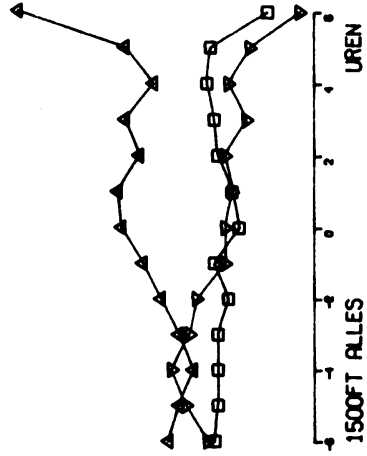
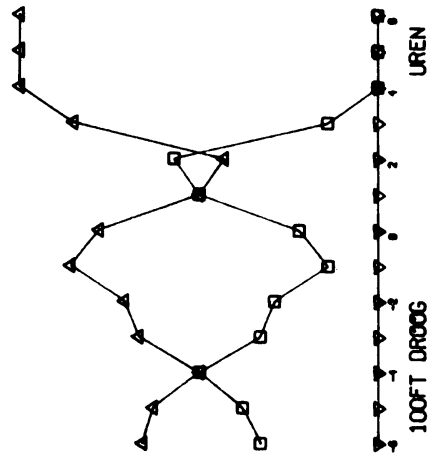
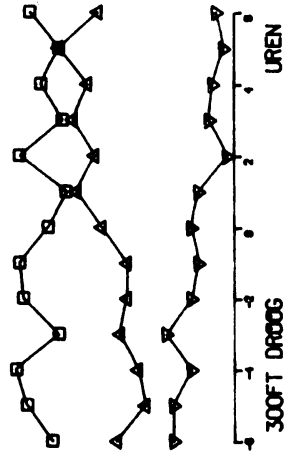
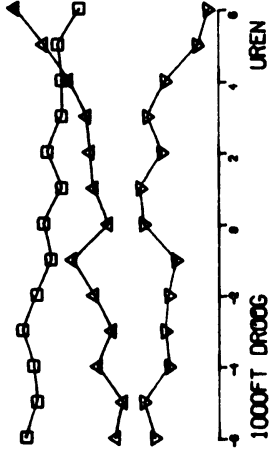
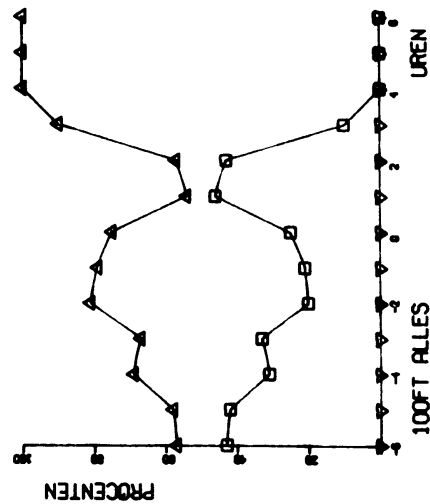
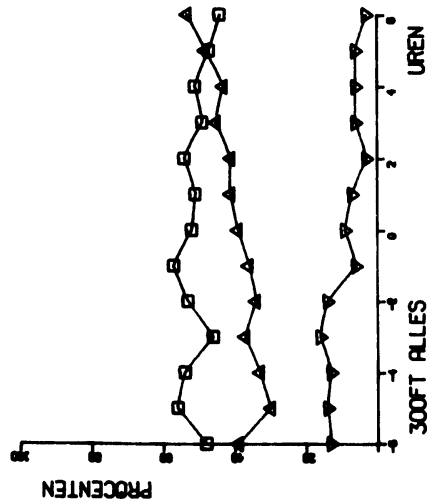
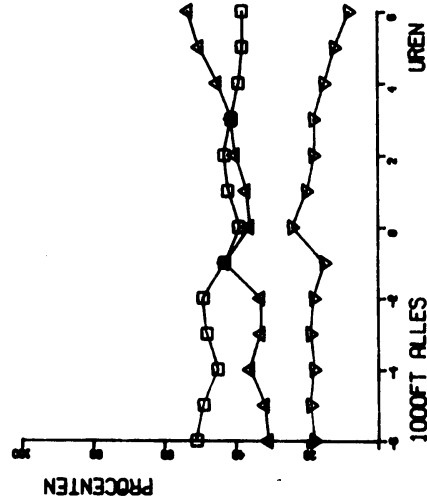
+1 UUR

BEEK

26 sep t/m 26 mrt

26 sep t/m 30 okt: 6 gmt
31 okt t/m 4 dec: 7 gmt
5 dec t/m 25 jan: 8 gmt
26 jan t/m 27 febr: 7 gmt
28 feb t/m 26 mrt: 6 gmt

WINTER ZONOP



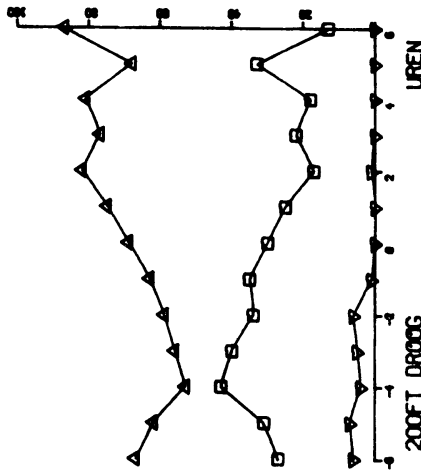
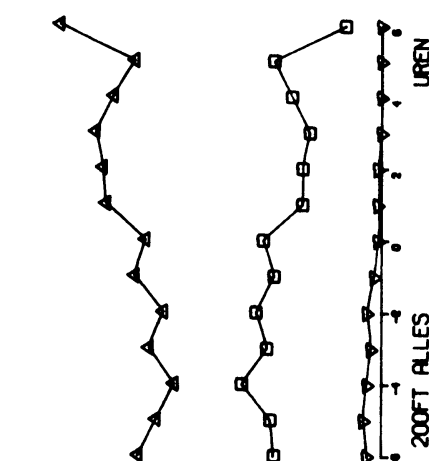
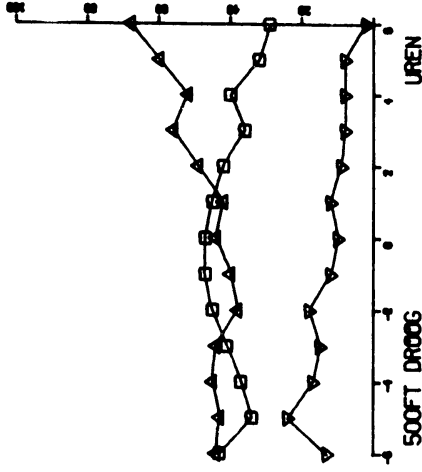
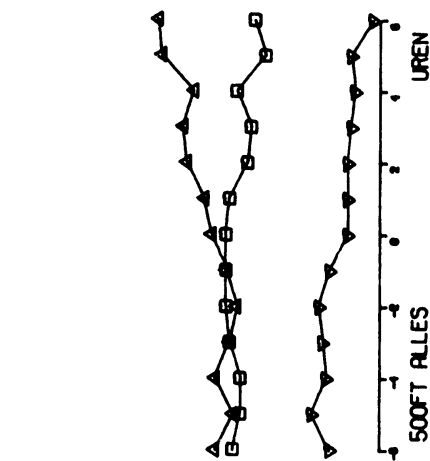
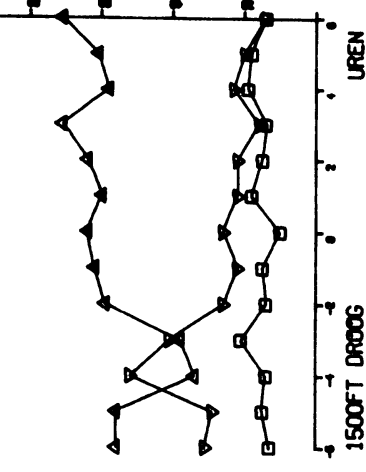
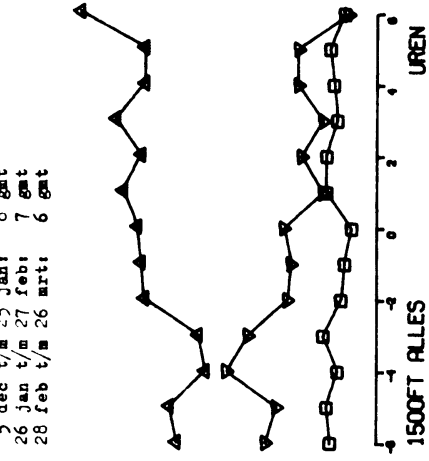
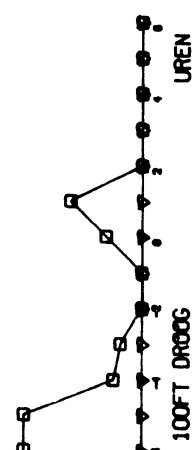
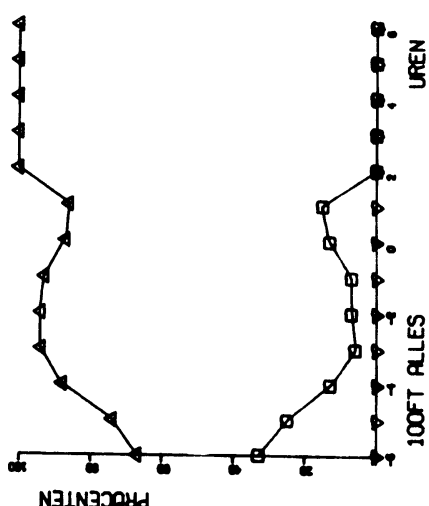
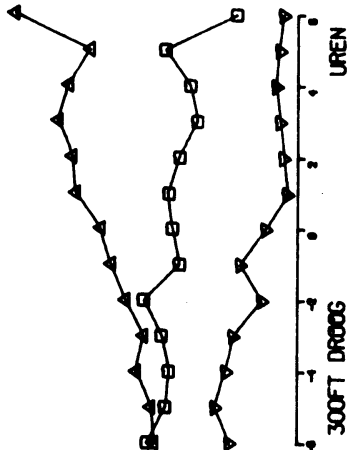
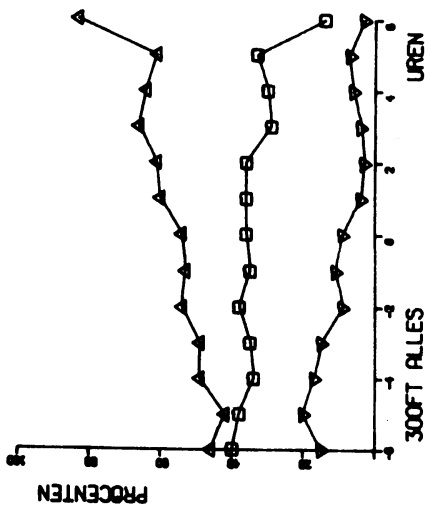
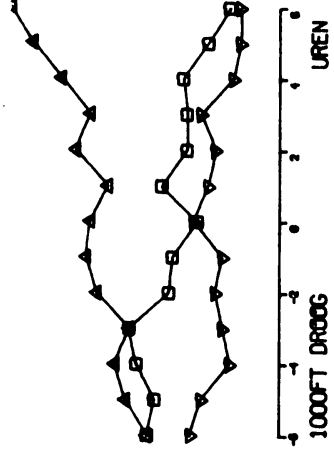
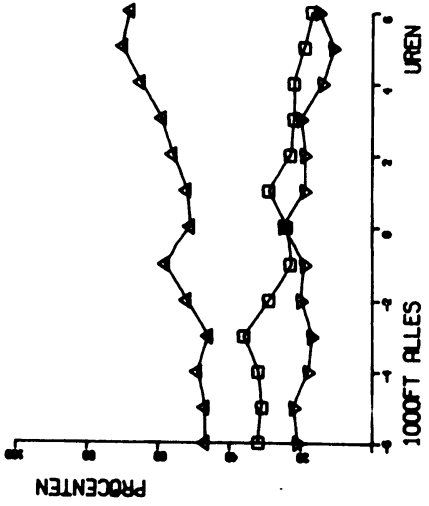
+2 UUR

BEEK

26 sep t/m 26 mrt

26 sep t/m 30 okt: 6 gmt
 31 okt t/m 4 dec: 7 gmt
 5 dec t/m 25 jan: 8 gmt
 26 jan t/m 27 feb: 7 gmt
 28 feb t/m 26 mrt: 6 gmt

WINTER ZONOP



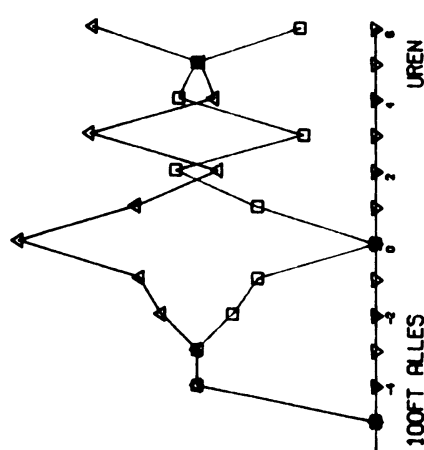
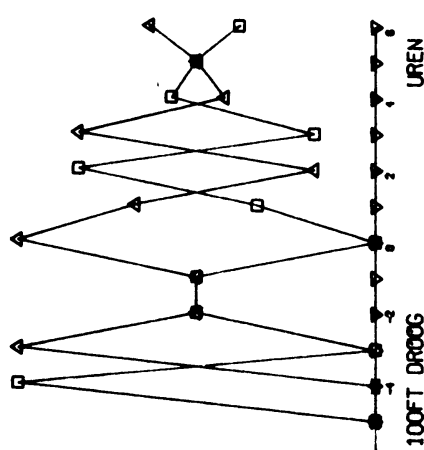
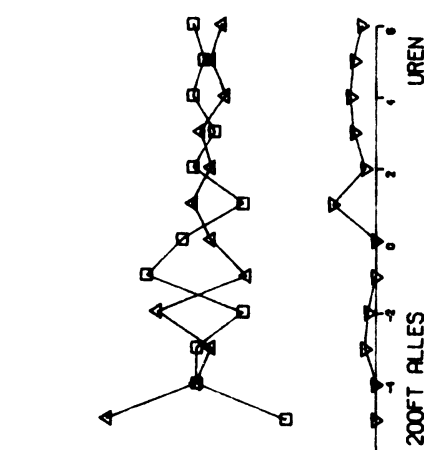
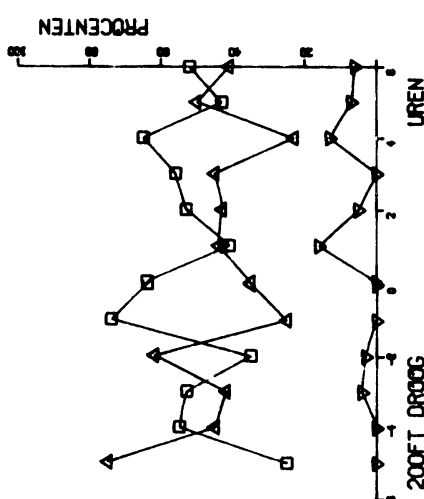
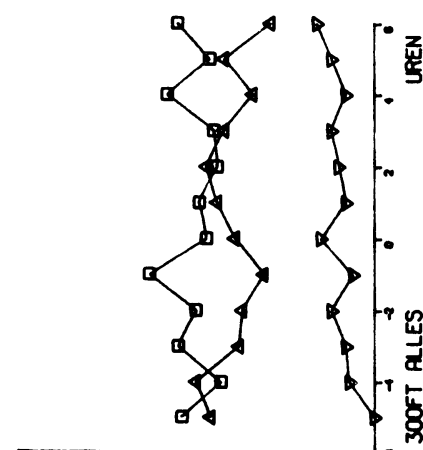
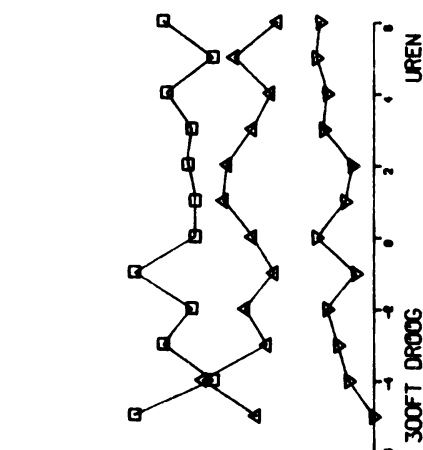
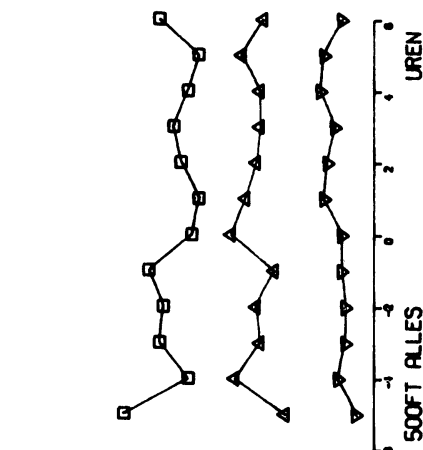
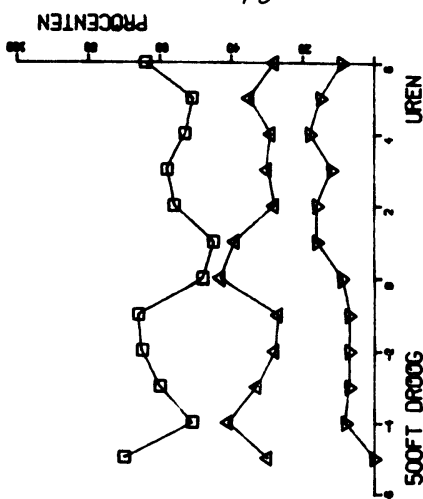
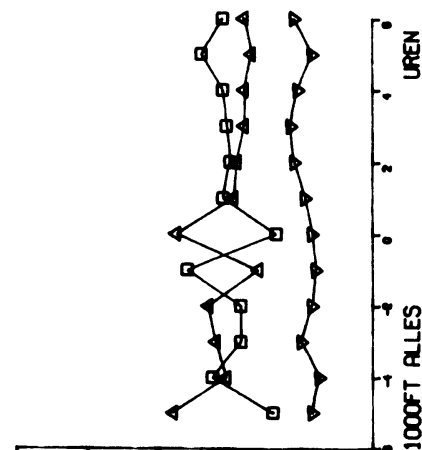
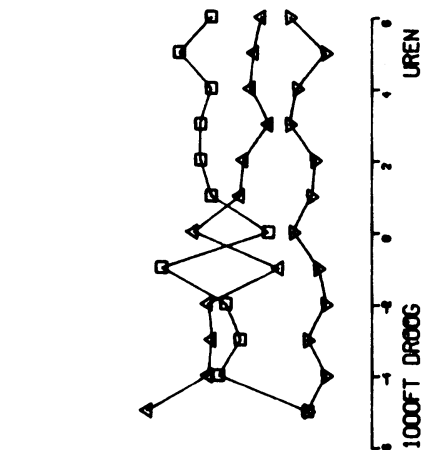
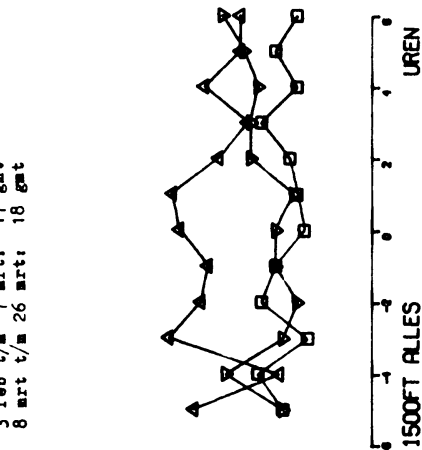
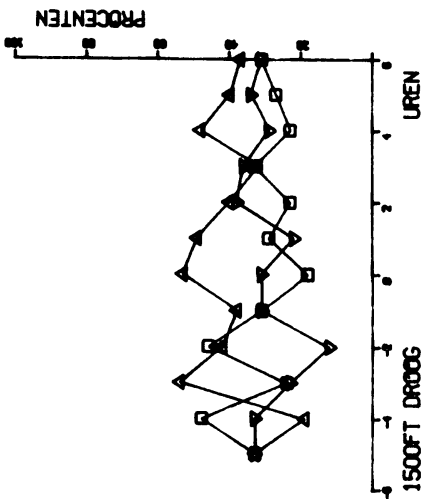
WINTER ZONONDER

26 sep t/m 23 okt: 17 gmt
 24 okt t/m 2 febr: 16 gmt
 3 febr t/m 7 mrt: 17 gmt
 8 mrt t/m 26 mrt: 18 gmt

26 sep t/m 26 mrt

BEEK

+1 UUR



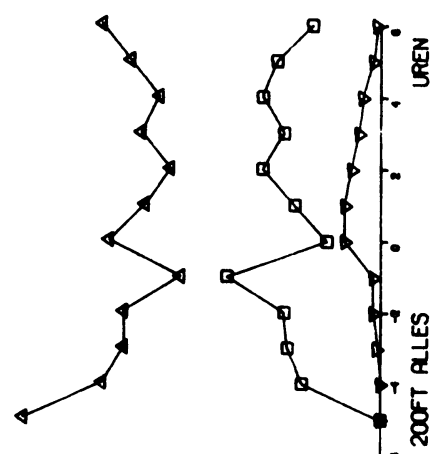
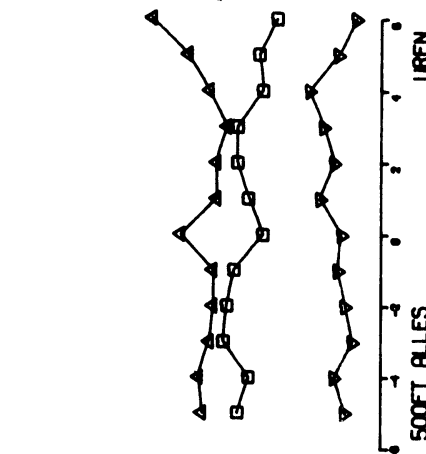
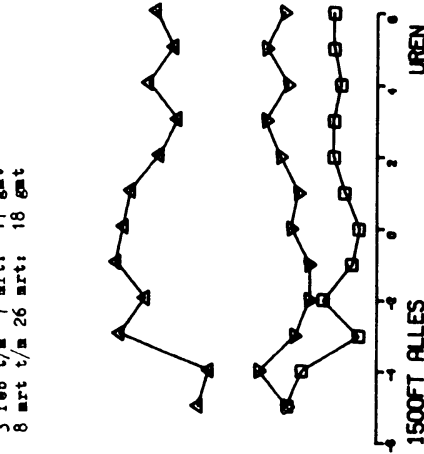
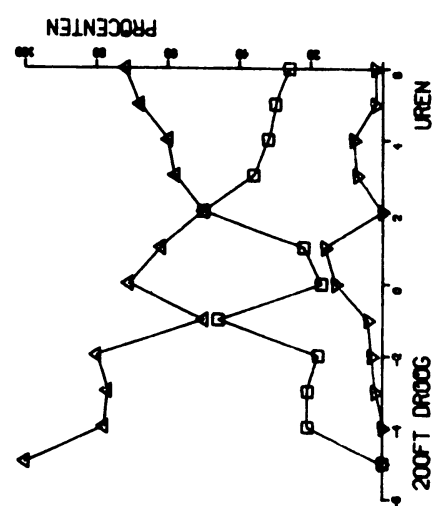
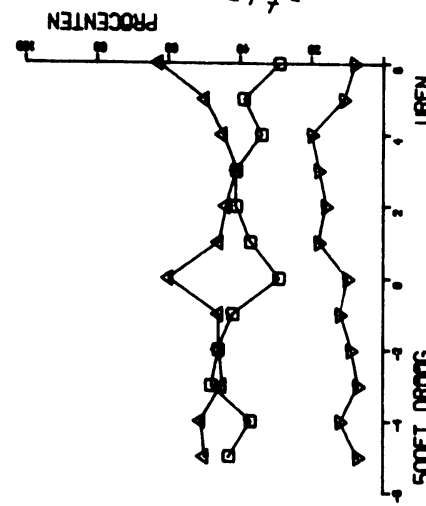
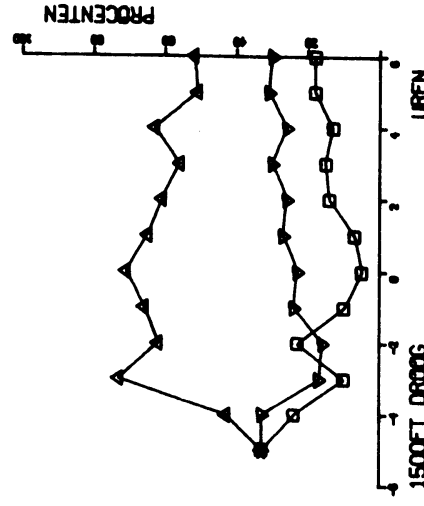
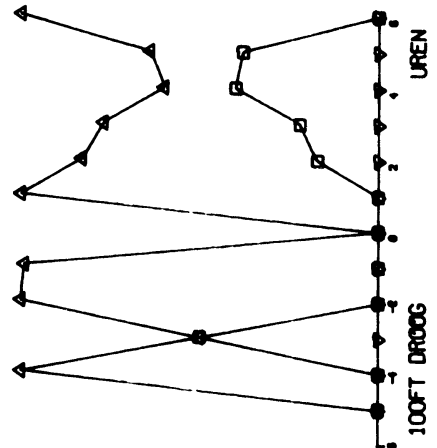
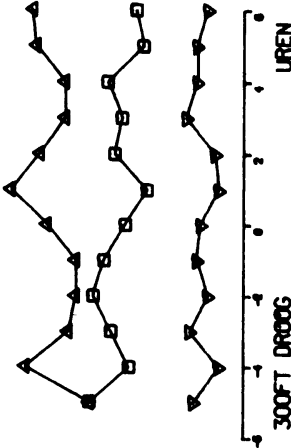
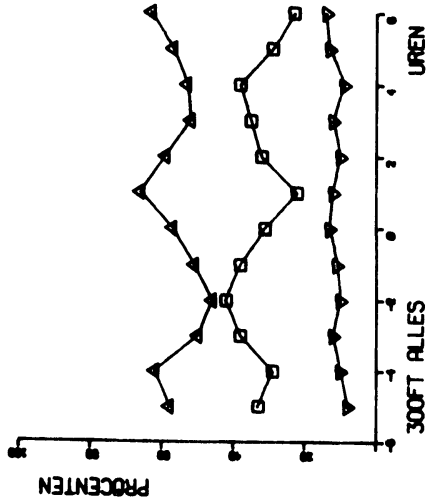
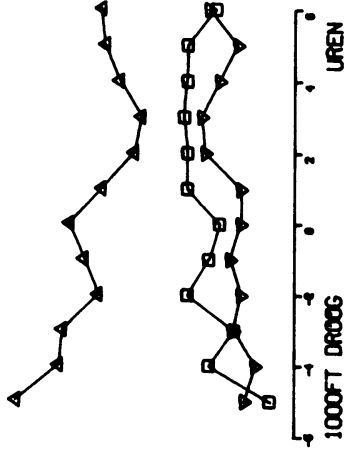
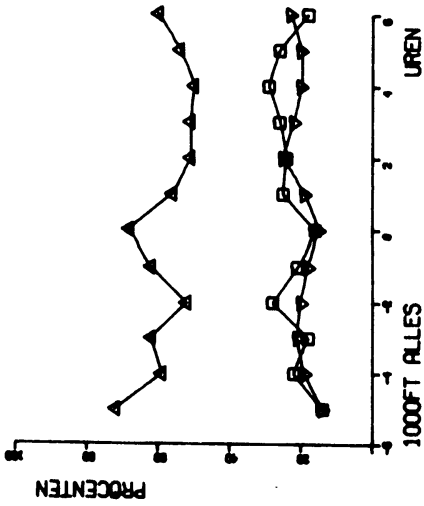
+2 UUR

BEEK

26 sep t/m 26 mrt

26 sep t/m 23 okt: 17 gnt
24 okt t/m 2 febr: 16 gnt
3 febr t/m 7 mrt: 17 gnt
8 mrt t/m 26 mrt: 18 gnt

WINTER ZONONDER



-7-

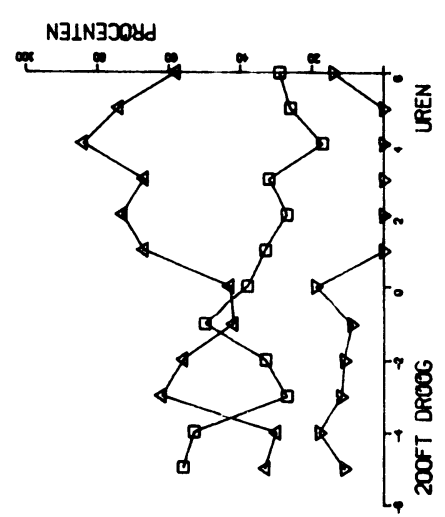
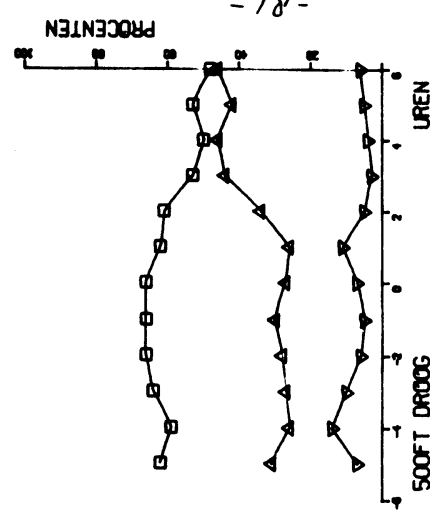
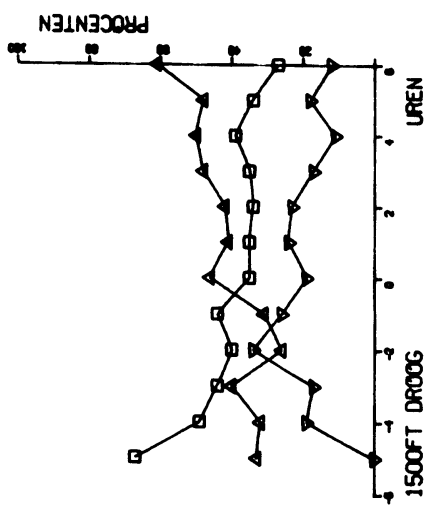
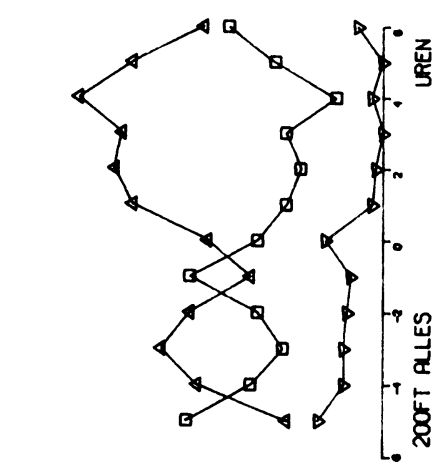
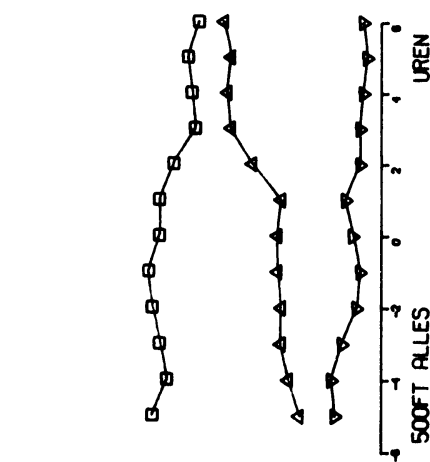
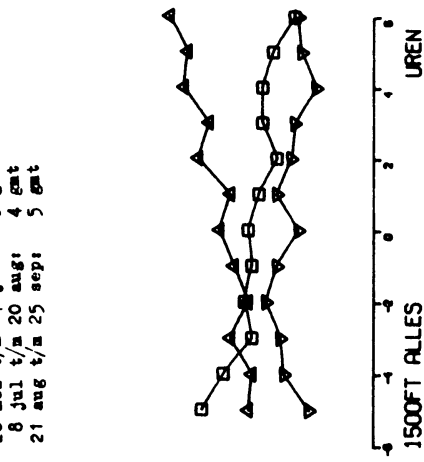
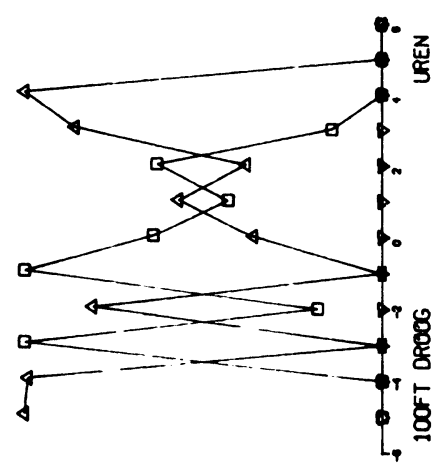
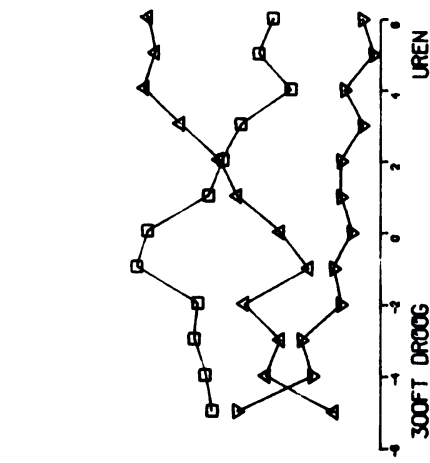
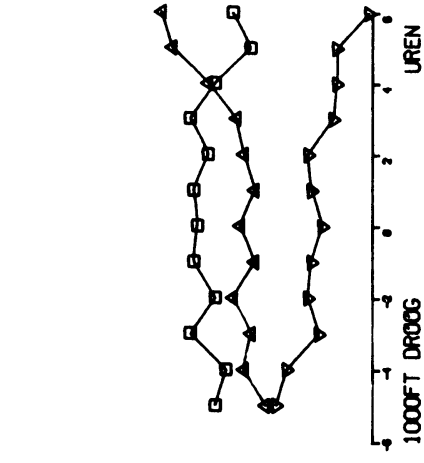
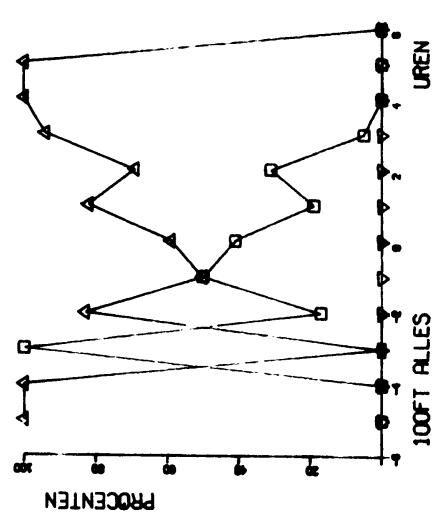
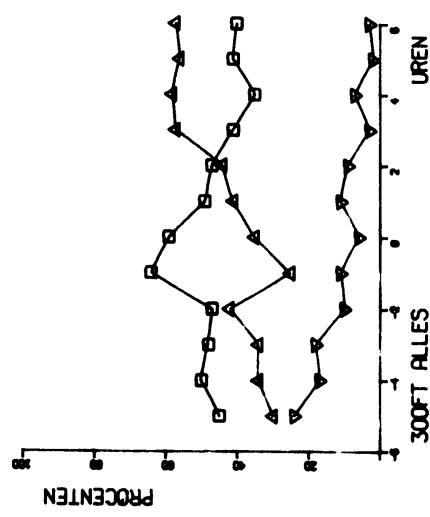
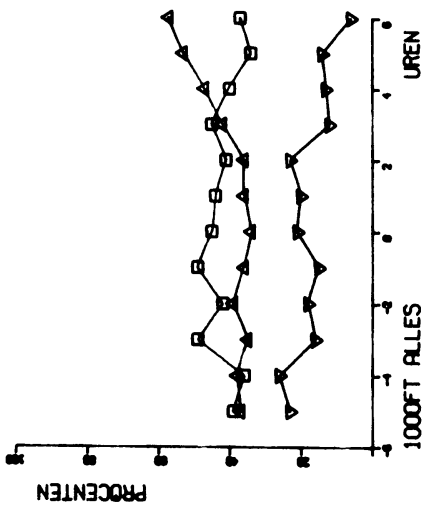
+1 UUR

EELDE

27 mrt t/m 25 sep

27 mrt t/m 21 apr: 5 gnt
 22 apr t/m 27 mei: 4 gnt
 28 mei t/m 7 juli: 3 gnt
 8 jul t/m 20 aug: 4 gnt
 21 aug t/m 25 sept: 5 gnt

ZOMER ZONOP



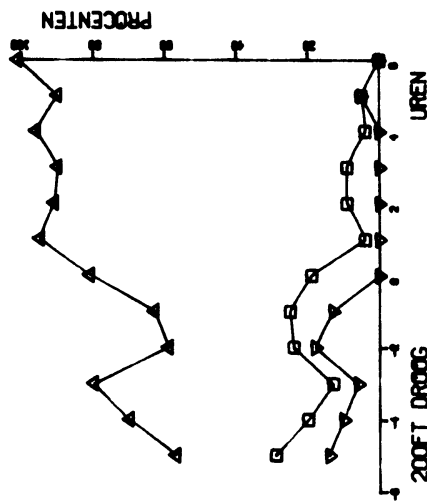
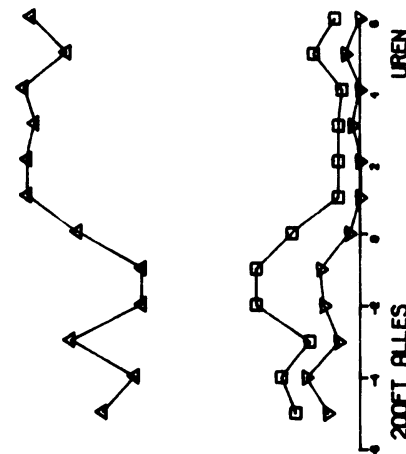
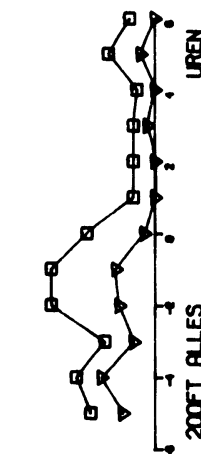
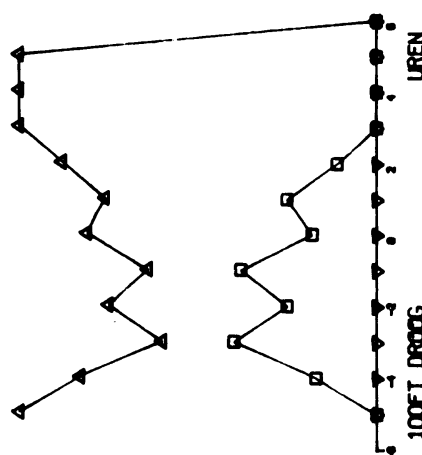
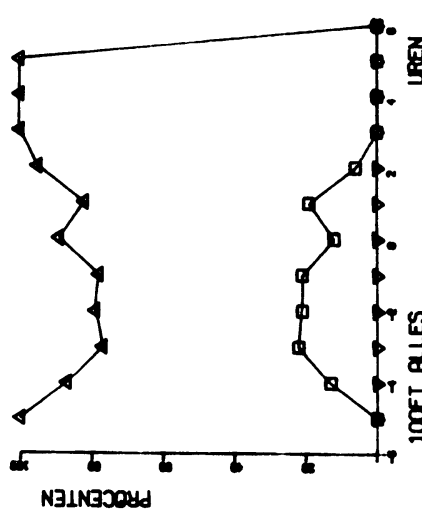
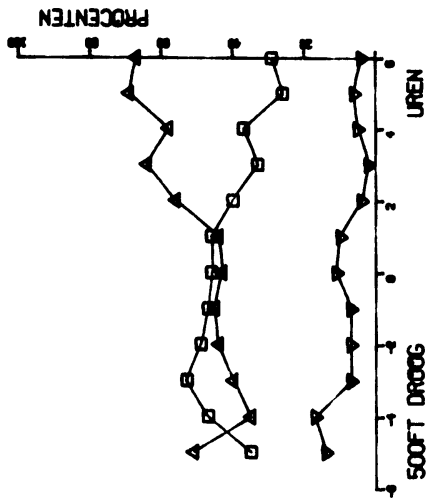
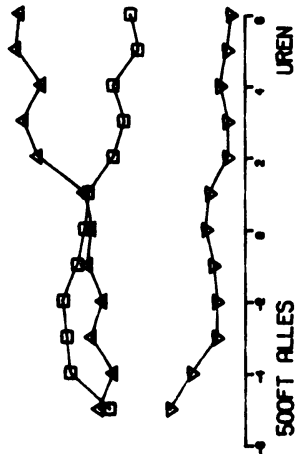
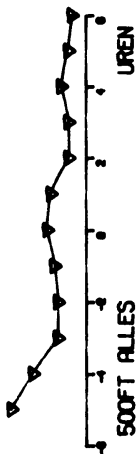
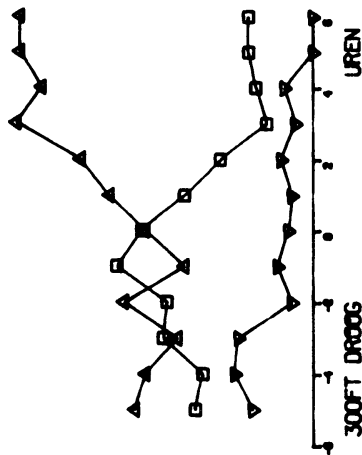
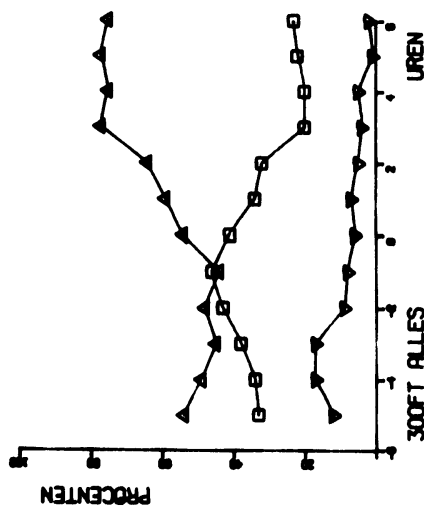
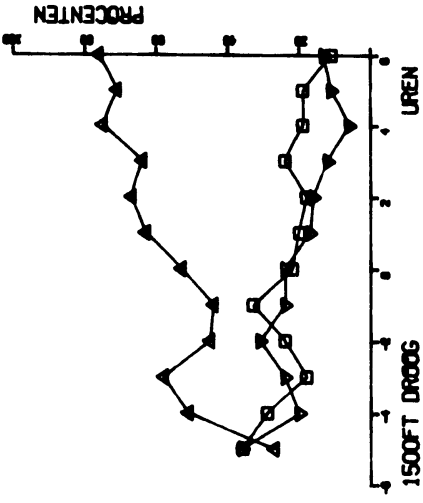
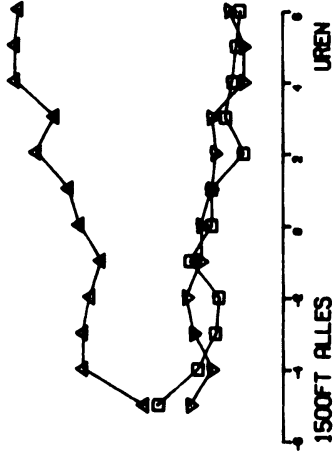
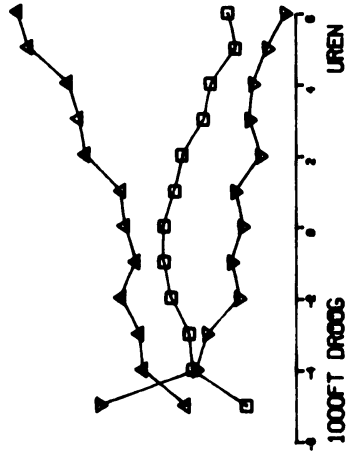
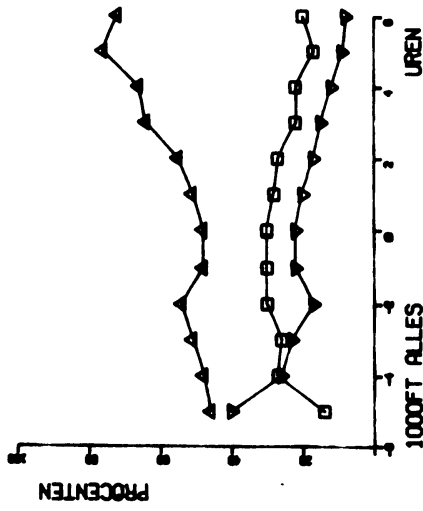
+2 UUR

EELDE

27 mrt t/m 25 sep

27 mrt t/m 21 apr: 5 gnt
 22 apr t/m 27 mei: 4 gnt
 28 mei t/m 7 juli: 3 gnt
 8 juli t/m 20 aug: 4 gnt
 21 aug t/m 25 sep: 5 gnt

ZOMER ZONOP



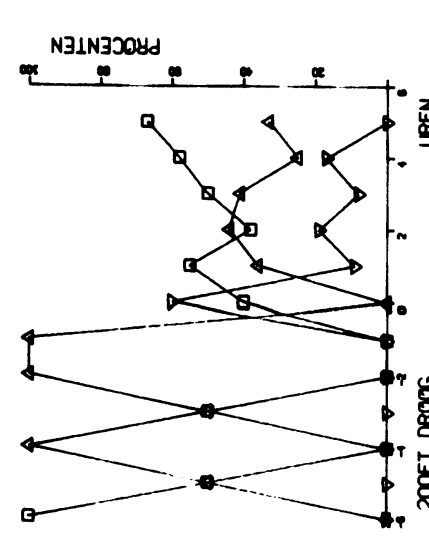
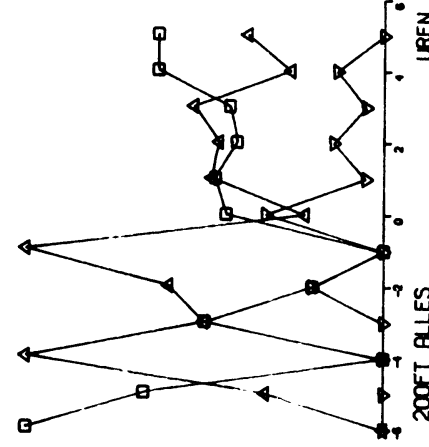
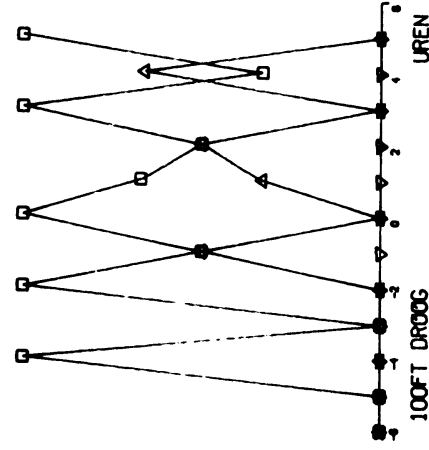
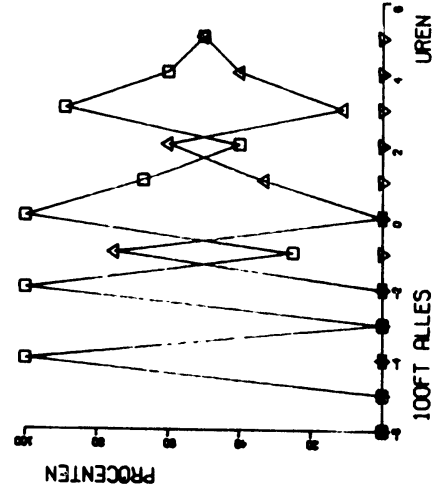
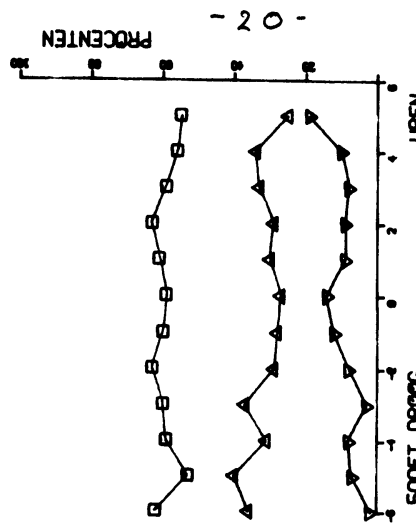
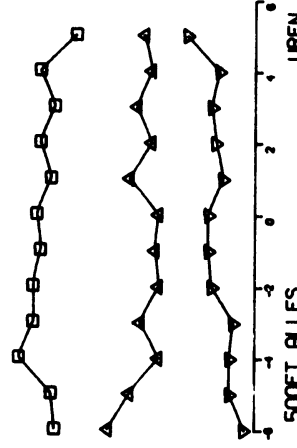
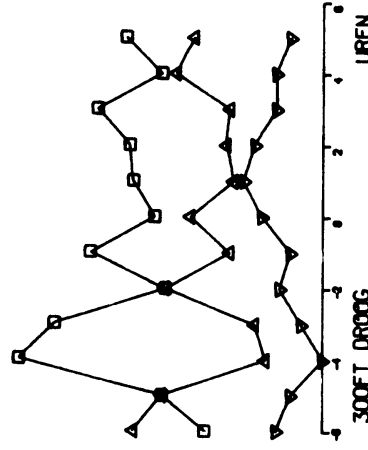
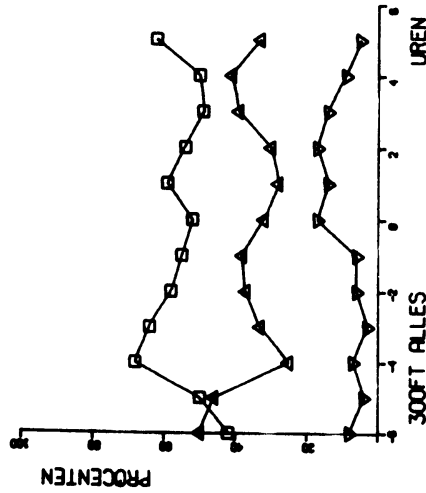
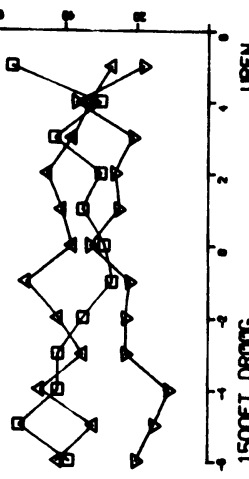
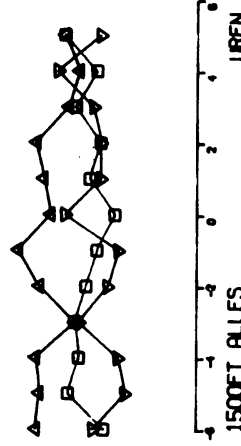
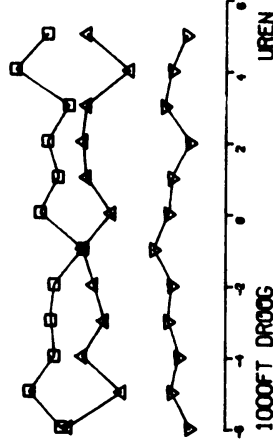
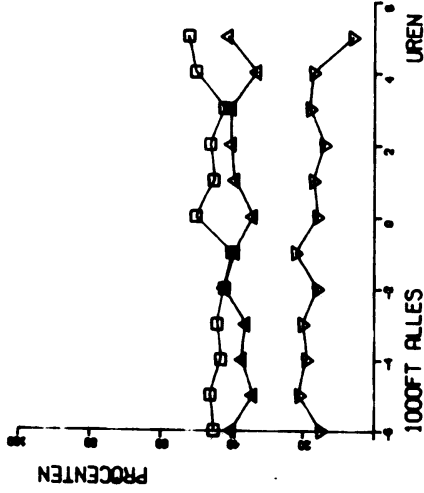
+1 UUR

EELDE

27 mrt t/m 25 sep

27 mrt t/m 11 apr: 18 gmt
 12 apr t/m 17 mei: 19 gmt
 18 mei t/m 2 aug: 20 gmt
 3 aug t/m 31 aug: 19 gmt
 1 sep t/m 25 sep: 18 gmt

ZOMER ZONONDER



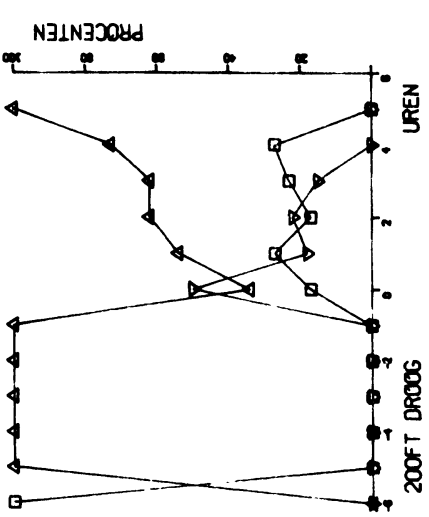
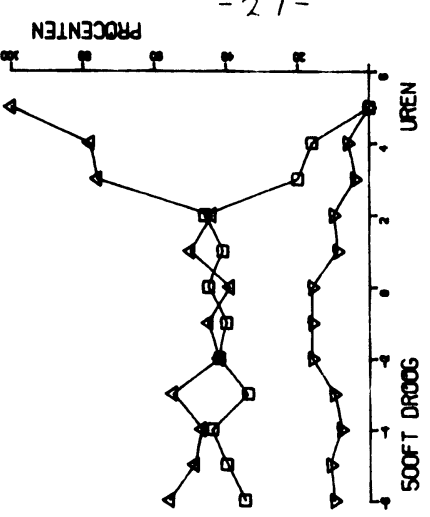
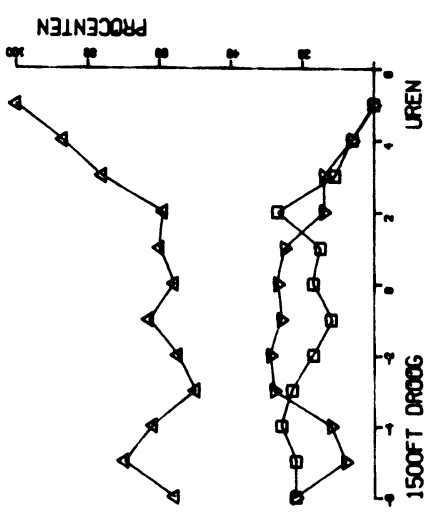
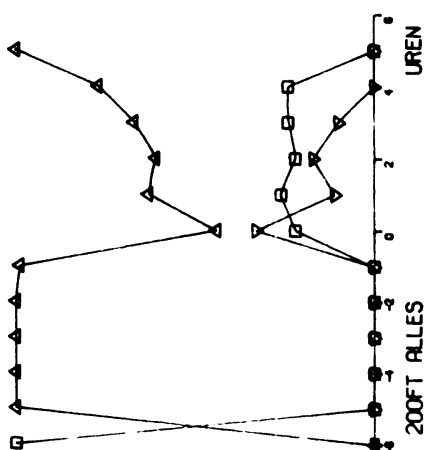
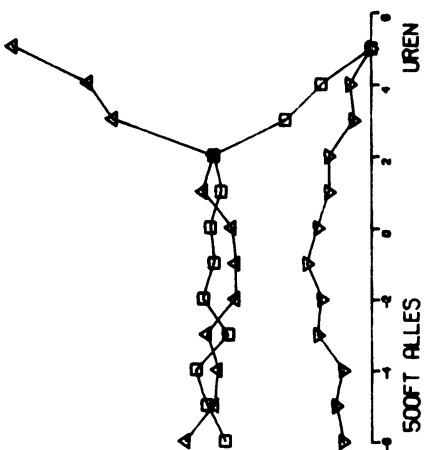
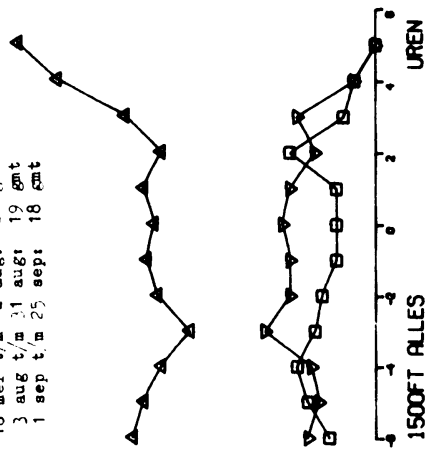
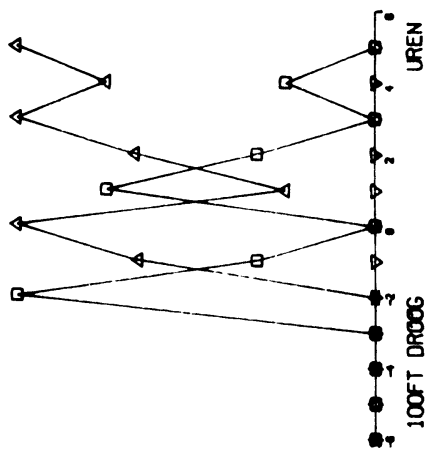
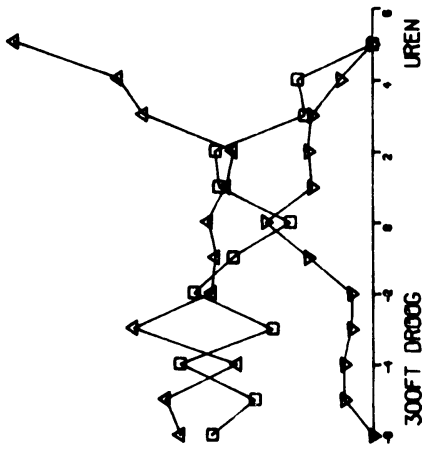
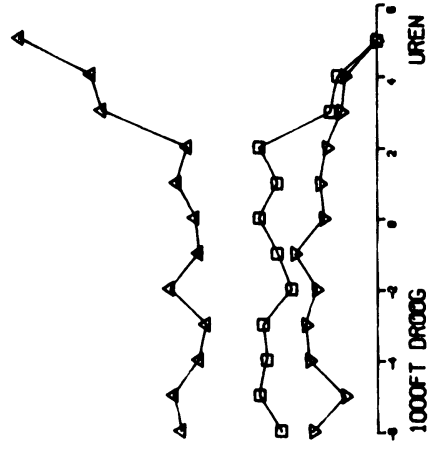
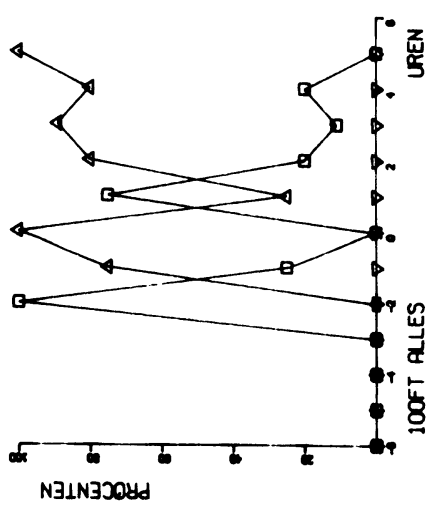
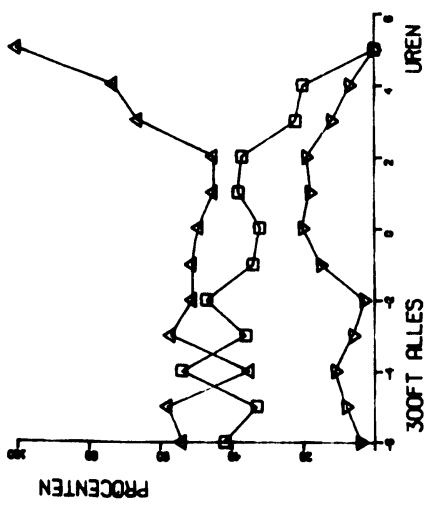
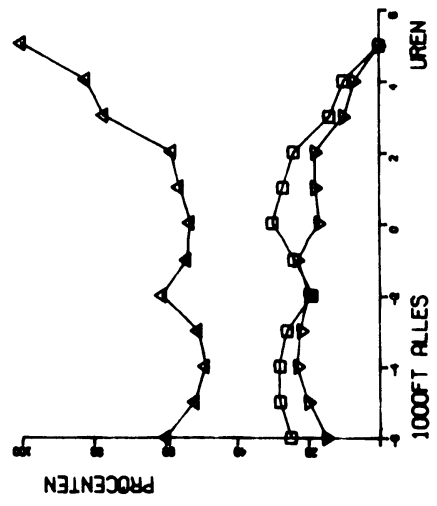
+2 UUR

EELDE

27 mrt t/m 25 sep

27 mrt t/m 11 apr: 18 gmt
 12 apr t/m 17 mei: 19 gmt
 18 mei t/m 2 aug: 20 gmt
 3 aug t/m 31 aug: 19 gmt
 1 sep t/m 25 sep: 18 gmt

ZOMER ZONONDER



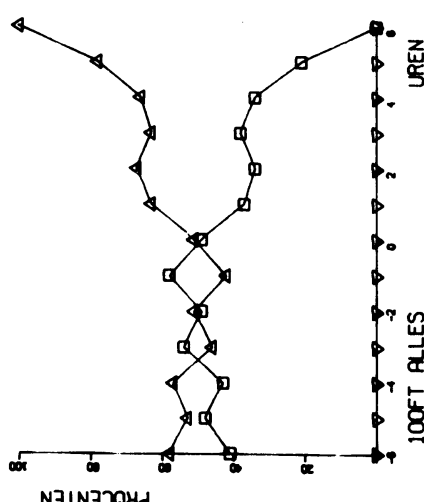
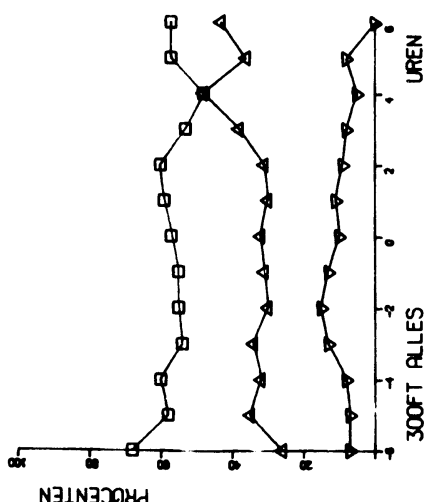
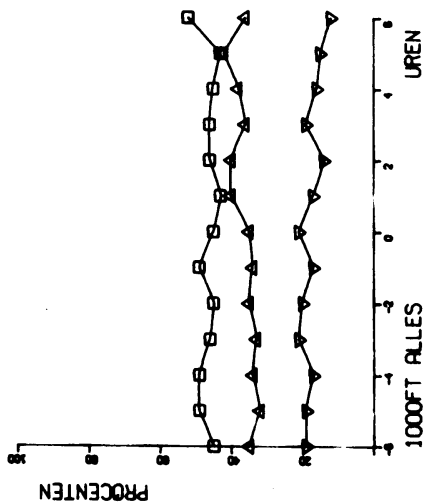
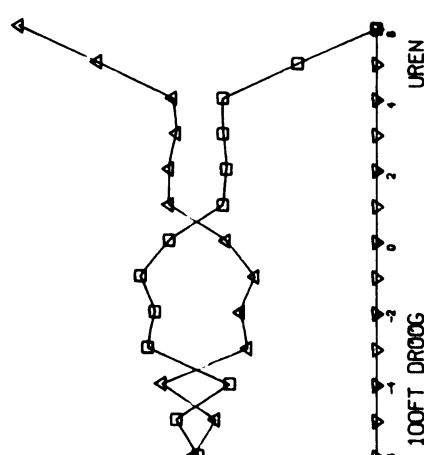
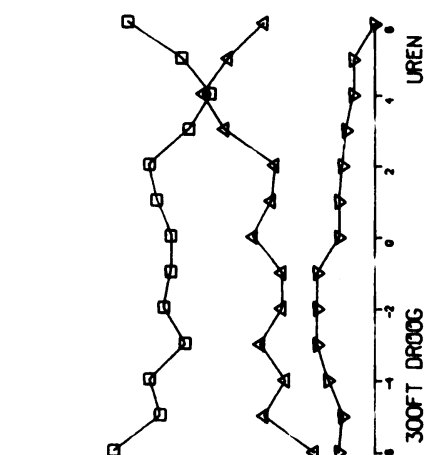
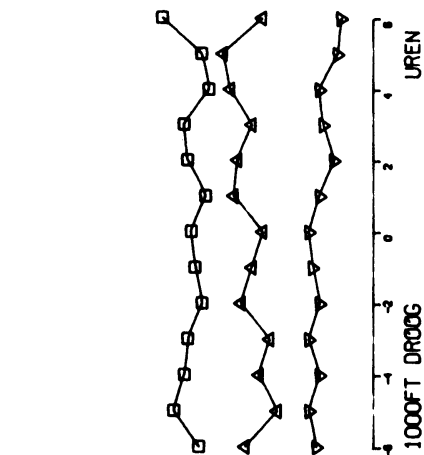
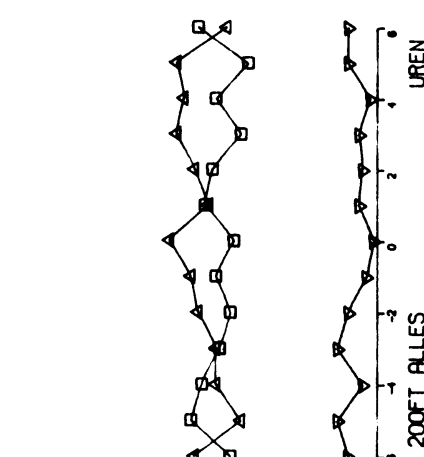
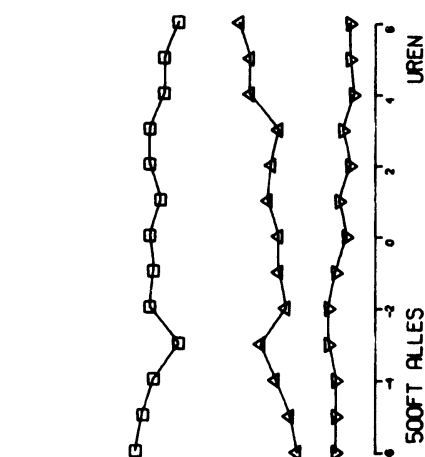
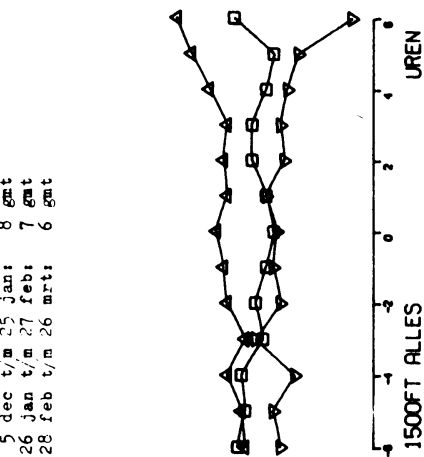
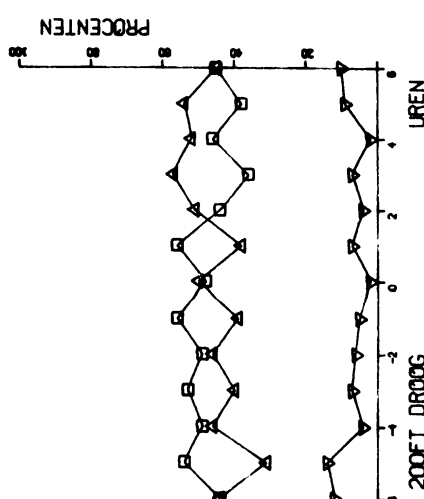
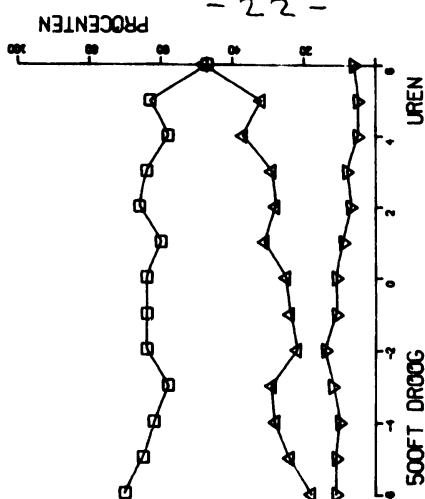
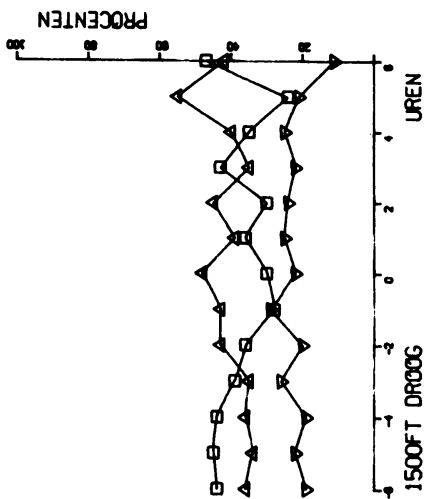
WINTER ZONOP

26 sep t/m 30 okt: 6 gmt
 31 okt t/m 4 dec: 7 gmt
 5 dec t/m 25 jan: 8 gmt
 26 jan t/m 27 febr: 7 gmt
 28 febr t/m 26 mrt: 6 gmt

26 sep t/m 26 mrt

EELDE

+1 UUR



- 22 -

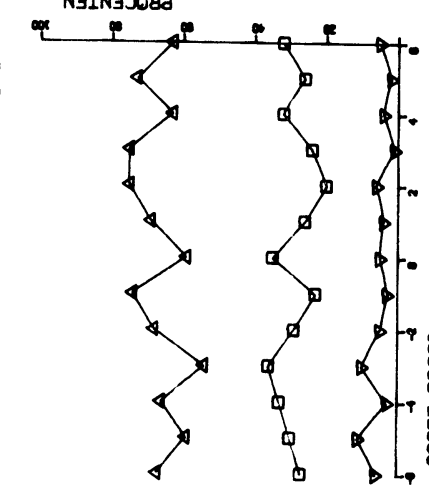
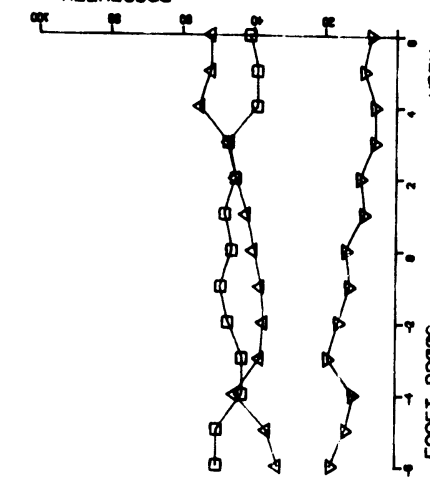
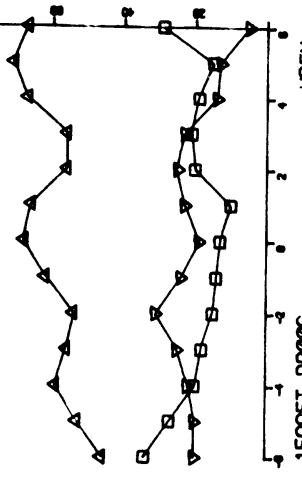
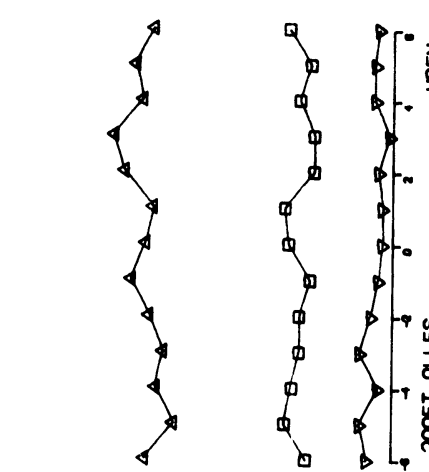
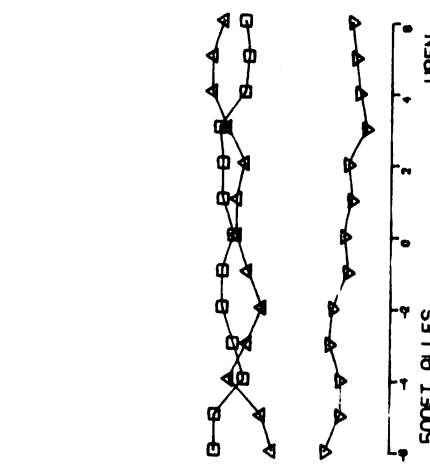
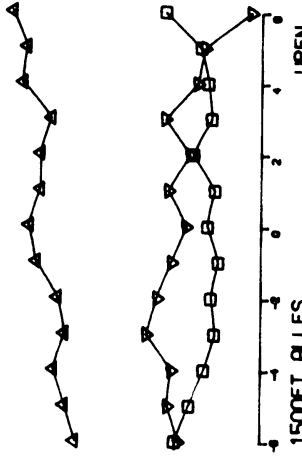
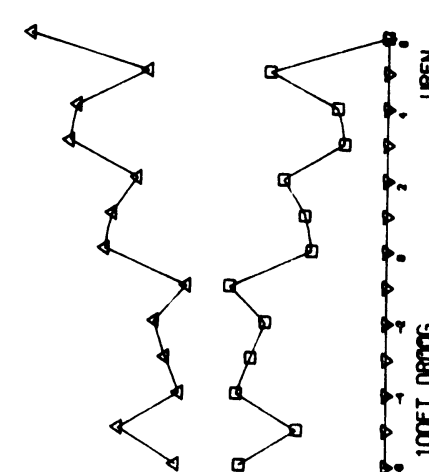
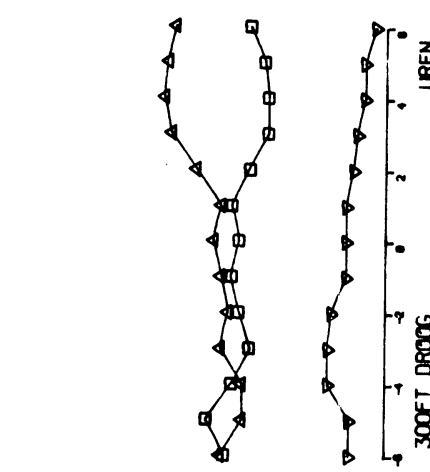
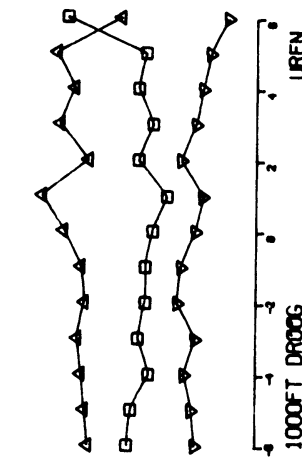
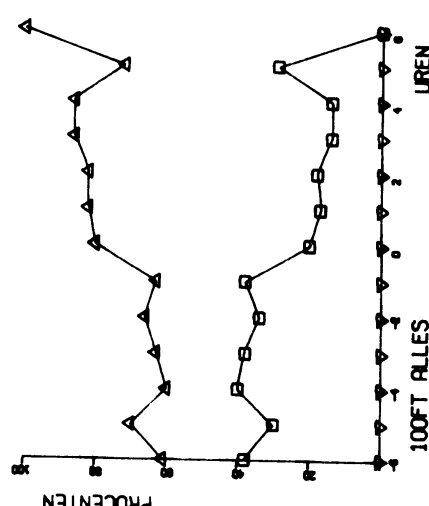
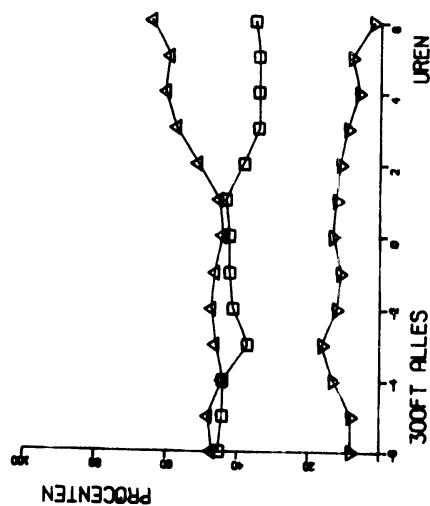
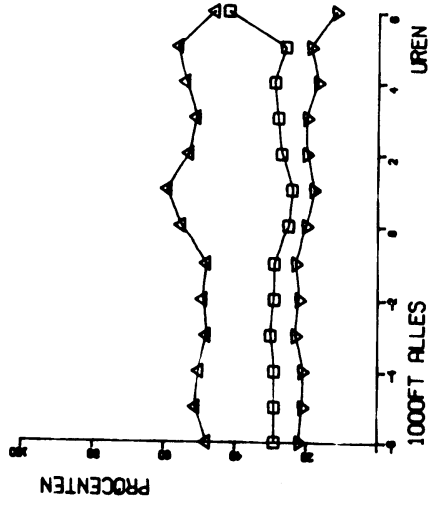
+2 UUR

EELDE

26 sep t/m 26 mrt

26 sep t/m 30 okt: 6 gmt
 31 okt t/m 4 dec: 7 gmt
 5 dec t/m 25 jan: 8 gmt
 26 jan t/m 27 febr: 7 gmt
 28 febr t/m 26 mrt: 6 gmt

WINTER ZONOP



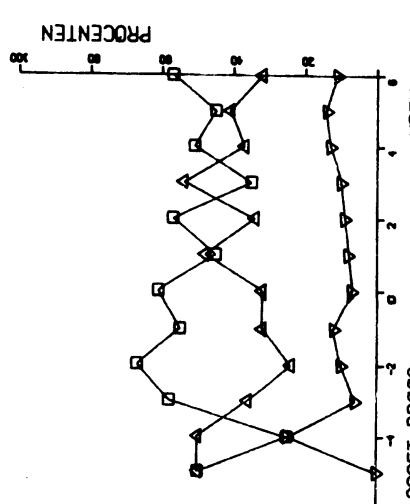
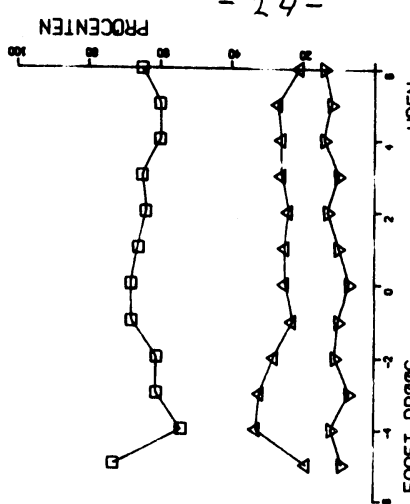
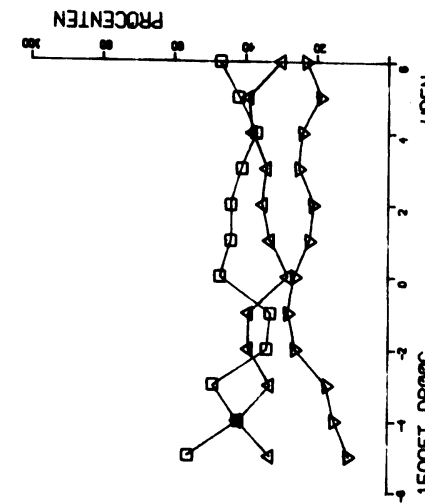
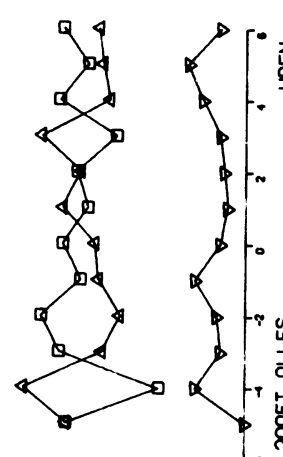
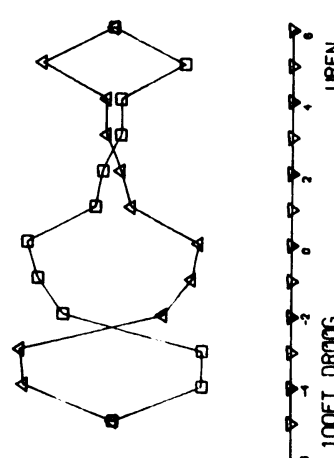
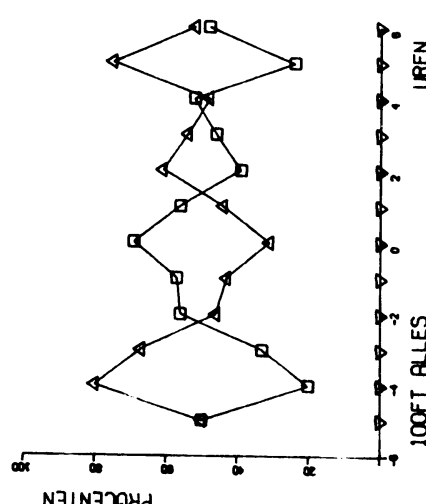
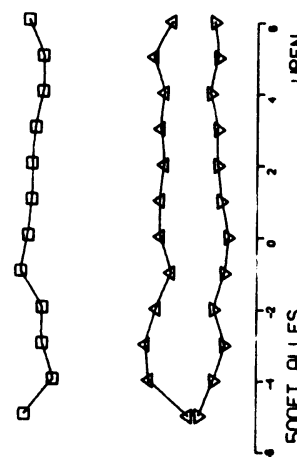
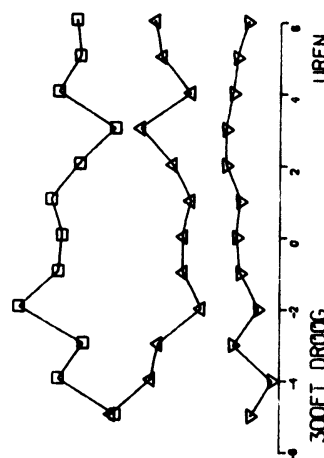
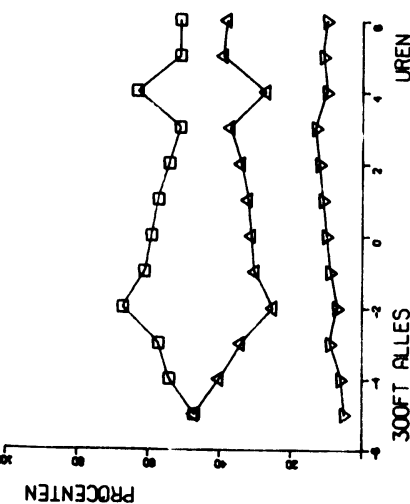
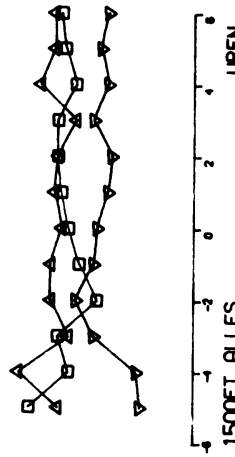
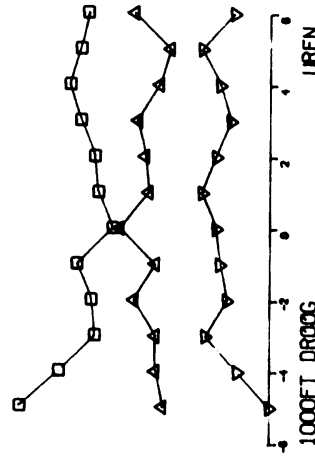
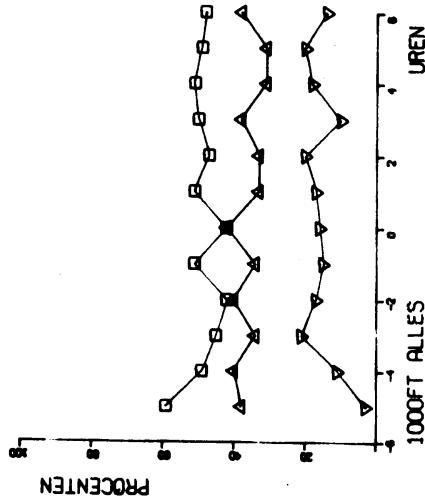
+1 UUR

EELDE

26 sep t/m 26 mrt

26 sep t/m 23 okt: 17 gmt
24 okt t/m 2 feb: 16 gmt
3 feb t/m 7 mrt: 17 gmt
8 mrt t/m 26 mrt: 18 gmt

WINTER ZONONDER



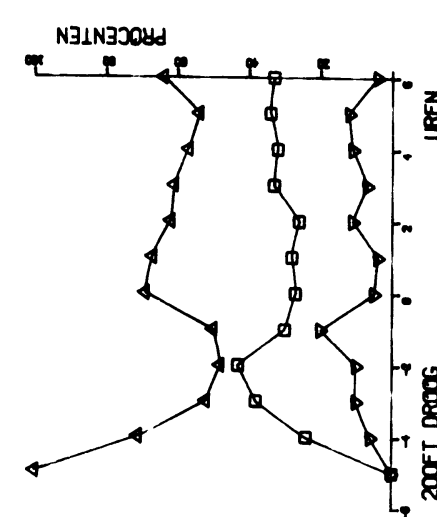
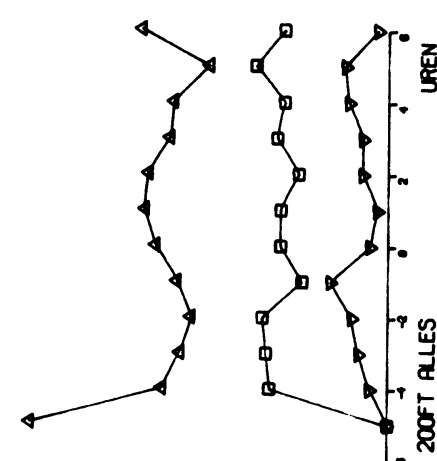
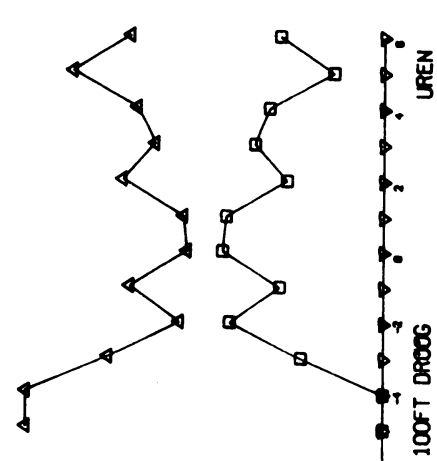
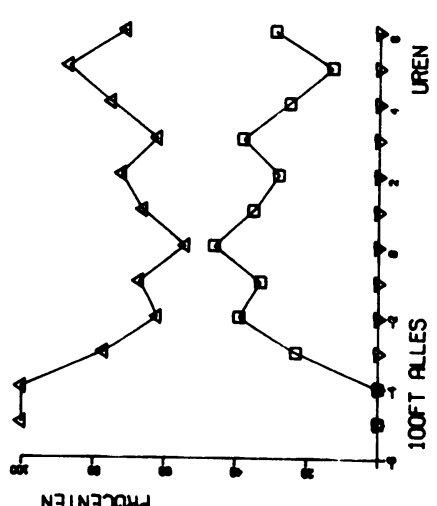
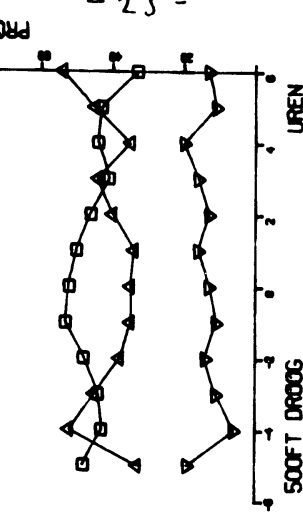
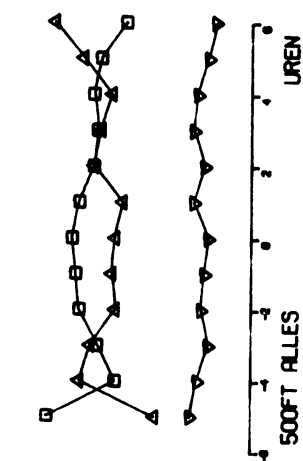
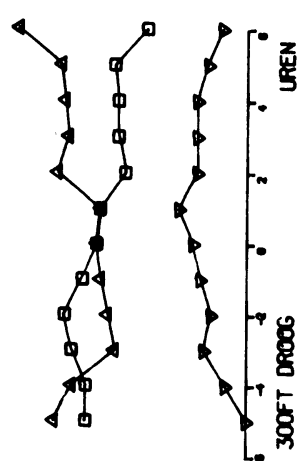
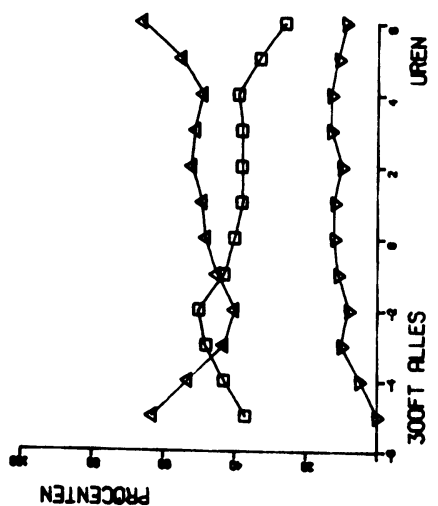
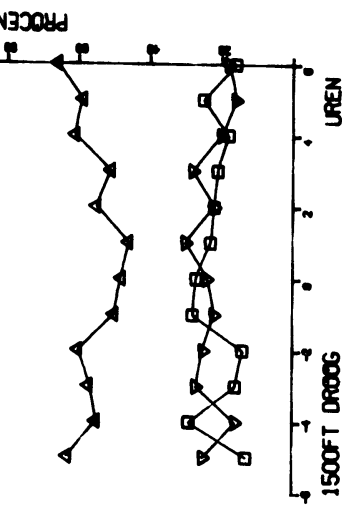
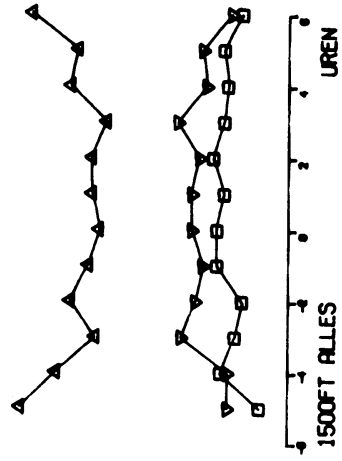
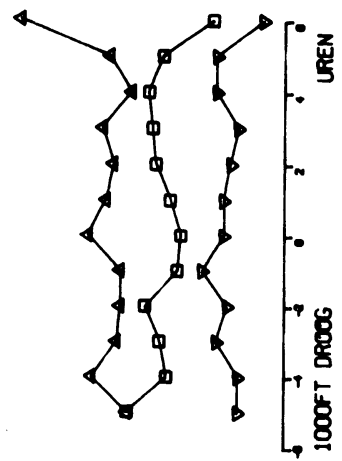
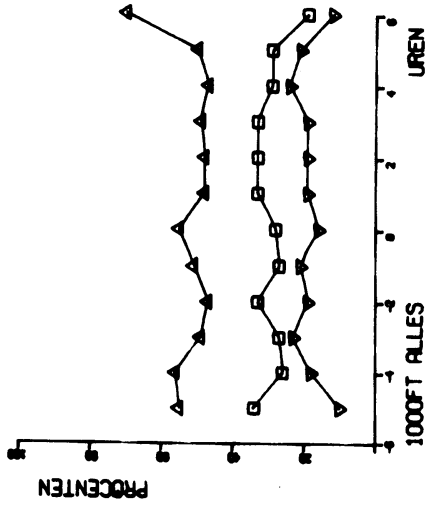
+2 UUR

EELDE

26 sep t/m 26 mrt

26 sep t/m 23 okt: 17 gmt
24 okt t/m 2 febr: 16 gmt
3 febr t/m 7 mrt: 17 gmt
8 mrt t/m 26 mrt: 18 gmt

WINTER ZONONDER



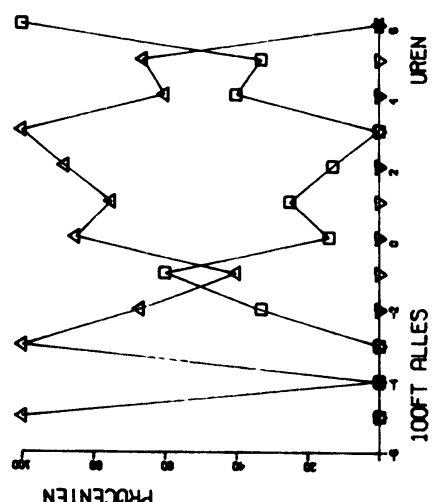
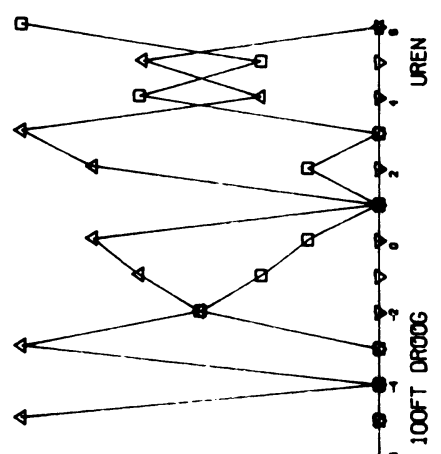
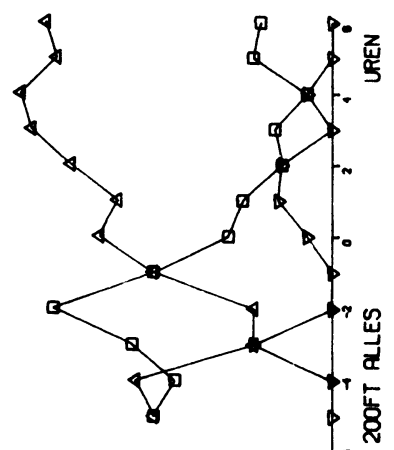
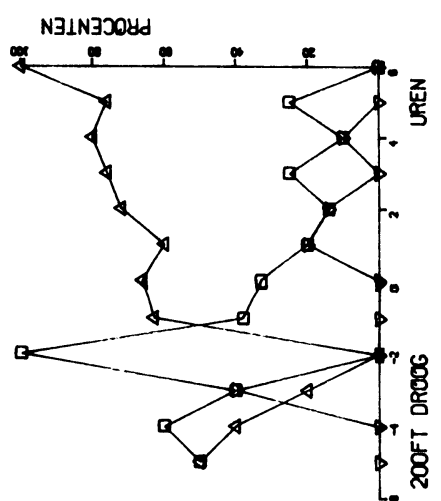
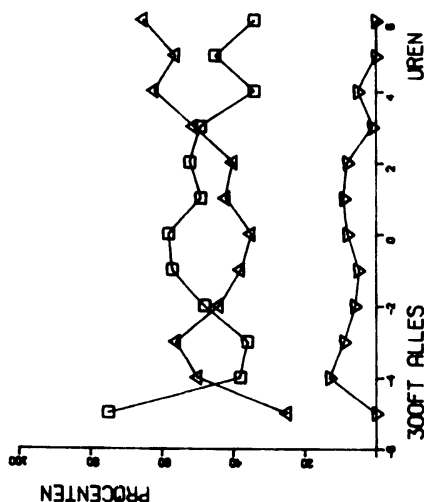
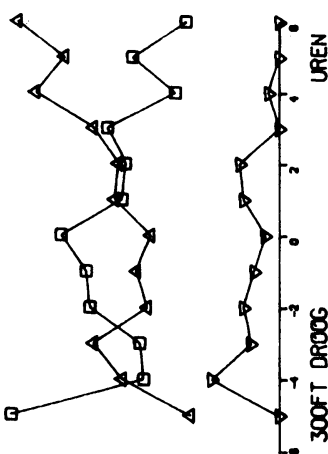
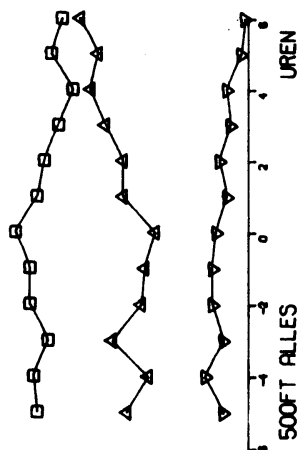
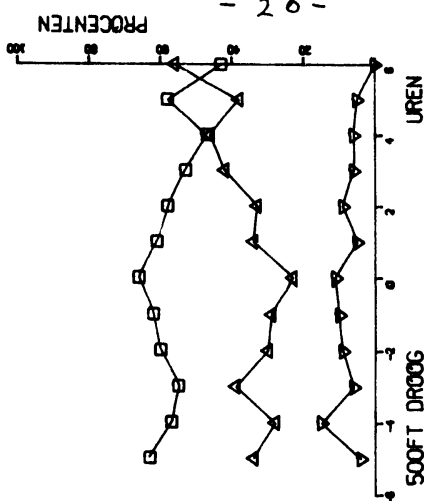
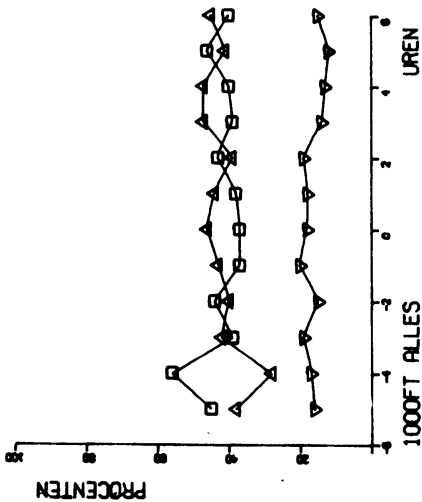
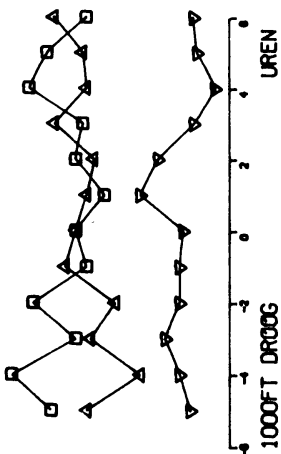
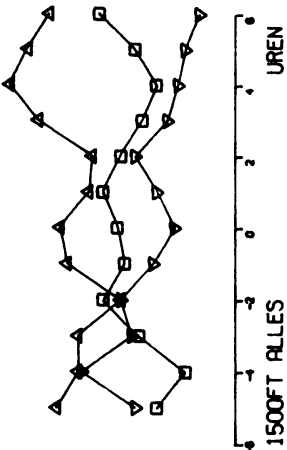
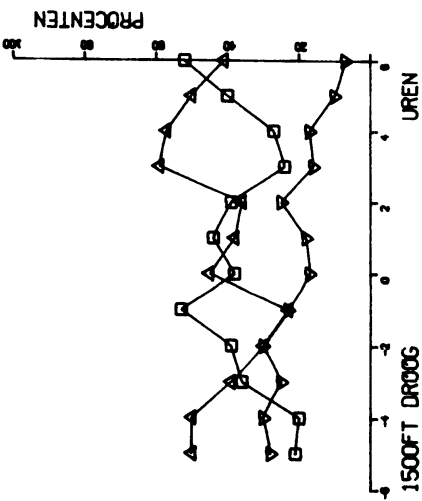
ZOMER ZONOP

27 mrt t/m 21 apr: 5 gnt
 22 apr t/m 27 mei: 4 gnt
 28 mei t/m 7 juli: 3 gnt
 8 juli t/m 20 aug: 4 gnt
 21 aug t/m 25 sep: 5 gnt

27 mrt t/m 25 sep

RÖTTERDAM

+1 UUR



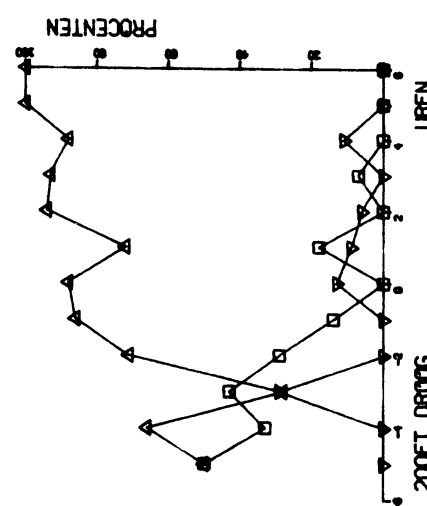
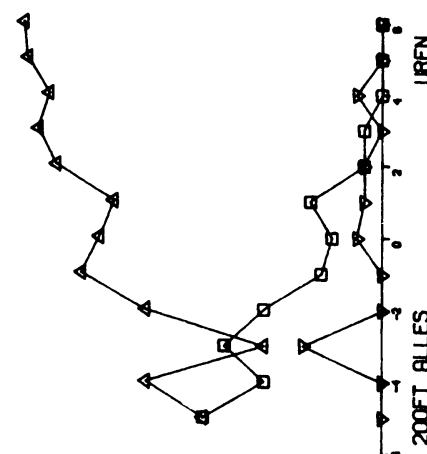
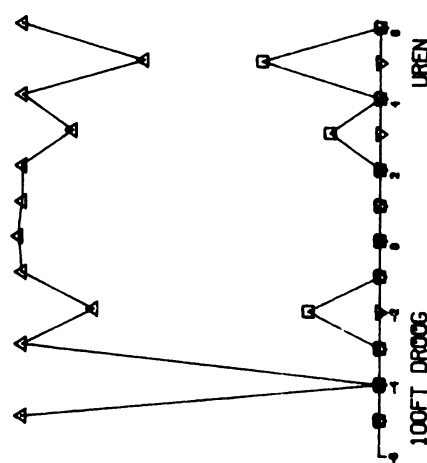
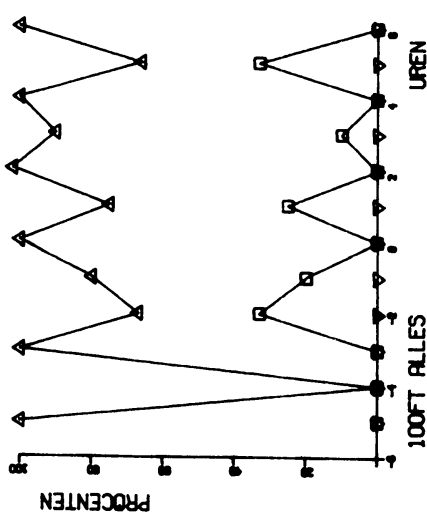
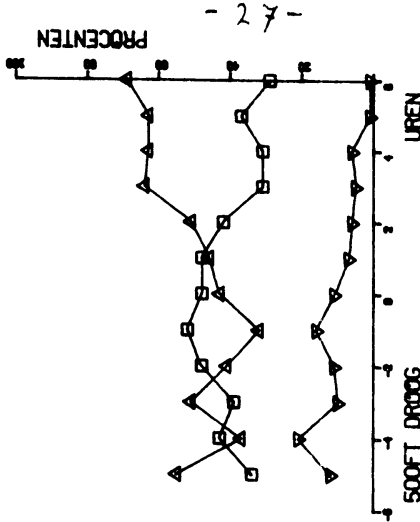
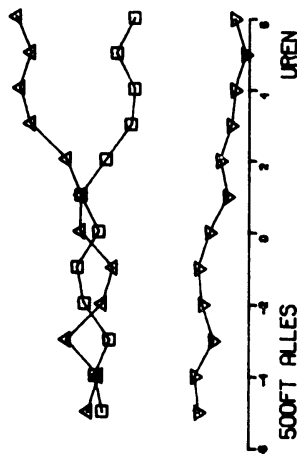
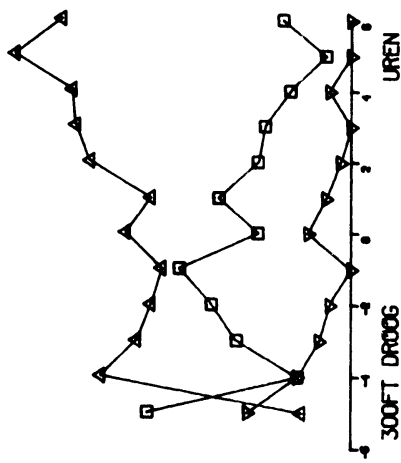
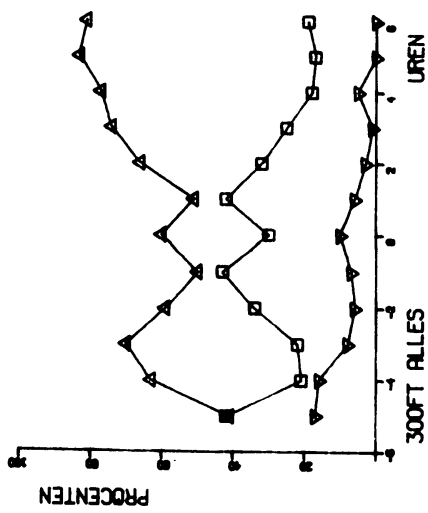
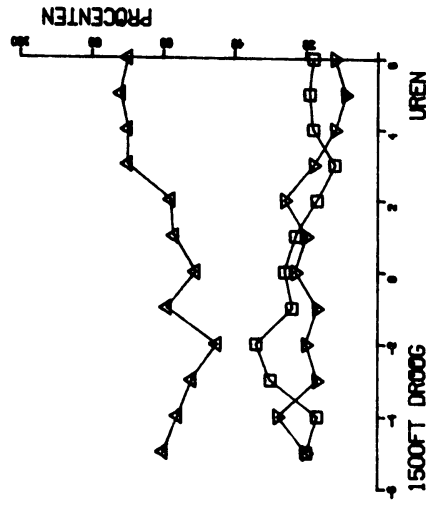
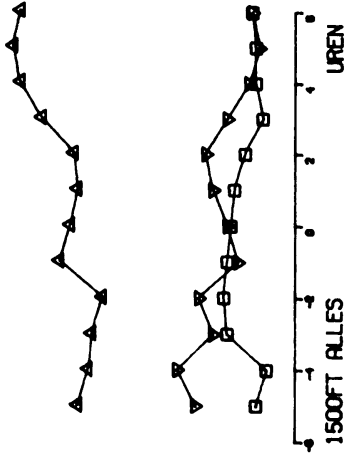
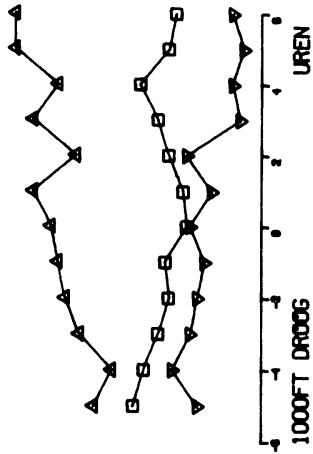
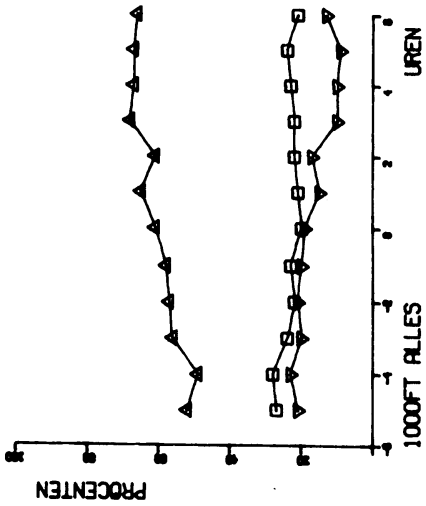
+2 UUR

ROTTERDAM

27 mrt t/m 25 sep

27 mrt t/m 21 apr: 5 gnt
 22 apr t/m 27 mei: 4 gnt
 28 mei t/m 7 juli: 3 gnt
 8 juli t/m 20 aug: 4 gnt
 21 aug t/m 25 sept: 5 gnt

ZOMER ZONOP



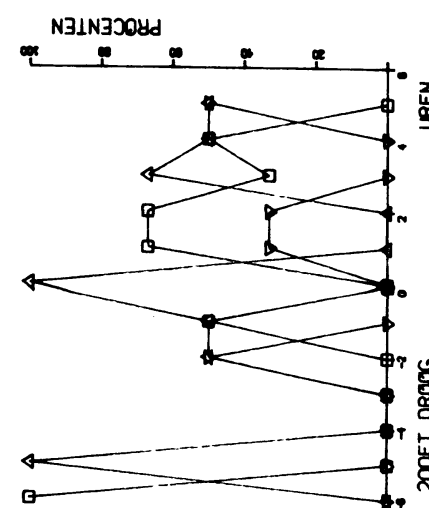
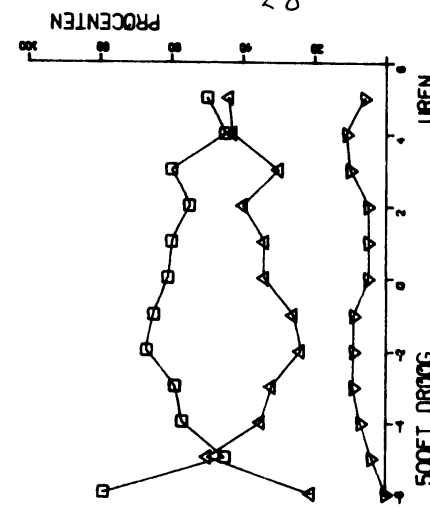
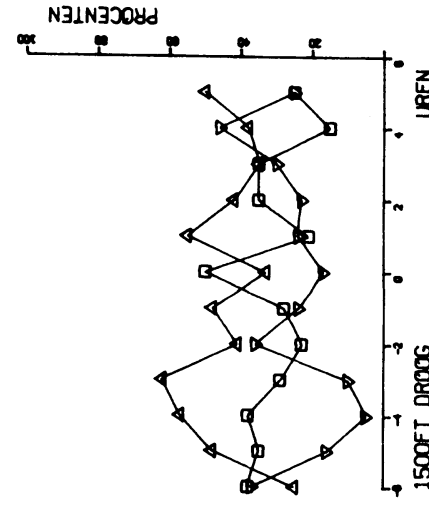
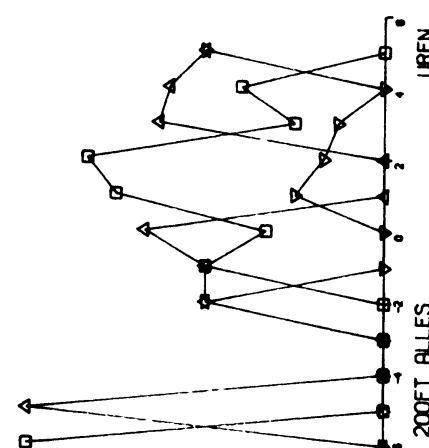
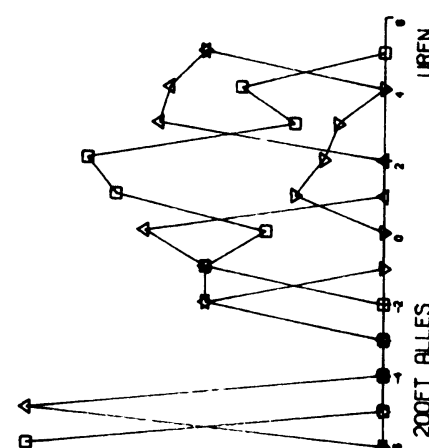
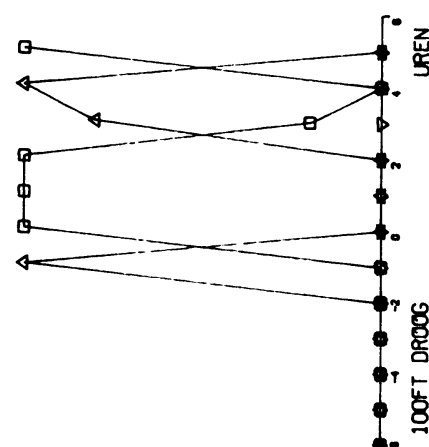
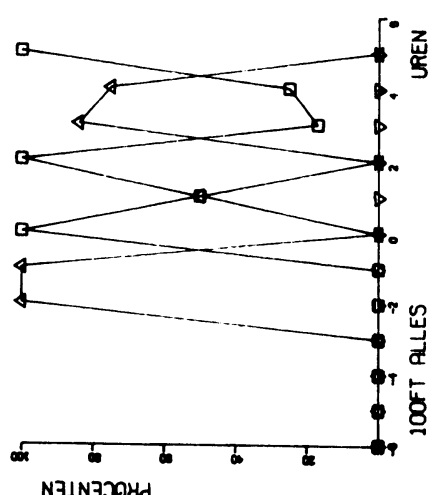
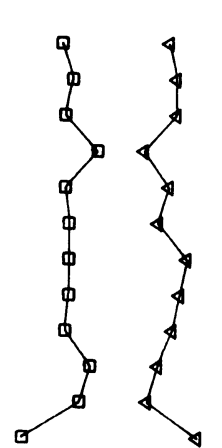
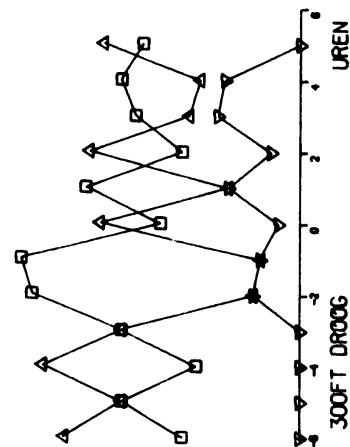
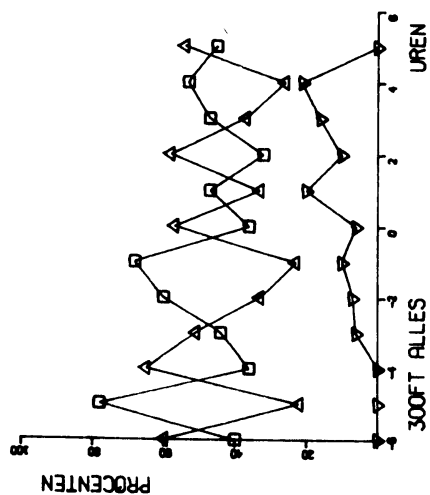
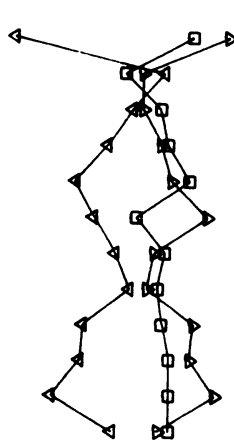
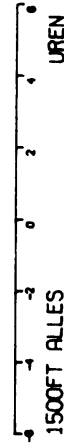
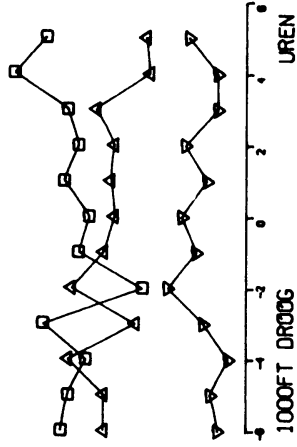
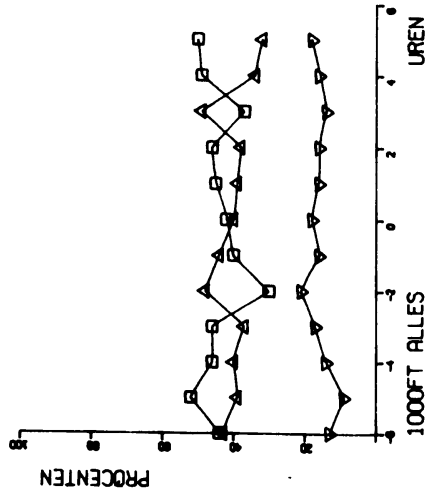
+1 UUR

RÖTTERDAM

27 mrt t/m 25 sep

27 mrt t/m 11 apr: 18 gmt
 12 apr t/m 17 mei: 19 gmt
 18 mei t/m 2 aug: 20 gmt
 3 aug t/m 31 aug: 19 gmt
 1 sep t/m 25 sep: 18 gmt

ZOMER ZONÖNDER



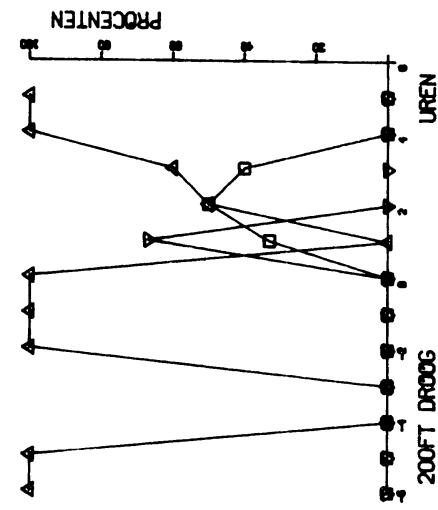
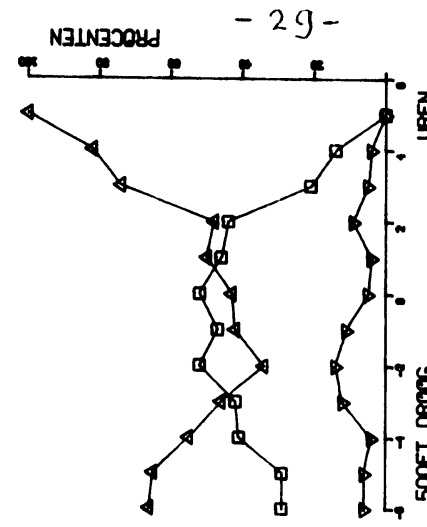
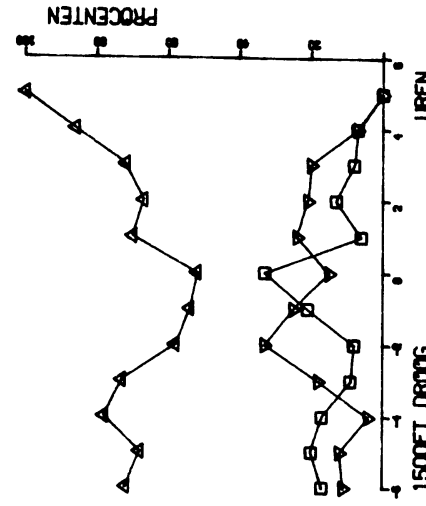
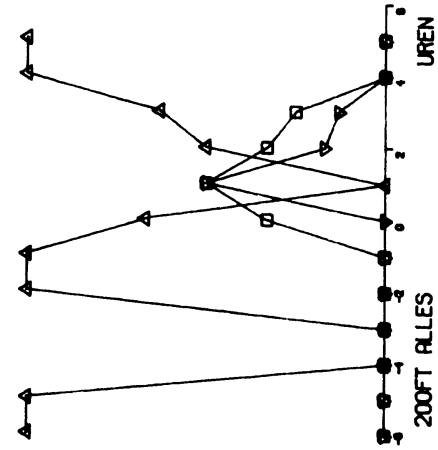
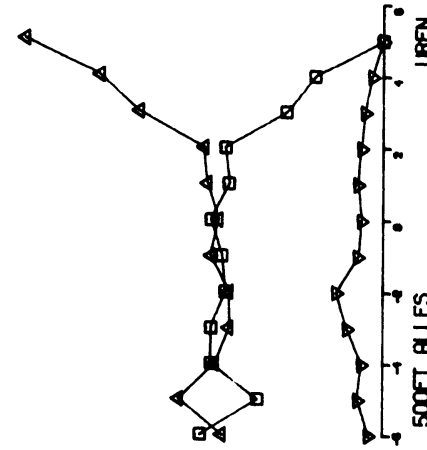
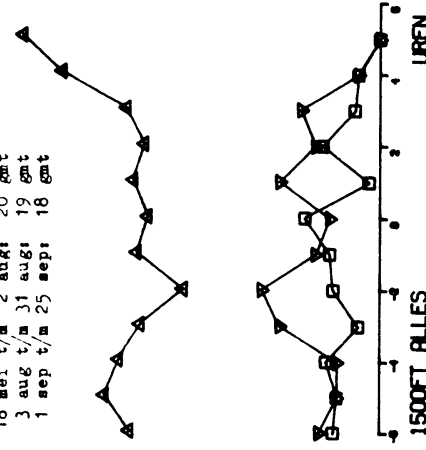
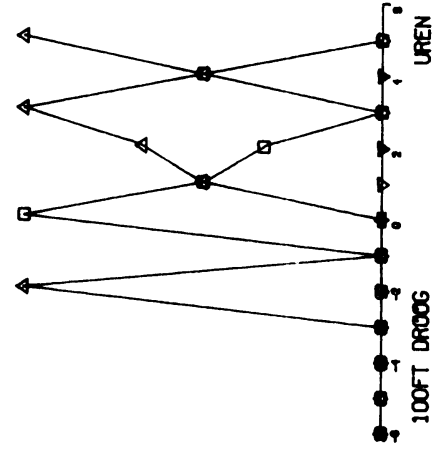
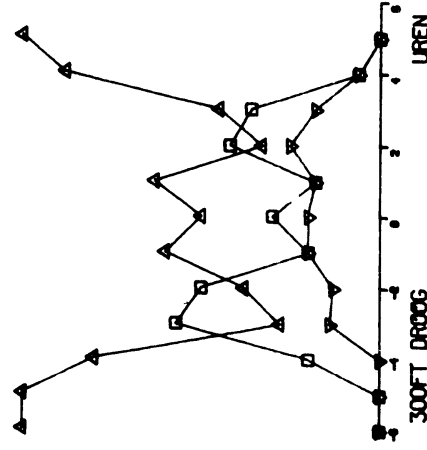
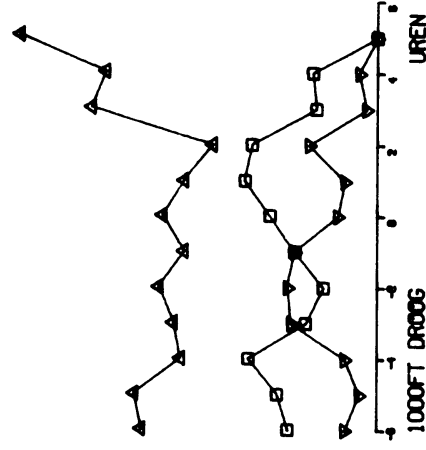
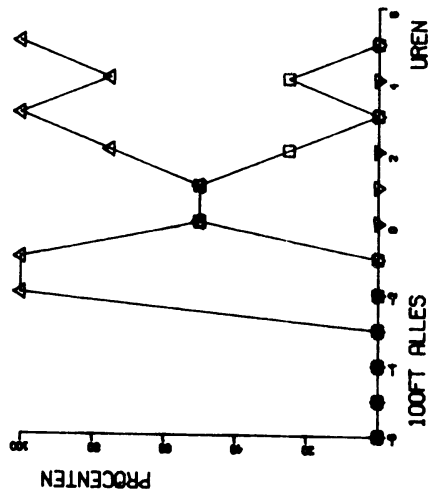
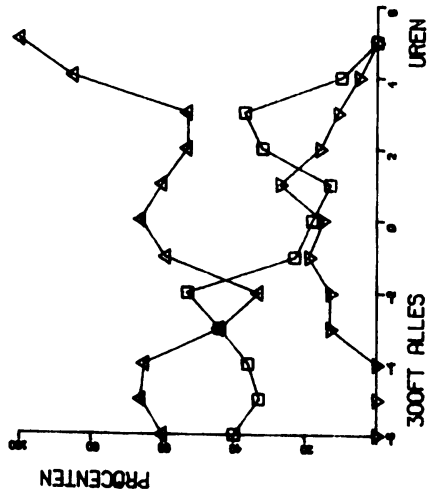
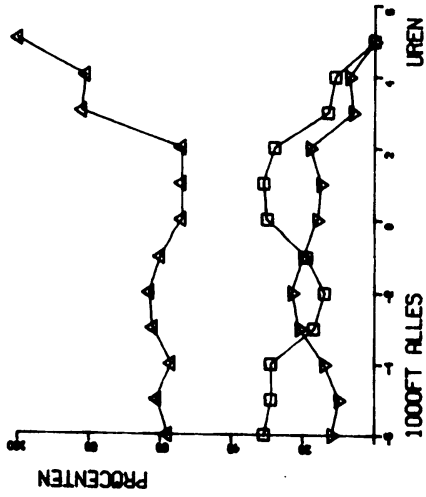
+2 UUR

ROTTERDAM

27 mrt t/m 25 sep

27 mrt t/m 11 aprs 18 GMT
 12 apr t/m 17 mei 19 GMT
 18 mei t/m 2 augt 20 GMT
 3 aug t/m 31 augt 19 GMT
 1 sep t/m 25 sept 18 GMT

ZOMER ZONONDER



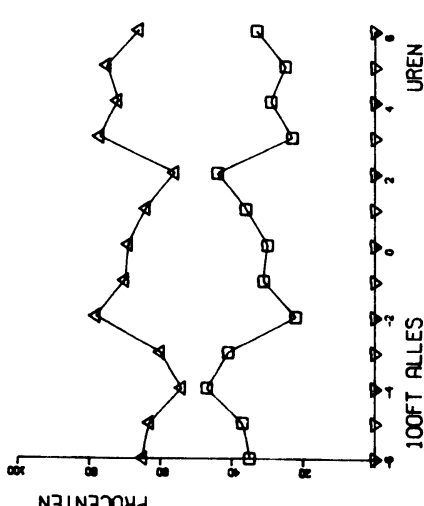
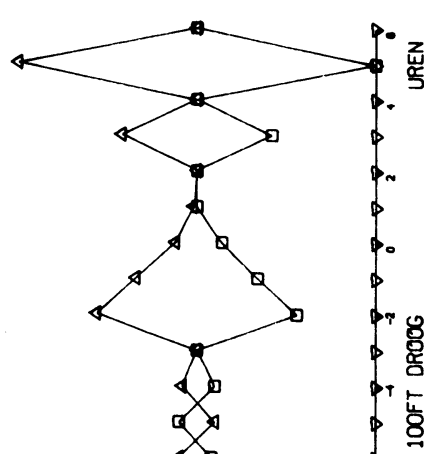
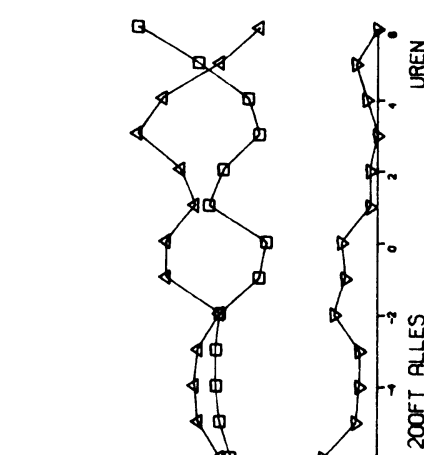
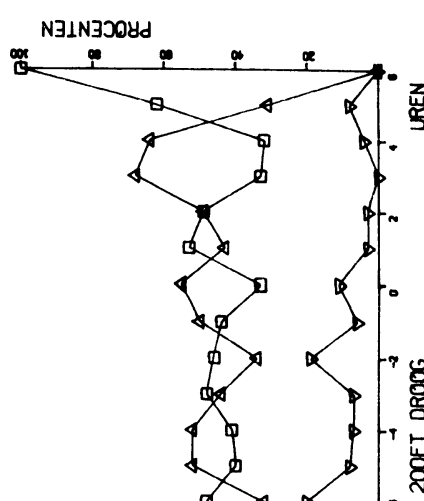
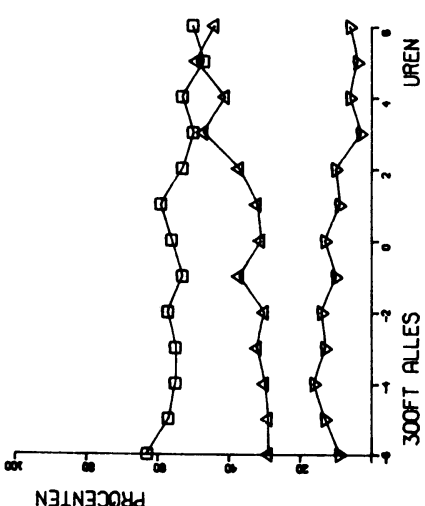
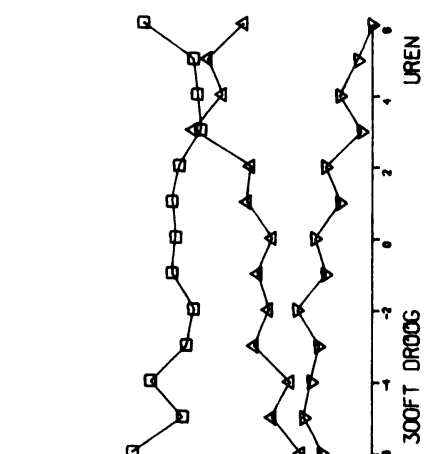
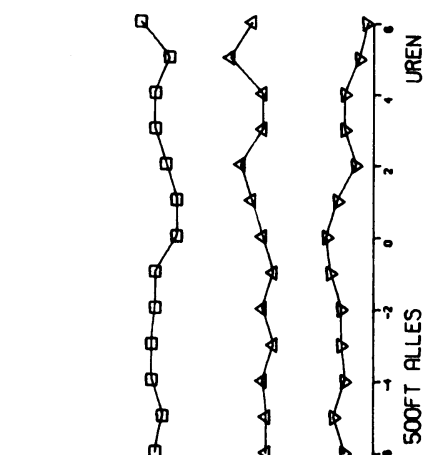
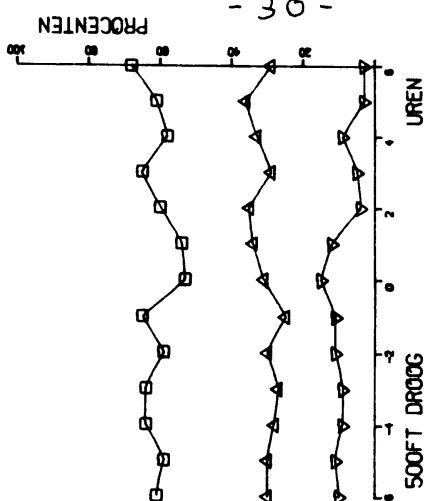
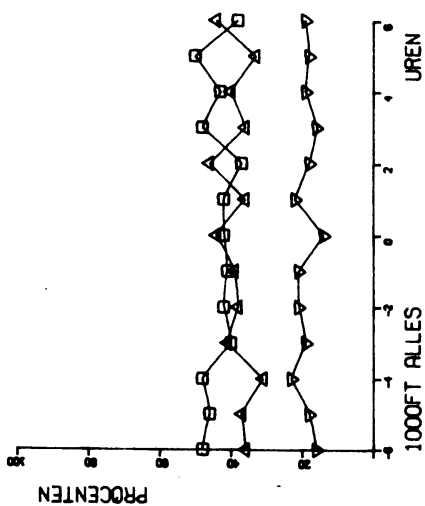
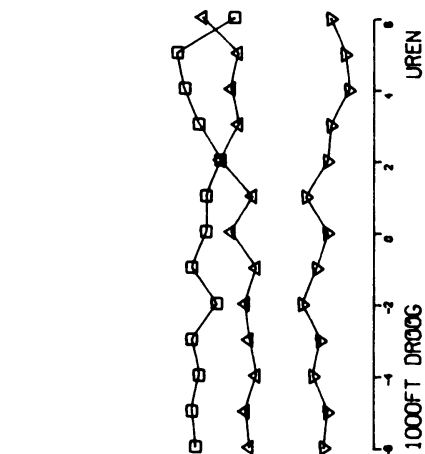
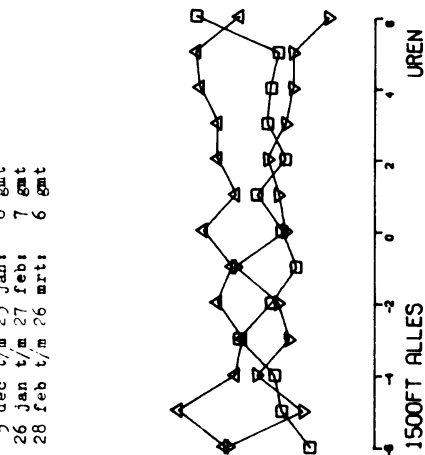
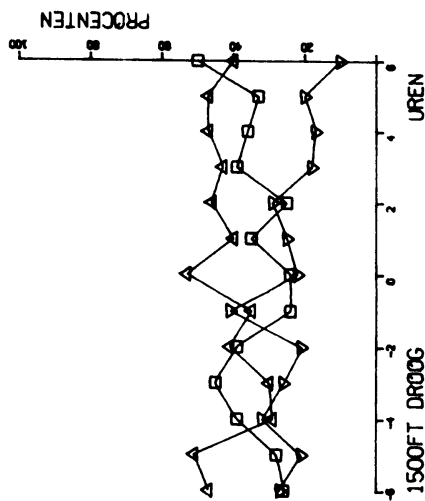
WINTER ZONOP

26 sep t/m 30 okt: 6 gmt
 31 okt t/m 4 dec: 7 gmt
 5 dec t/m 25 jan: 8 gmt
 26 jan t/m 27 febr: 7 gmt
 28 febr t/m 26 mrt: 6 gmt

26 sep t/m 26 mrt

RÖTTERDAM

+1 UUR



103 -

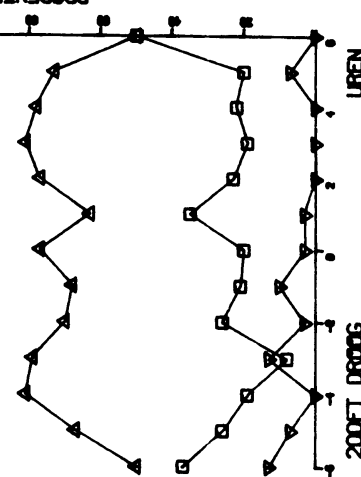
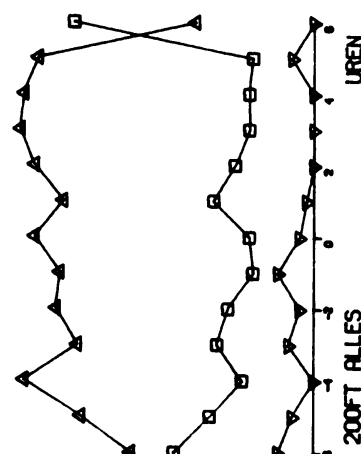
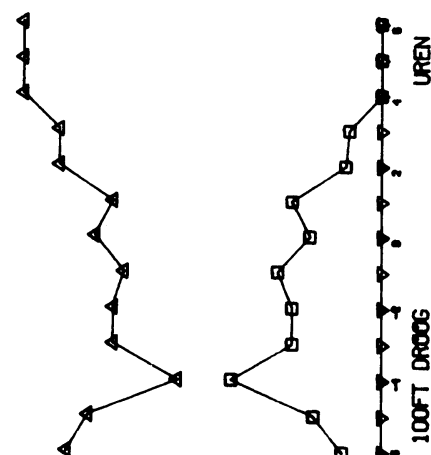
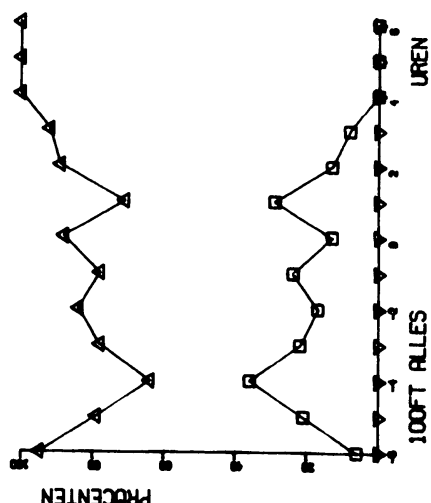
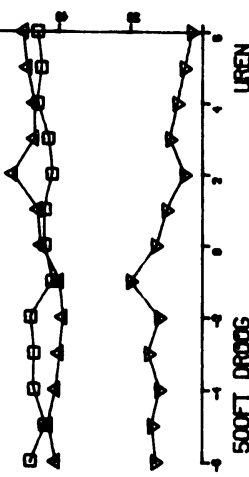
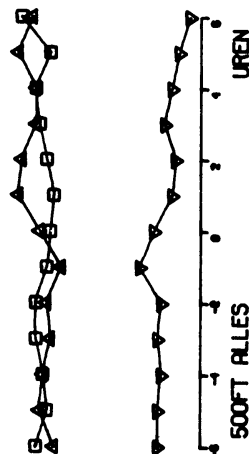
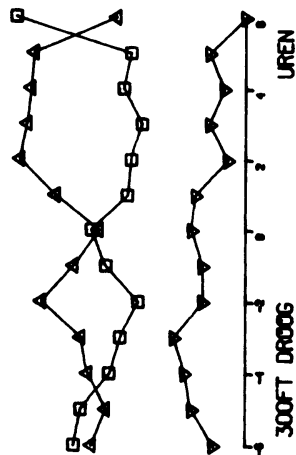
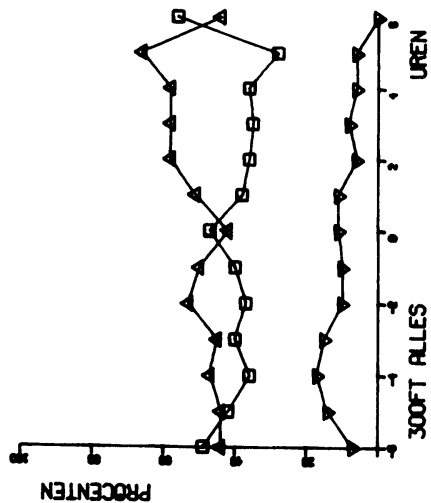
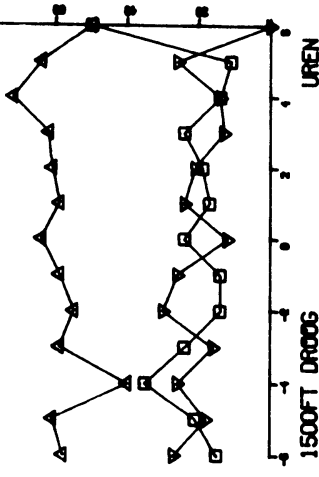
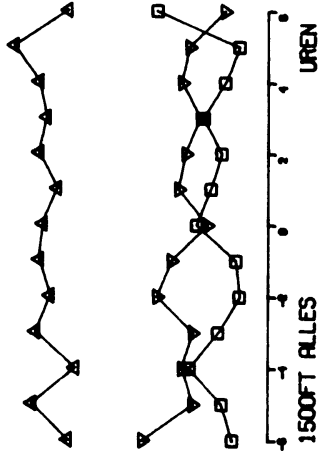
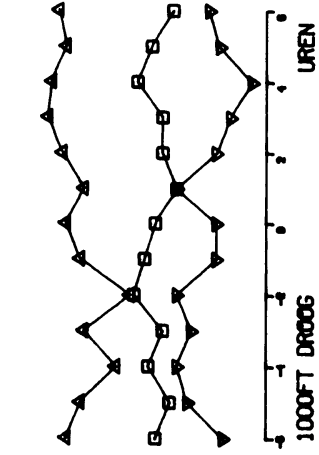
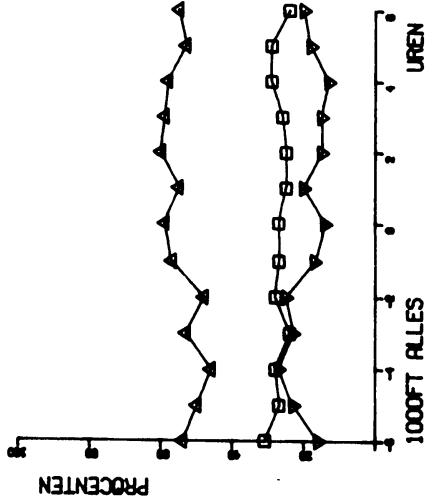
+2 UUR

RÖTTERDAM

26 sep t/m 26 mrt

26 jun t/m 30 okt: 9 gmt
 31 okt t/m 4 dec: 7 gmt
 5 dec t/m 25 jan: 8 gmt
 26 jan t/m 27 febr: 7 gmt
 28 febr t/m 26 mrt: 6 gmt

WINTER ZONOP

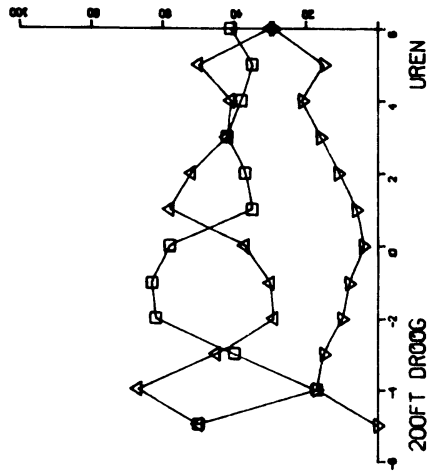
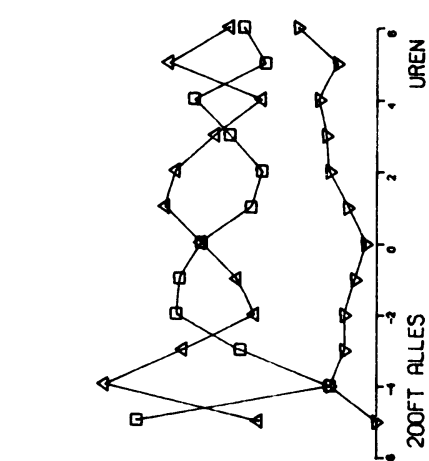
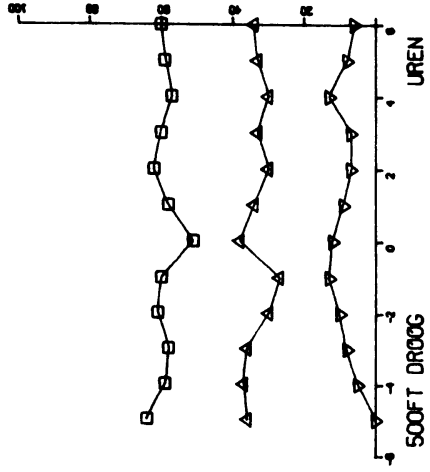
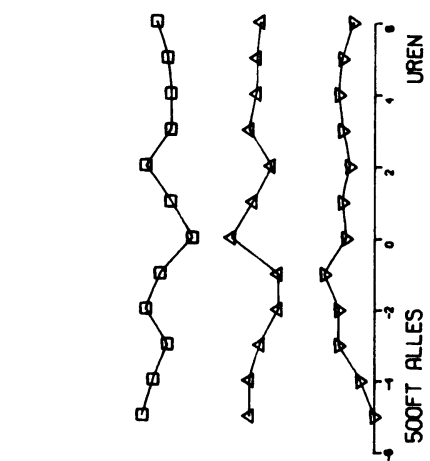
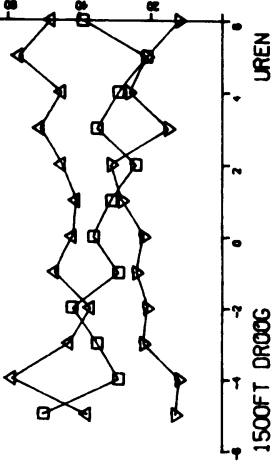
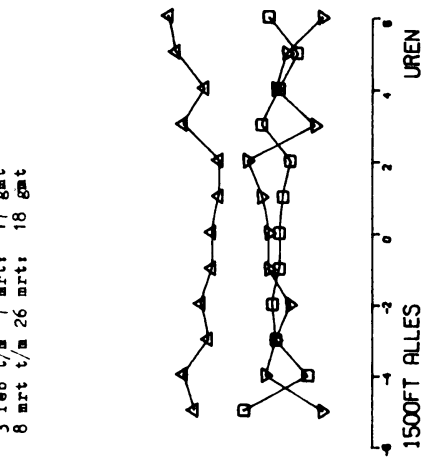
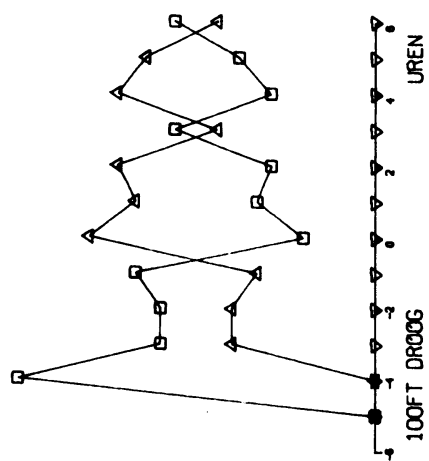
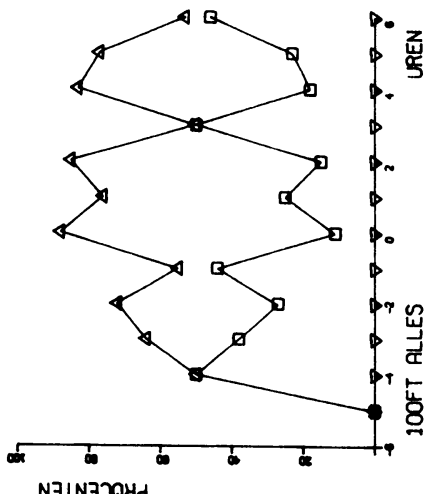
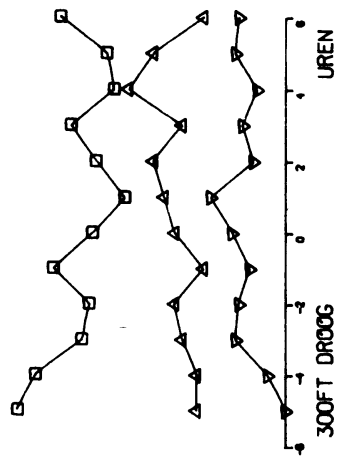
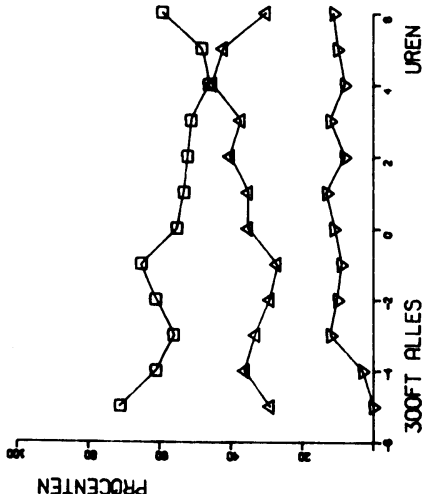
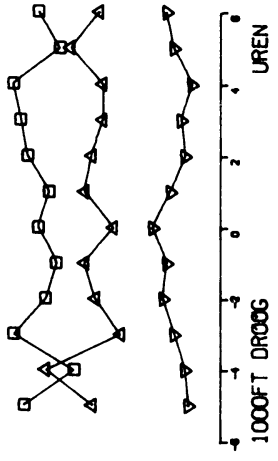
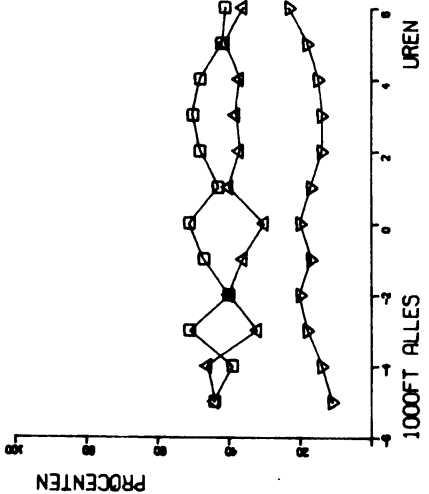


+1 UUR ROTTERDAM

26 sep t/m 26 mrt

26 sep t/m 23 okt: 17 gmt
 24 okt t/m 2 feb: 16 gmt
 3 feb t/m 7 mrt: 17 gmt
 8 mrt t/m 26 mrt: 18 gmt

WINTER ZONONDER



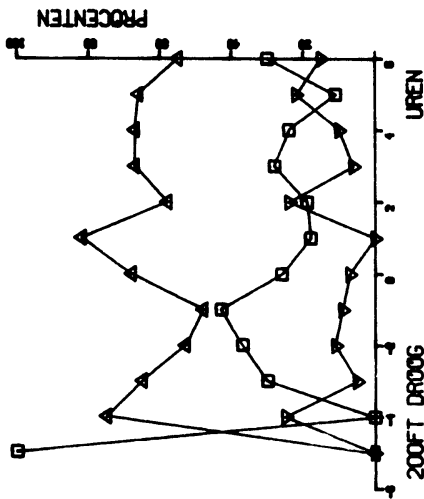
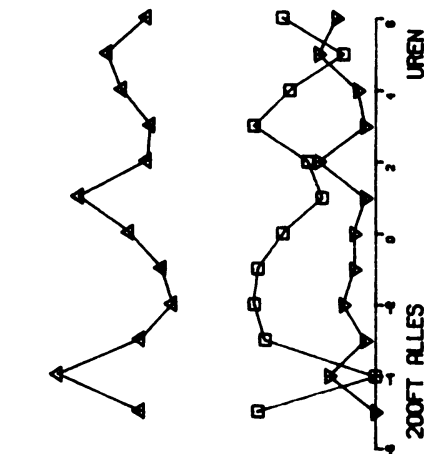
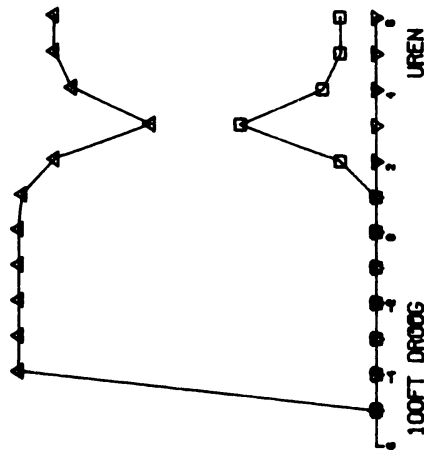
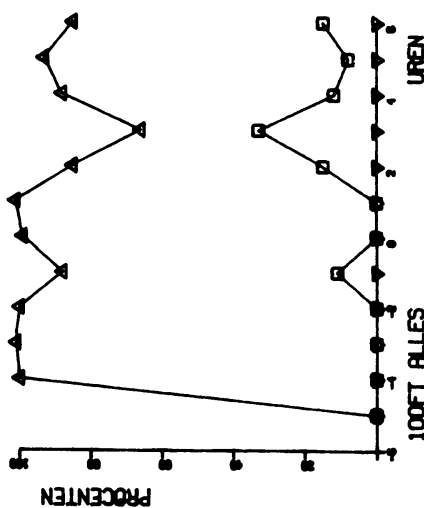
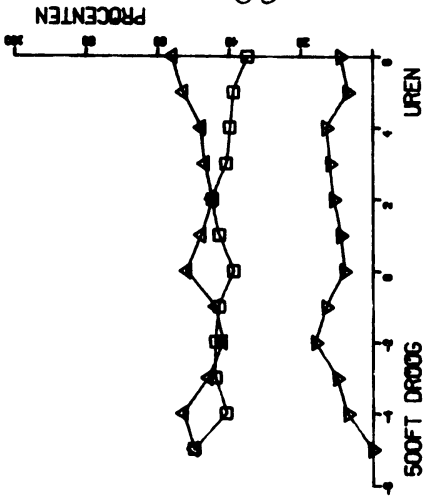
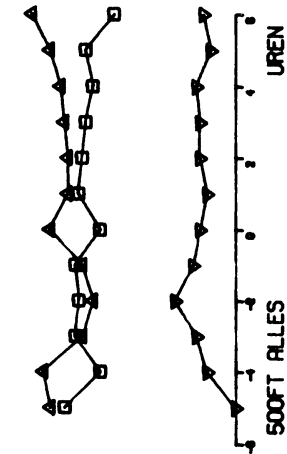
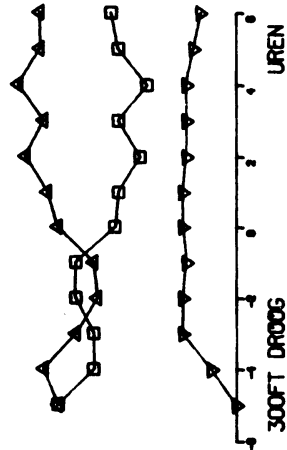
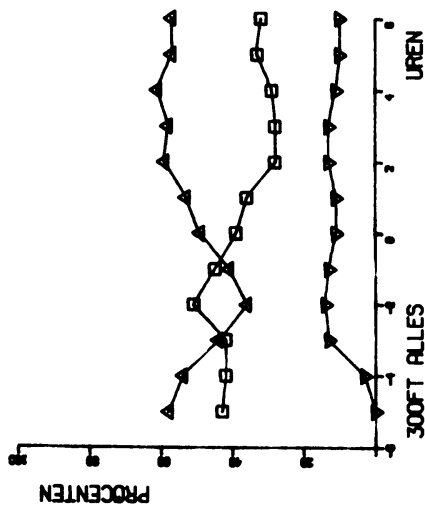
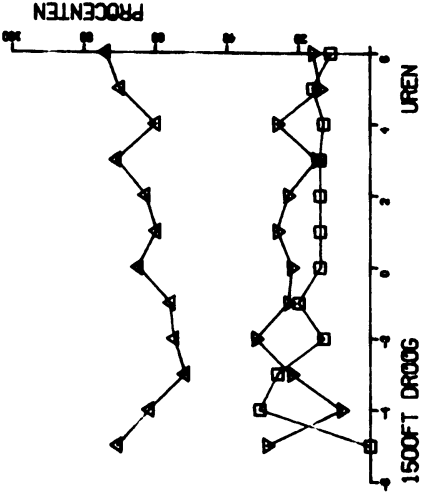
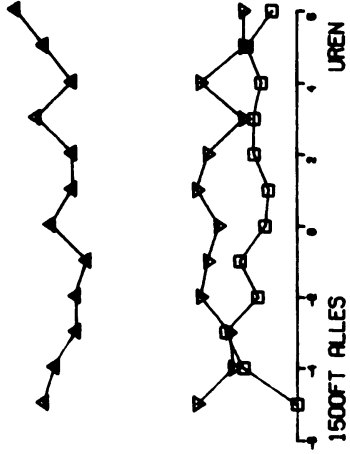
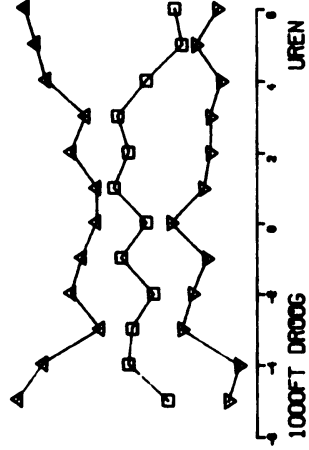
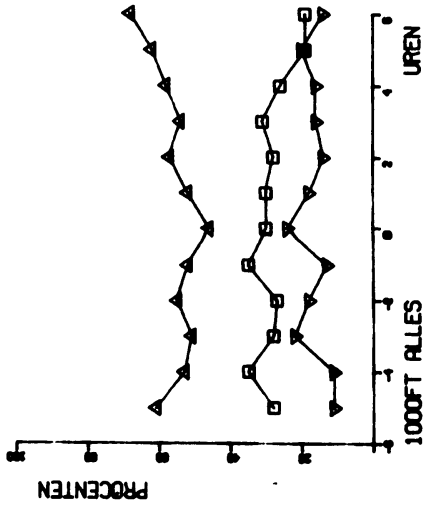
+2 UUR

ROTTERDAM

26 sep t/m 26 mrt

26 sep t/m 23 okt: 17 gnt
24 okt t/m 2 febr: 16 gnt
3 febr t/m 7 mrt: 17 gnt
8 mrt t/m 26 mrt: 18 gnt

WINTER ZONONDER



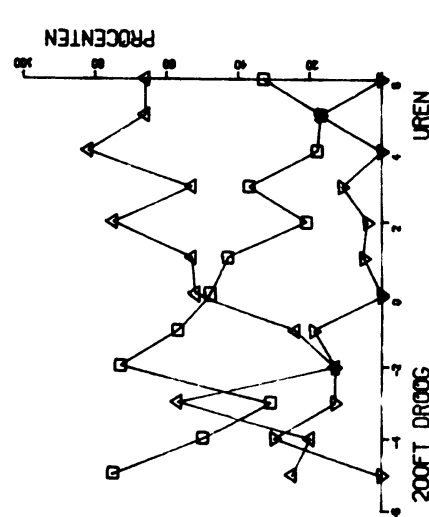
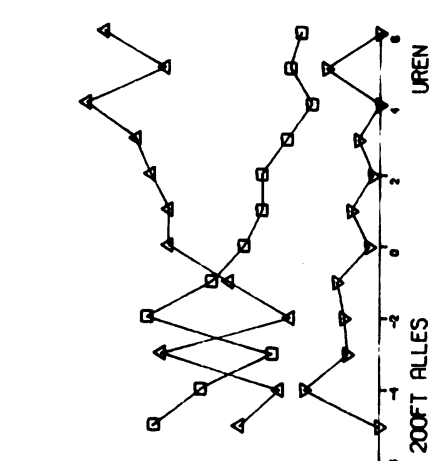
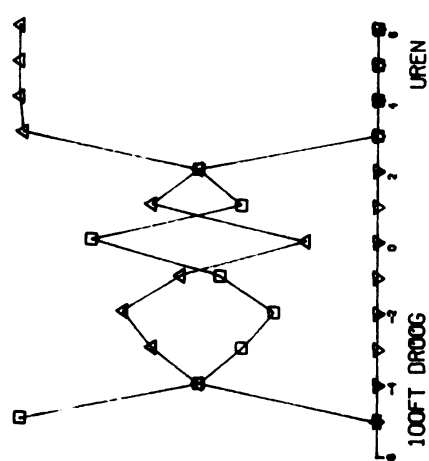
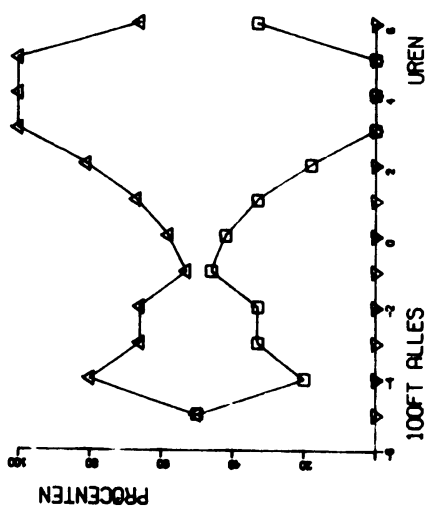
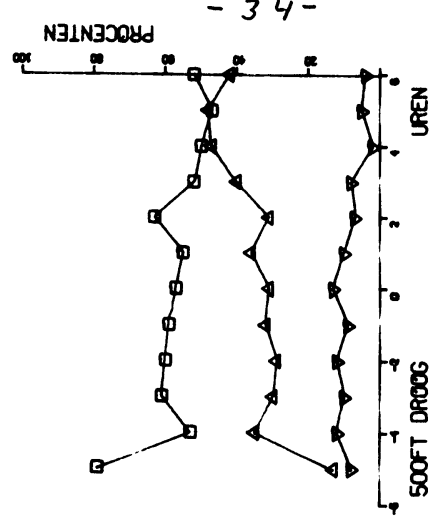
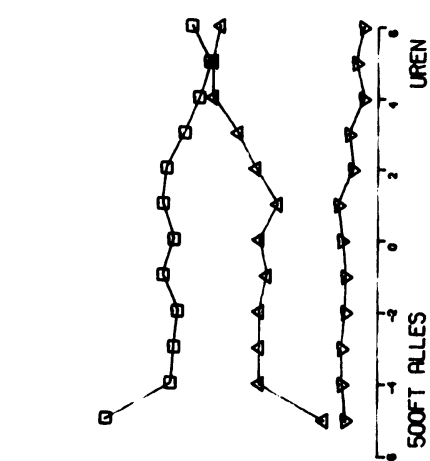
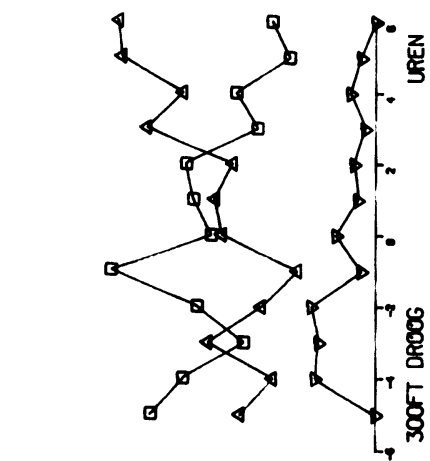
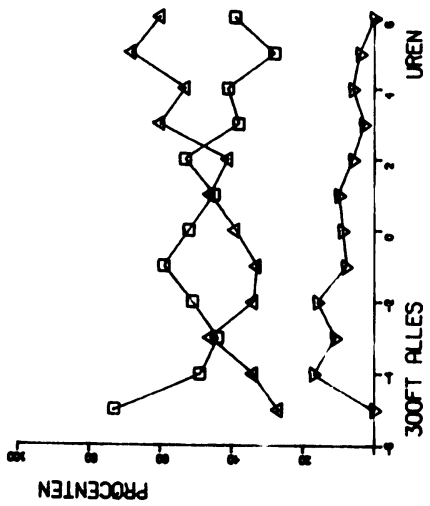
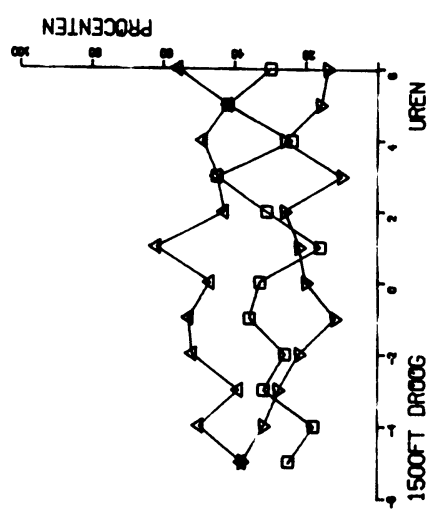
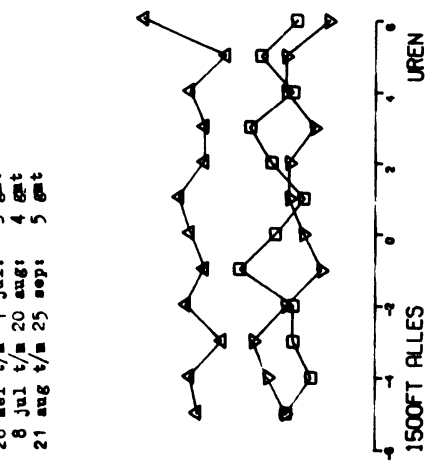
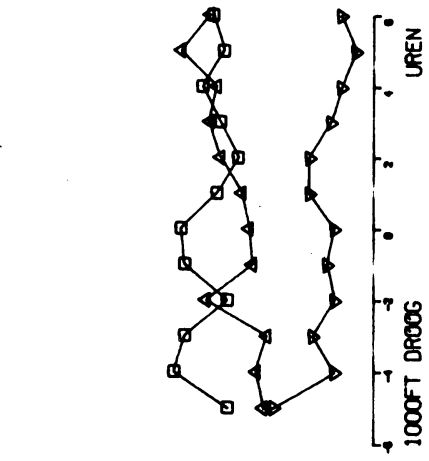
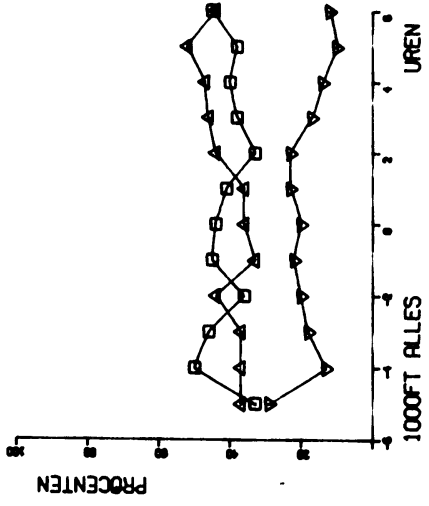
+1 UUR

SCHIPHOL

27 mrt t/m 25 sep

27 mrt t/m 21 apr: 5 gnt
 22 apr t/m 27 mei: 4 gnt
 28 mei t/m 7 juli: 3 gnt
 8 juli t/m 20 aug: 4 gnt
 21 aug t/m 25 sep: 5 gnt

ZOMER ZONOP



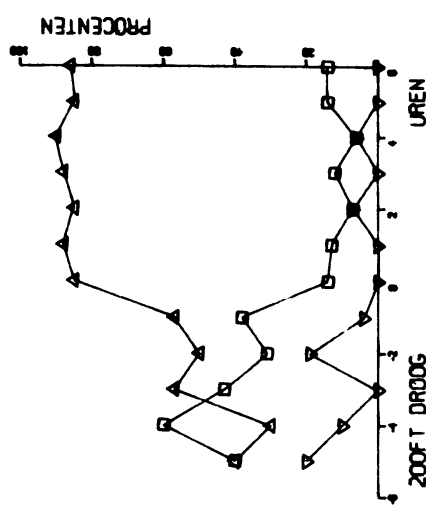
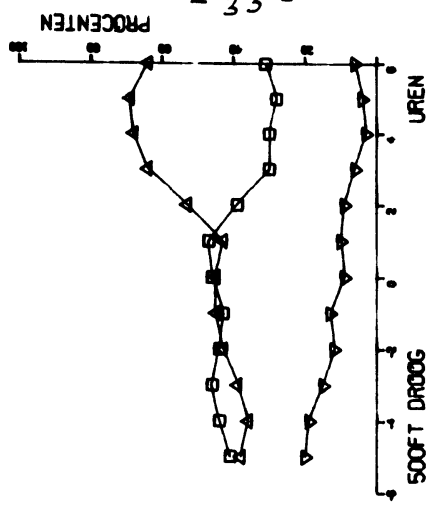
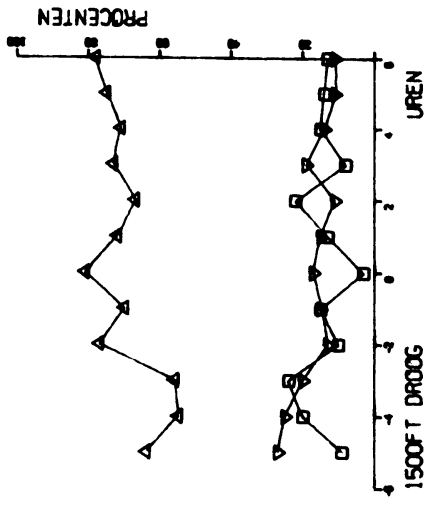
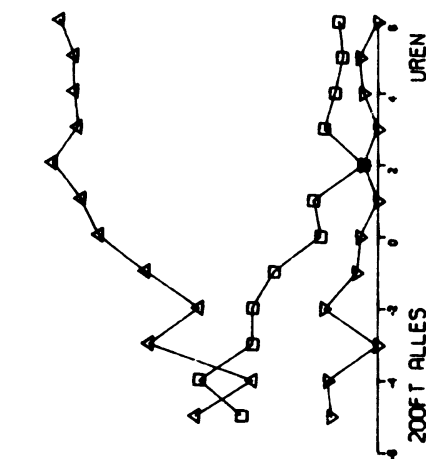
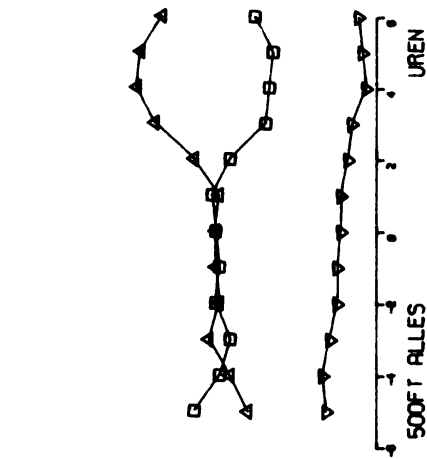
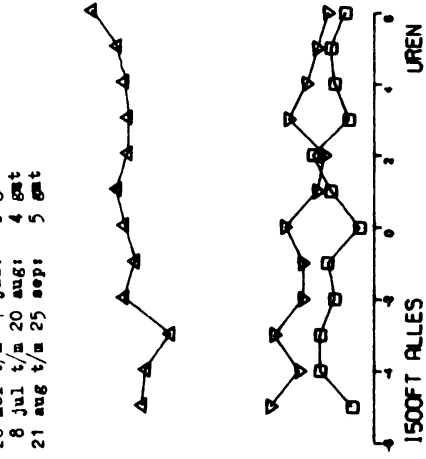
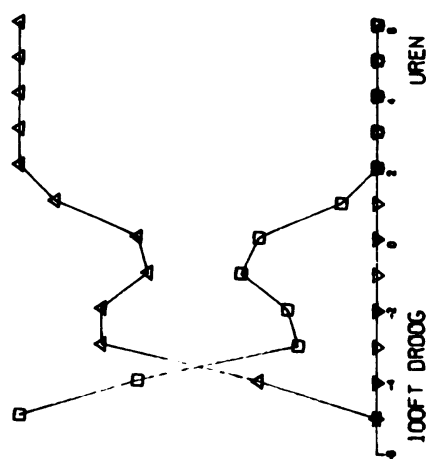
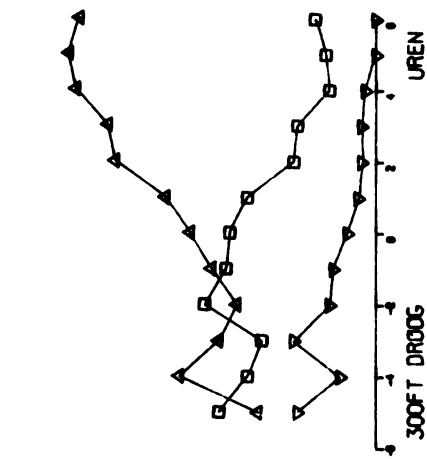
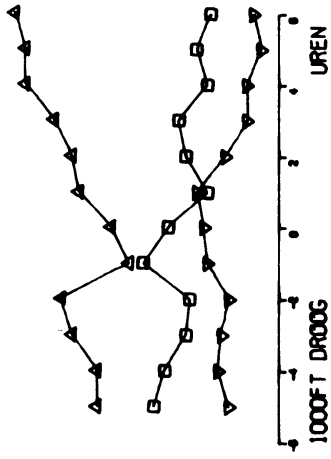
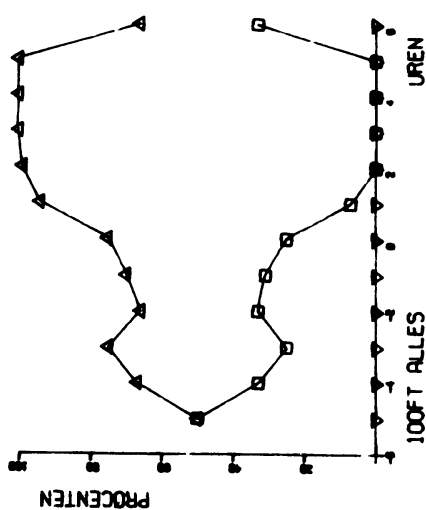
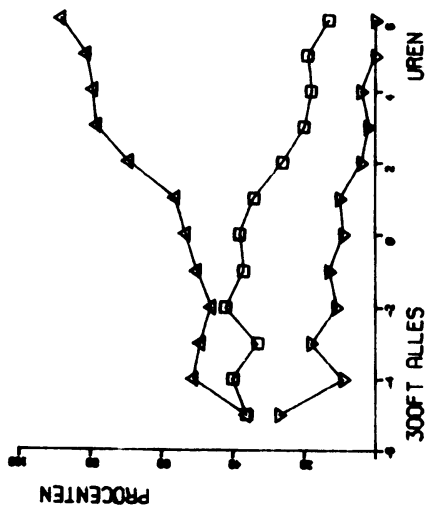
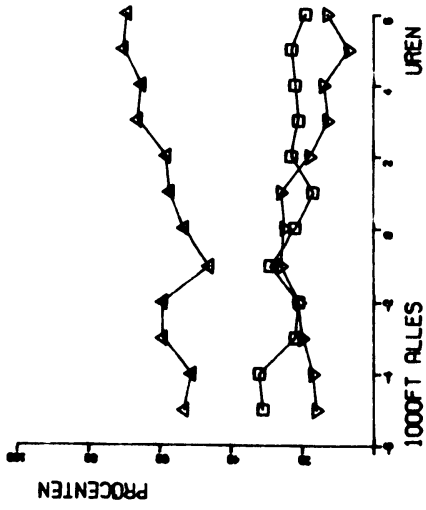
+2 UUR

SCHIPHOL

27 mrt t/m 25 sep

27 mrt t/m 21 apr: 5 gmt
 22 apr t/m 27 mei: 4 gmt
 28 mei t/m 7 juli: 3 gmt
 8 juli t/m 20 aug: 4 gmt
 21 aug t/m 25 sep: 5 gmt

ZOMER ZONOP



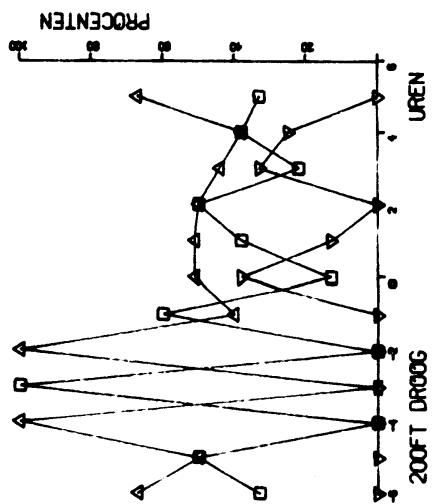
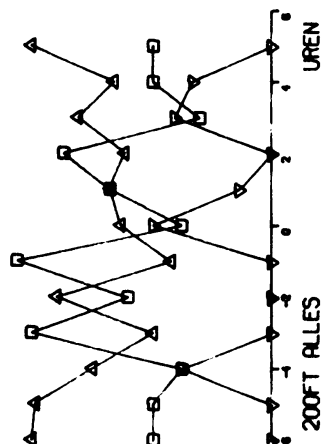
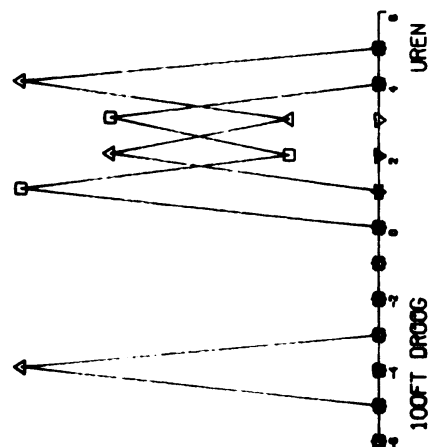
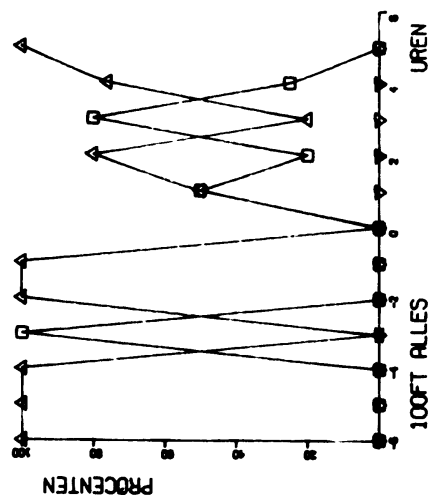
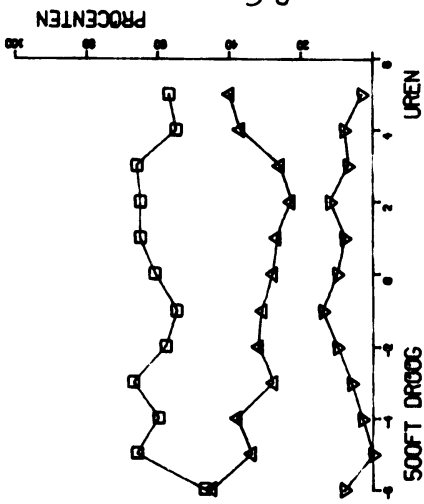
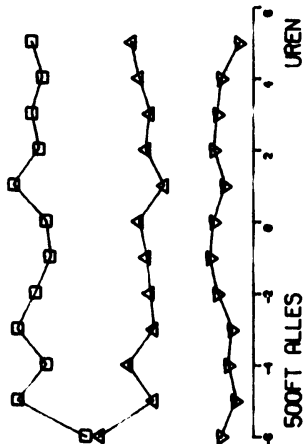
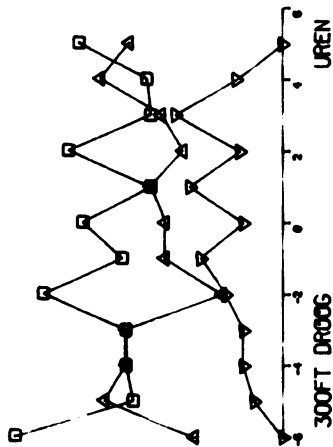
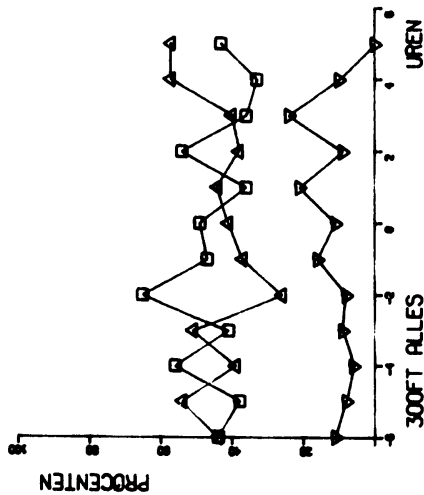
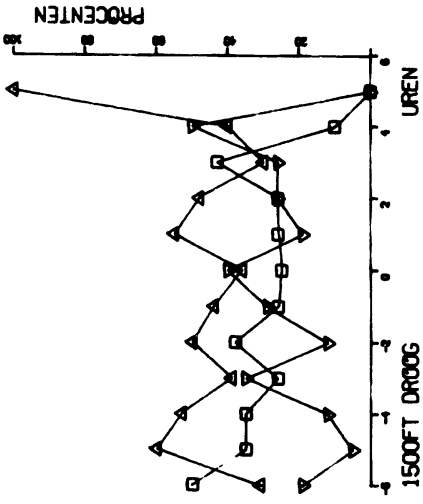
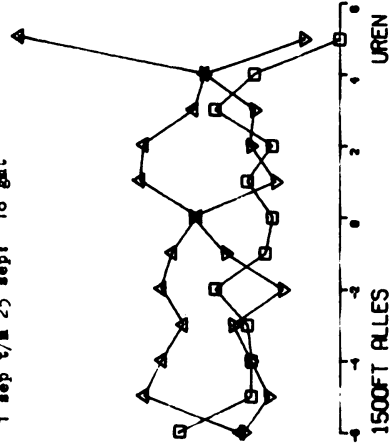
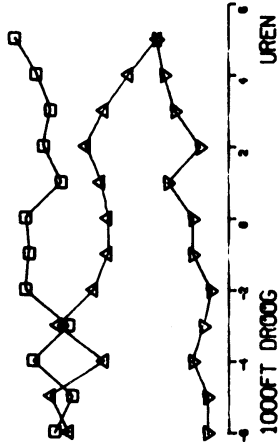
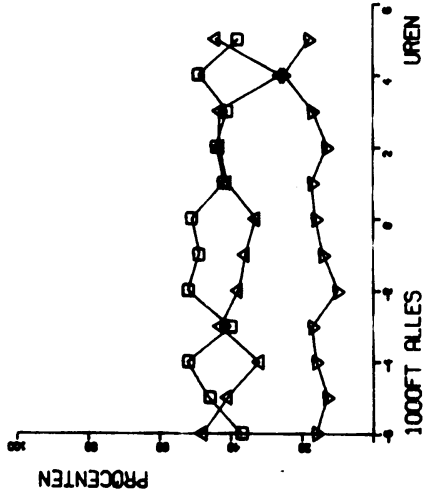
+1 UUR

SCHIPHOL

27 mrt t/m 25 sep

27 mrt t/m 11 apr: 18 gmt
 12 apr t/m 17 mei: 19 gmt
 18 mei t/m 2 aug: 20 gmt
 3 aug t/m 31 aug: 19 gmt
 1 sep t/m 25 sep: 18 gmt

ZOMER ZONONDER



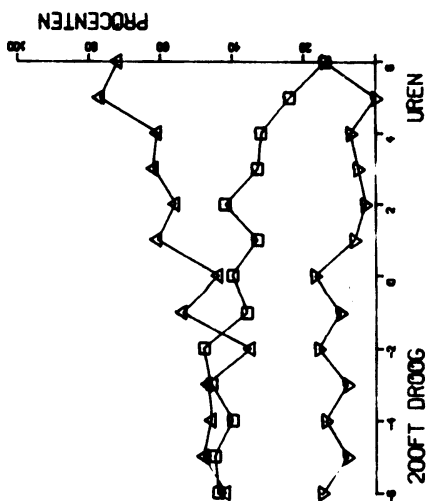
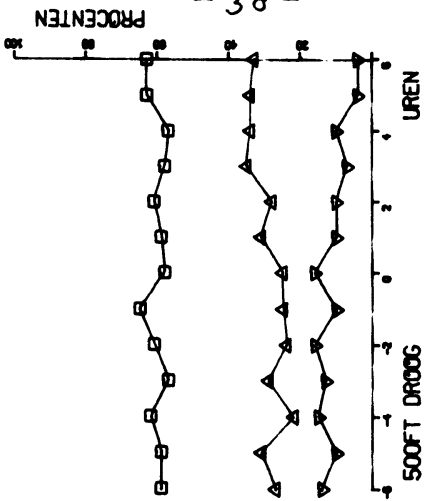
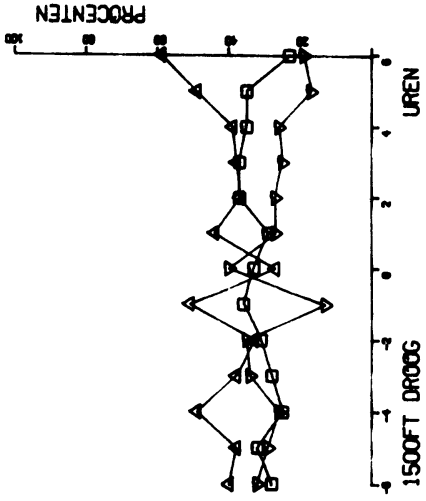
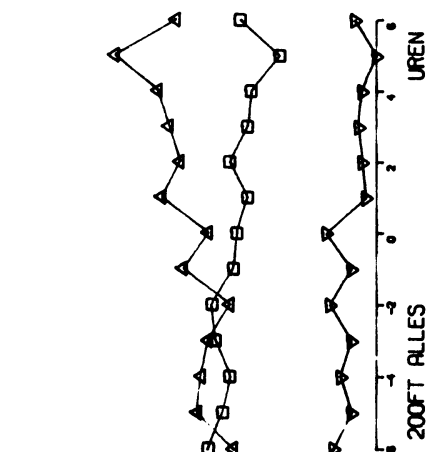
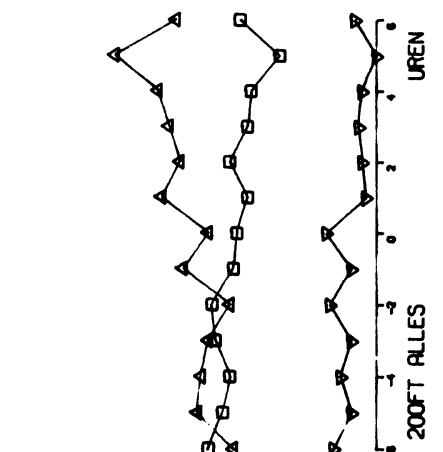
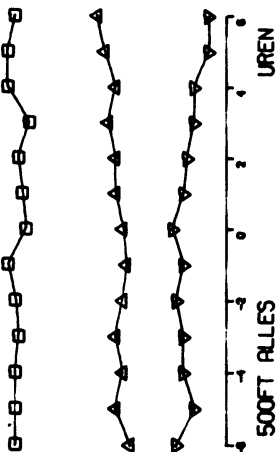
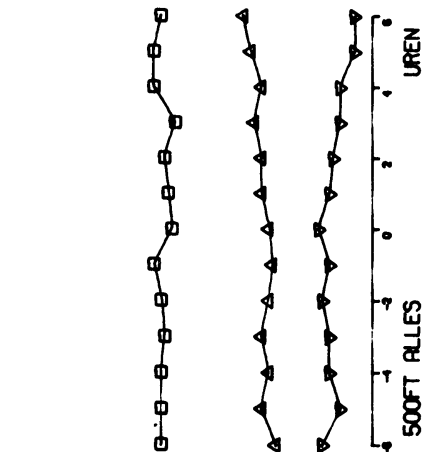
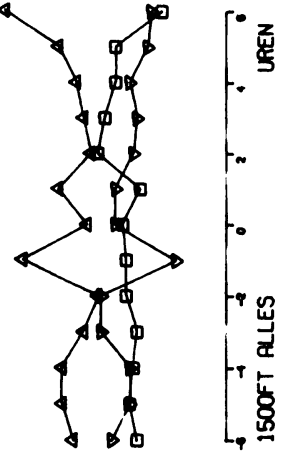
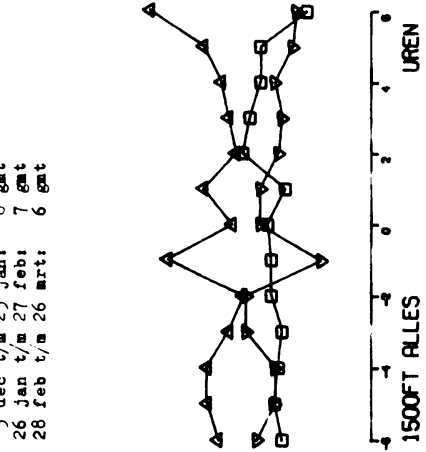
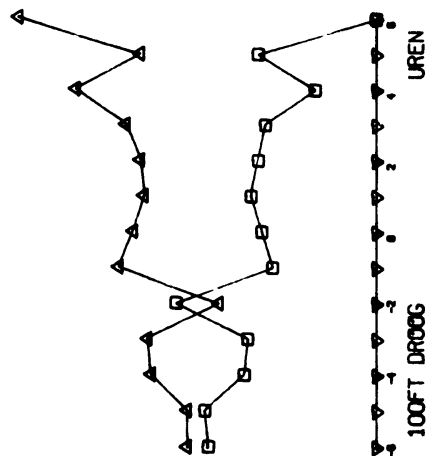
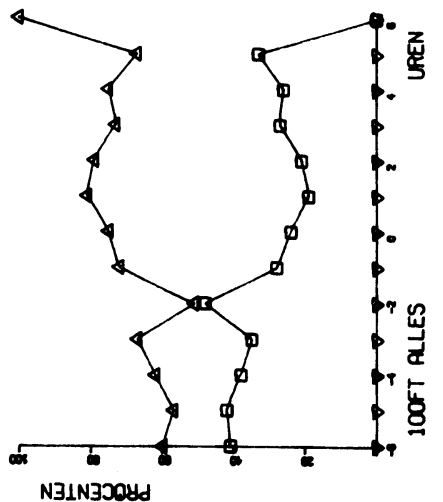
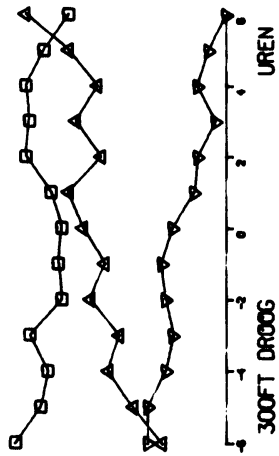
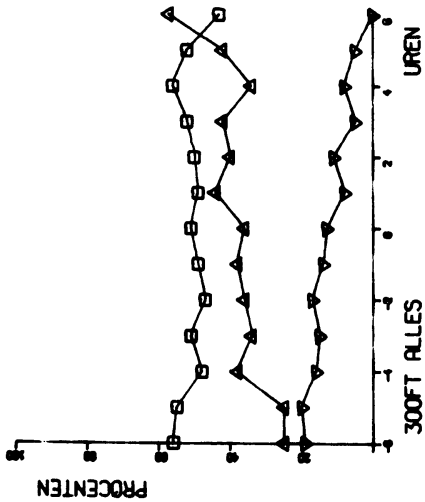
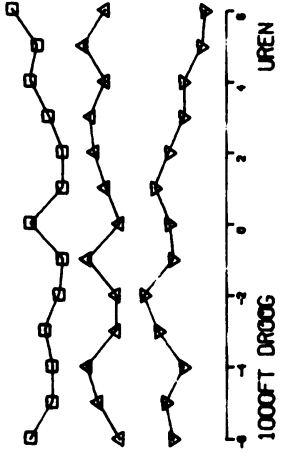
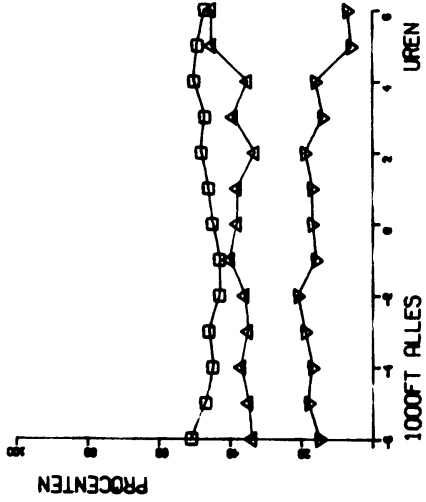
+1 UUR

SCHIPHOL

26 sep t/m 26 mrt

26 sep t/m 30 okt: 6 gmt
 31 okt t/m 4 dec: 7 gmt
 5 dec t/m 25 jan: 8 gmt
 26 jan t/m 27 febr: 7 gmt
 28 feb t/m 26 mrt: 6 gmt

WINTER ZONOP



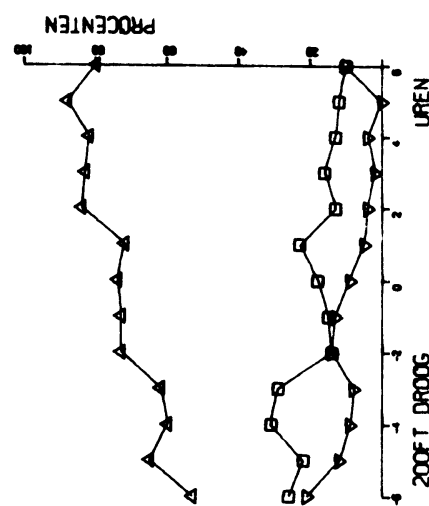
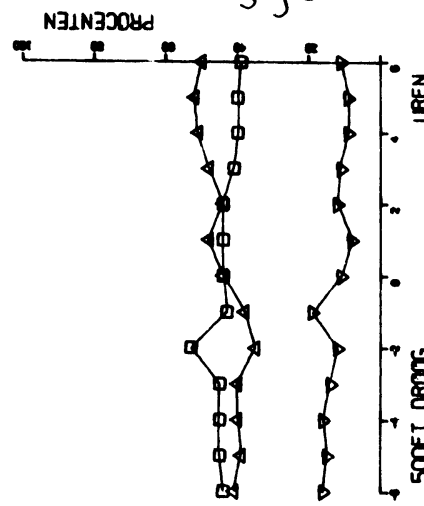
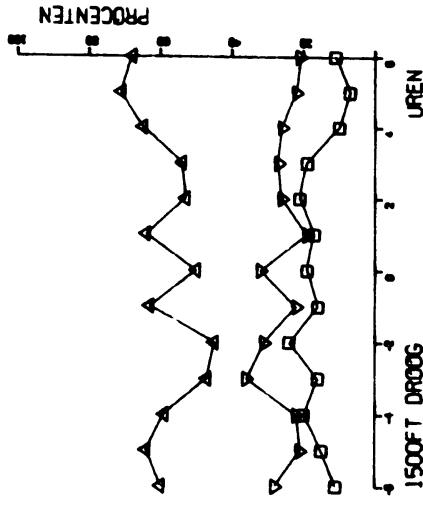
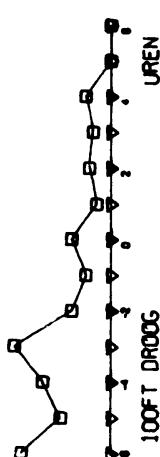
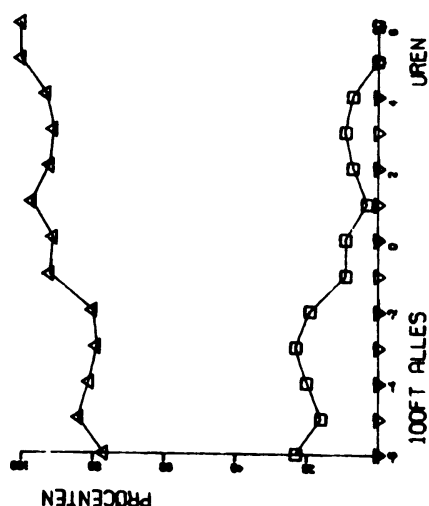
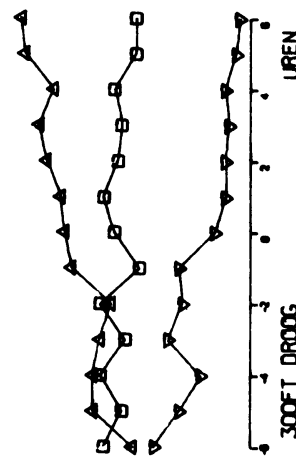
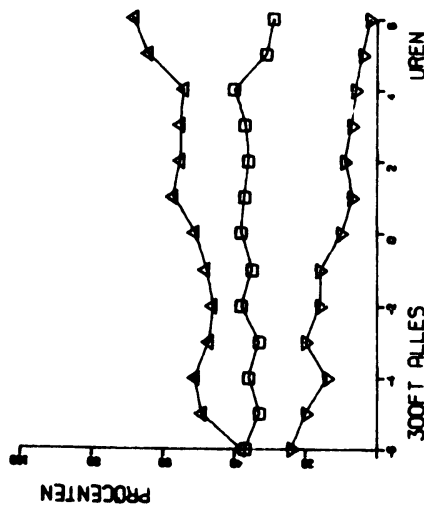
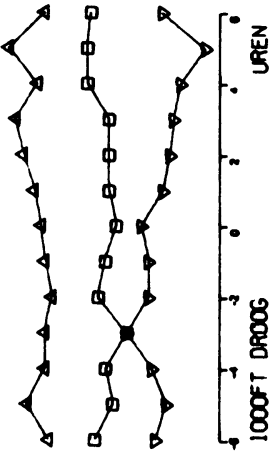
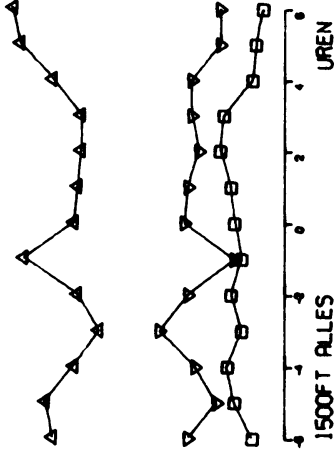
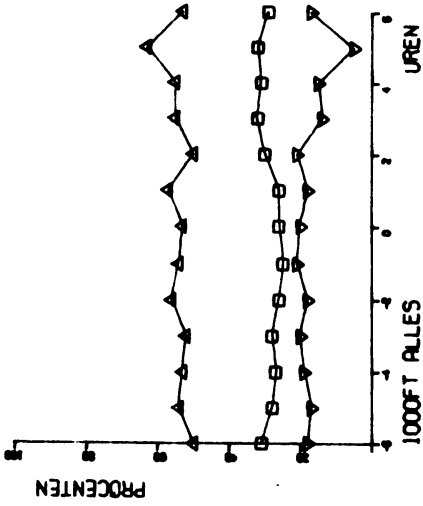
+2 UUR

SCHIPHOL

26 sep t/m 26 mrt

26 sep t/m 30 okt: 6 gmt
31 okt t/m 4 dec: 7 gmt
5 dec t/m 25 jan: 8 gmt
26 jan t/m 27 febr: 7 gmt
28 feb t/m 26 mrt: 6 gmt

WINTER ZONOP



- 3 -

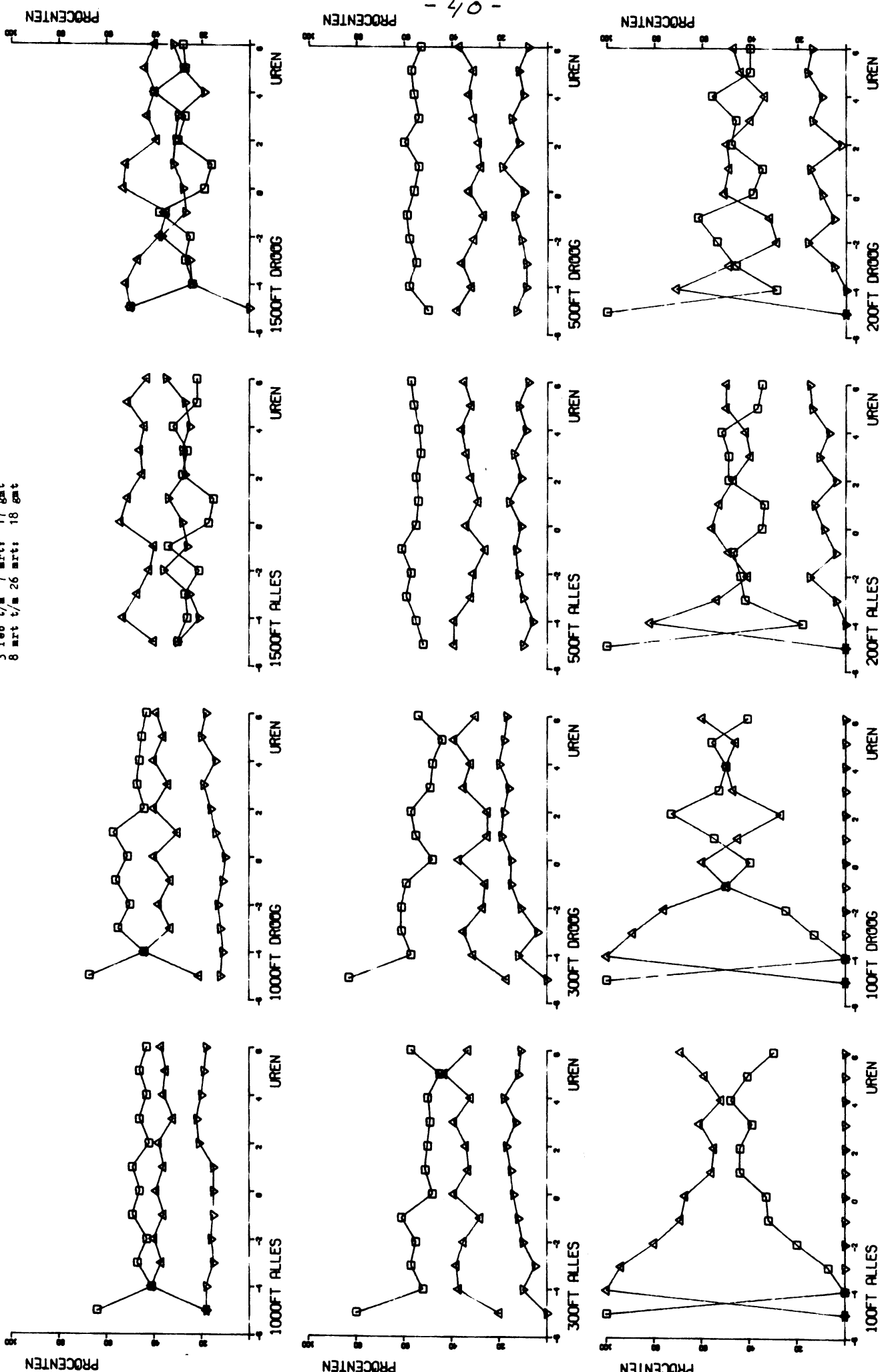
WINTER ZONONDER

26 sep t/m 23 okt: 17 gnt
 24 okt t/m 2 febr: 16 gnt
 3 febr t/m 7 mrt: 17 gnt
 8 mrt t/m 26 mrt: 18 gnt

26 sep t/m 26 mrt

SCHIPHOL

+1 UUR



+2 UUR

SCHIPHOL

26 sep t/m 26 mrt

26 sep t/m 23 okt: 17 gmt
24 okt t/m 2 feb: 16 gmt
3 feb t/m 7 mrt: 17 gmt
8 mrt t/m 26 mrt: 18 gmt

WINTER ZONONDER

