

Moored current meter data from JASIN 1978

by

Rolf H. KÄSE, Michaela KNOLL, Gerold SIEDLER and Walter ZENK

Institut für Meereskunde an der Universität Kiel

With 31 figures and 3 tables

Daten verankerter Strömungsmesser von JASIN 1978

Zusammenfassung

Nach einer kurzen Darstellung der mittleren hydrographischen Verhältnisse aus dem inneren Meßgebiet von JASIN (59° N, 12° 30' W) werden Daten aus Verankerungen K1, K2 und K3 in Form von Vektorzeitreihen, Zeitreihen der Komponenten als fortschreitende Vektordiagramme und in Häufigkeitsverteilungen dargestellt. K1 war eine Unterwasserverankerung mit 7 Aanderaa-Strömungsmessern in den oberen 1000 m. Bei K2 handelte es sich um eine doppelseitig verankerte formstabilisierte Oberflächenboje mit 6 VACM-Strömungsmessern und zusätzlichen Temperaturmeßgeräten im oberen Bereich der Sprungschicht. Zwei vertikal parallel angeordnete Thermistorketten im Tiefenbereich 2—82 m bildeten das Herzstück der K3, welche ebenso wie K2 mit meteorologischen Sensoren ausgestattet war. Die Verankerungen haben während mehrerer Wochen im Sommer 1978 Beobachtungswerte aufgezeichnet.

Summary

After a short presentation of mean hydrographic conditions at the Fixed Intensive Array of JASIN (59° N, 12° 30' W) data from moorings K1, K2 and K3 are given as stick plots and component time series, progressive vector diagrams, and frequency distributions. K1 was a subsurface mooring with 7 Aanderaa current meters in the upper 1000 m. K2 was equipped with a spar buoy carrying 6 VACMs and some additional temperature sensors in the upper thermocline. Two vertical and parallel thermistor chains in the depth range 2—82 m were the main sensor arrays of K3, which, like K2, was also equipped with meteorological sensors. Data from these moorings were obtained during several weeks in the summer of 1978.

1. Moorings

The international Joint Air-Sea Interaction Project JASIN 1978 included meteorological and oceanographic observations in the eastern North Atlantic west of Scotland. The main objectives of this programme and the field activities on research platforms from the Federal Republic of Germany were summarized by SIEDLER & ZENK (1980).

Three current meter moorings with self-recording instruments were deployed by the German participants in the Fixed Intensive Array (FIA). K1 was a single-point sub-surface mooring with 7 Aanderaa current meters and a small surface marker attached to the uppermost float. It served studies of the vertical structure of the internal wave field in the water column below 100 m. K2 included a spar buoy with 6 Vector Averaging Current Meters (VACM) and 2 Aanderaa thermistor chains suspended below. The spar buoy was tethered to 2 surface moorings. It allowed observations of the current and temperature stratification in the upper 110 m needed for mixed layer structure and internal wave studies. K3 was a surface mooring with a H-shaped thermistor chain array with drogue attached, its purpose being the observation of temperature microstructure variability in the mixed layer. Both K2 and K3 carried an Aanderaa meteorological package on a surface buoy. Although the moorings were deployed for individual projects, the obtained data supplement each other to some extent and will therefore be presented together in this paper. Analysis of the individual projects will be published separately at a later date.

Detailed figures of the 3 moorings were already shown in SIEDLER & ZENK (1980) before, only simpli-

Address: R. H. KÄSE, M. KNOLL, G. SIEDLER & W. ZENK, Institut für Meereskunde an der Univ. Kiel, Düsterbrookweg 20, D-2300 Kiel, FRG.

Table 1. Summary of available data from JASIN moorings K1, K2 and K3. Because of instrument displacements due to mooring motion caused by strong barotropic currents, data from the period before 10 August 1978 should be interpreted with caution.

Tabelle 1. Zusammenfassung aller verfügbarer Daten der JASIN-Verankerung K1, K2 und K3. Wegen Geräteverlagerungen infolge von Verankerungseigenbewegungen, die durch starke barotrope Ströme hervorgerufen wurden, sollten die Daten aus dem Zeitraum vor dem 10. August 1978 mit Vorsicht ausgewertet werden.

JASIN REF. NO.	IFM REF. NO.	DEPHT [m]	SENSOR TYPE	Δt [sec]		COMMENTS
K1	226 101	70	V T C P	600		T, C, P STARTING 10 AUG 78
	226 102	170	V T	600		T STARTING 10 AUG 78
	226 103	270	V T C	600		T, C STARTING 10 AUG 78
	226 104	480	V T C P	600		T, C, P STARTING 10 AUG 78
	226 105	580	V T	600		T STARTING 10 AUG 78
	226 106	780	T	600		T STARTING 10 AUG 78 NO SPEED DATA
	226 107	980	V T	600		T STARTING 10 AUG 78
K2	227 201	20	\bar{V} T	56.25		
	227 202	22.5	\bar{V} T	56.25		
	227 203	60	\bar{V} T	56.25		
	227 204	41-61	11T	600		
	227 206	80	T	56.25		NO SPEED DATA
	227 207	110	\bar{V} T	56.25		
	227 208	110	1T	600		T2-11 NO DATA
	227 301	-4 -8	\bar{V} T P	300		
	227 302	1547-1577	11T	600		
K3	228 101	-2	V T P	300		
	228 102	30	T	300		ROTOR LOST
	228 202	30	T	56.25		ROTOR LOST
	228 301	30	V T	300		
	228 103	2-82	15T	56.25		A-CHAIN
	228 302	8-82	14T	56.25		B-CHAIN T 15 NO DATA

fied schematics including the IFM reference numbers are therefore presented in Fig. 1. The available data and mooring positions are summarized in Tables 1 and 2, including some general comments on data quality.

Particular effort was made to calibrate the thermistor chains of mooring K3 before the experiment. Groups of 16 sensors were calibrated at 7 temperatures, with reference to a quartz thermometer. The data points were fitted by a spline procedure. The resolution obtained was ± 0.003 °C. The data were recorded on Sea Data tape cassettes and transferred to computer tape after automatic reading.

Data processing at the Institut für Meereskunde of Aanderaa and VACM instruments followed the standard procedures like those described earlier by KÄSE et al. (1978).

2. Data presentation

As an introduction to the mooring data in Figures 2-3 we present a selection of temperature, salinity and σ_t -profiles, including their standard deviations.

These CTD data originate from Multisonde and Bathysonde observations onboard R.V. "Meteor" and W.F.S. "Planet". "Meteor" operated in the vicinity of our moorings within the three JASIN phases: 8-22 July (Phase 0), 23 July-16 August (Phase 1) and 17 August-16 September 1978 (Phase 2). "Planet" was present during phase 2 only. For logistical details the reader may refer to SIEDLER & ZENK (1980). A report on all stratification data has been prepared by KNOLL (1983). Current meter data from moorings are structured into three groups: K1 figures 4-14b, K2 figures 14c-24, 26, 30 and K3 figures 25, 27-29, 31. After the presentation of stick plot diagrammes, progressive vector diagrammes are shown. They are followed by grouped time series of current components and temperatures of the individual instruments and frequency distributions of selected temperature and current components.

Meteorological observations are summarized in Figures 30 and 31. A summary of the figure collection is given in Table 3.

Table 2. Mooring positions
Tabelle 2. Positionen der Verankerungen

JASIN ref. no.	IFM ref. no.	ϕ (N)	λ (W)
K1	226	58° 59.7'	12° 30.5'
K2	227	58° 59.0'	12° 31.0'
K3	228	58° 59.2'	12° 32.3'

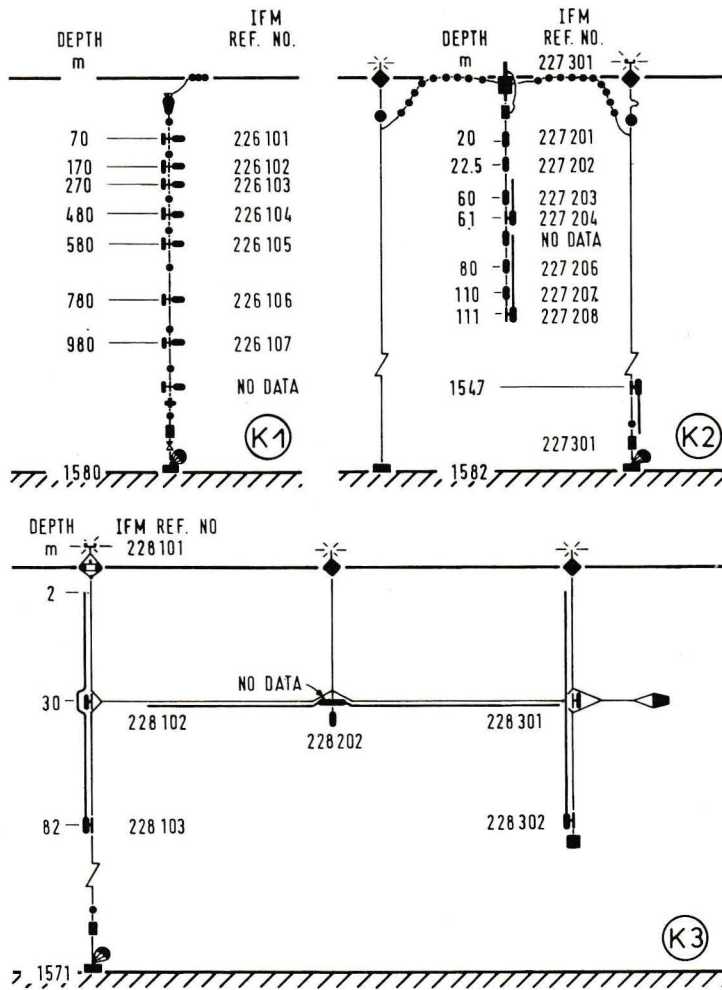


Fig. 1. JASIN moorings K1, K2 and K3. Pattern of instrument positions not to scale.

Abb. 1. JASIN-Verankerungen K1, K2 und K3. Die Darstellung der Instrumentenanordnung ist nicht maßstabsgetreu.

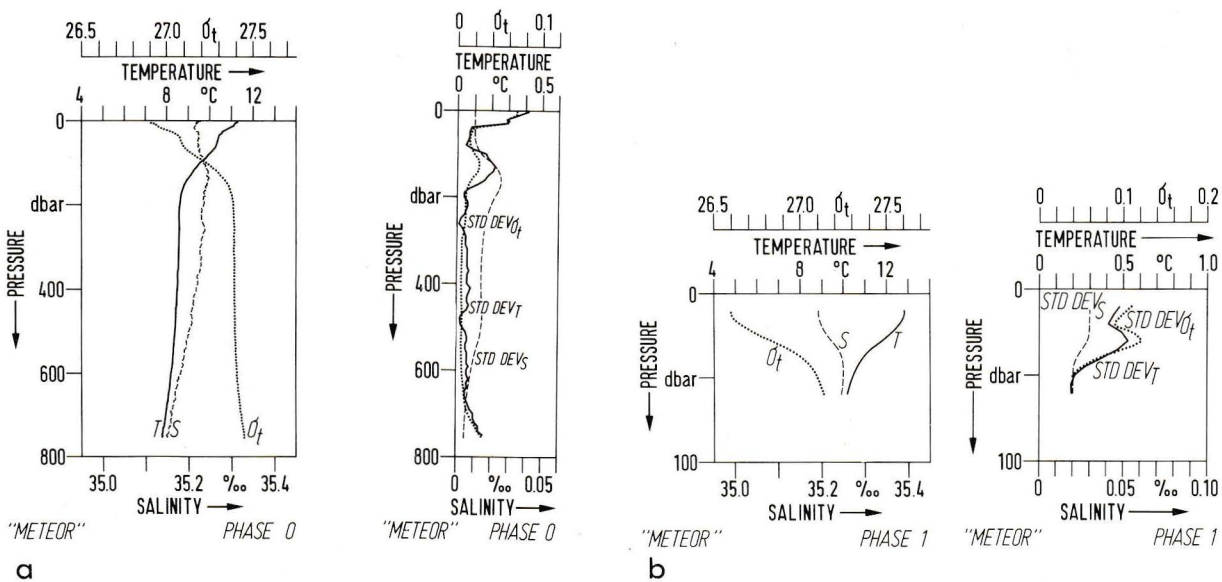


Fig. 2. Mean stratification and standard deviations (STD DEV) from Multisonde profiles taken from F.S. "Meteor" in Phase 0, 6 samples (a) and Phase 1, 1100 samples (b).

Abb. 2. Mittlere Schichtung und Standardabweichungen (STD DEV) aus Profilen mit der Multisonde nach Messungen auf F. S. „Meteor“ während der Phase 0, 6 Profile (a) und Phase 1, 1100 Profile (b).

Acknowledgements

This work has been supported by the Deutsche Forschungsgemeinschaft, Bonn. We would like to acknowledge the assistance of the crews of the research vessels "Meteor" and "Planet" and of the technical and data processing staff of the Marine Physics Group of the Institut für Meereskunde at Kiel University.

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- SIEDLER, G. & W. ZENK (1980): JASIN 1978 Field activities on the research vessels "Meteor", "Planet", "Poseidon" and the research aircraft D-CMET. — "Meteor" Forsch.-Ergebn. A, No. 21, 25–48.

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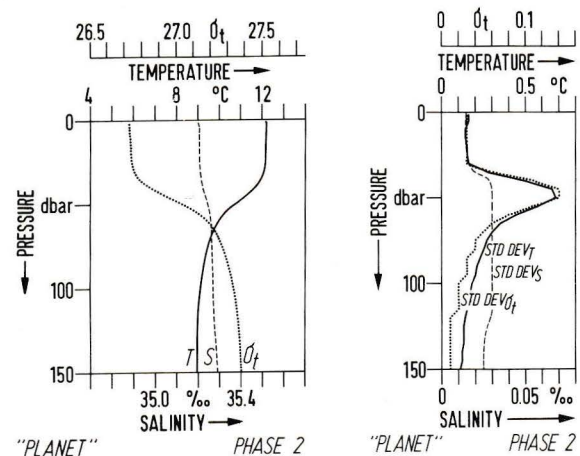


Fig. 3. Mean stratification and standard deviations (STD DEV) from 141 Bathysonde profiles taken from W.F.S. "Planet" in Phase 2.

Abb. 3. Mittlere Schichtung und Standardabweichungen (STD DEV) von 141 Profilen mit der Bathysonde nach Messungen auf W. F. S. „Planet“ während der Phase 2.

fig.	JASIN ref.no.	IfM ref.no.	mean depth(m)	freq. distr.	time series	progr. vector diagram	stick plot
4,5	226101	K1	70			x	x
4,5	02		170			x	x
4,5	03		270			x	x
4,5	04		480			x	x
4,5	05		580			x	x
4,5	07		980			x	x
6	01		70				
7	02		170		PTS σ_t UV TUV		
8	03		270		PTS σ_t UV		
9	04		480		PTS σ_t UV		
10	05		580		TUV		
11	06		780		T		
12	07		980		TUV		
13	226101, 02,03, 04,05, 06,07	K1		T			
14a,b	226101, 02,03, 04,05, 07	K1		UV			
14c,d	227201, 02,03, 07	K2		\overline{UV}			
15,16	227201	K2	20			x	x
15,16	02		22.5			x	x
15,16	03		60			x	x
15,16	07		110			x	x
17	01		20		\overline{TUV}		
18	02		22.5		\overline{TUV}		
19	03		60		\overline{TUV}		
20	06		80		T		
21	07		110		\overline{TUV}		
22	08		110		T		
23	227302	K2	5,35 above bottom		TT		
24	227204	K2	41,51,61		TTT		
25	228103	K3	8,42,82		TTT		
26	227301 227201, 04,08 227302	K2		T			
27	228301	K3	30				x
28	301		30		TUV		
29	202		30		T		
30	227301	K2	on buoy		PTUV	x	x
31	228101	K3	on buoy		PTUV	x	x

Table 3. Summary of figures. Data presented are indicated by x or by the following identifiers: U, V = east, north current/wind components from Aanderaa instruments, \overline{U} , \overline{V} from vector averaging current meters (VACM), T = temperature, P = pressure, S = salinity, σ_t = density.

Tabelle 3. Zusammenfassende Bildübersicht. Die dargestellten Daten sind durch x oder die folgenden Buchstaben gekennzeichnet: U, V, Ost-, Nord-Strömungs/Windkomponente, \overline{U} , \overline{V} wie zuvor von VACM-Strommessern, P = Druck, T = Temperatur, S = Salzgehalt, σ_t = Dichte.

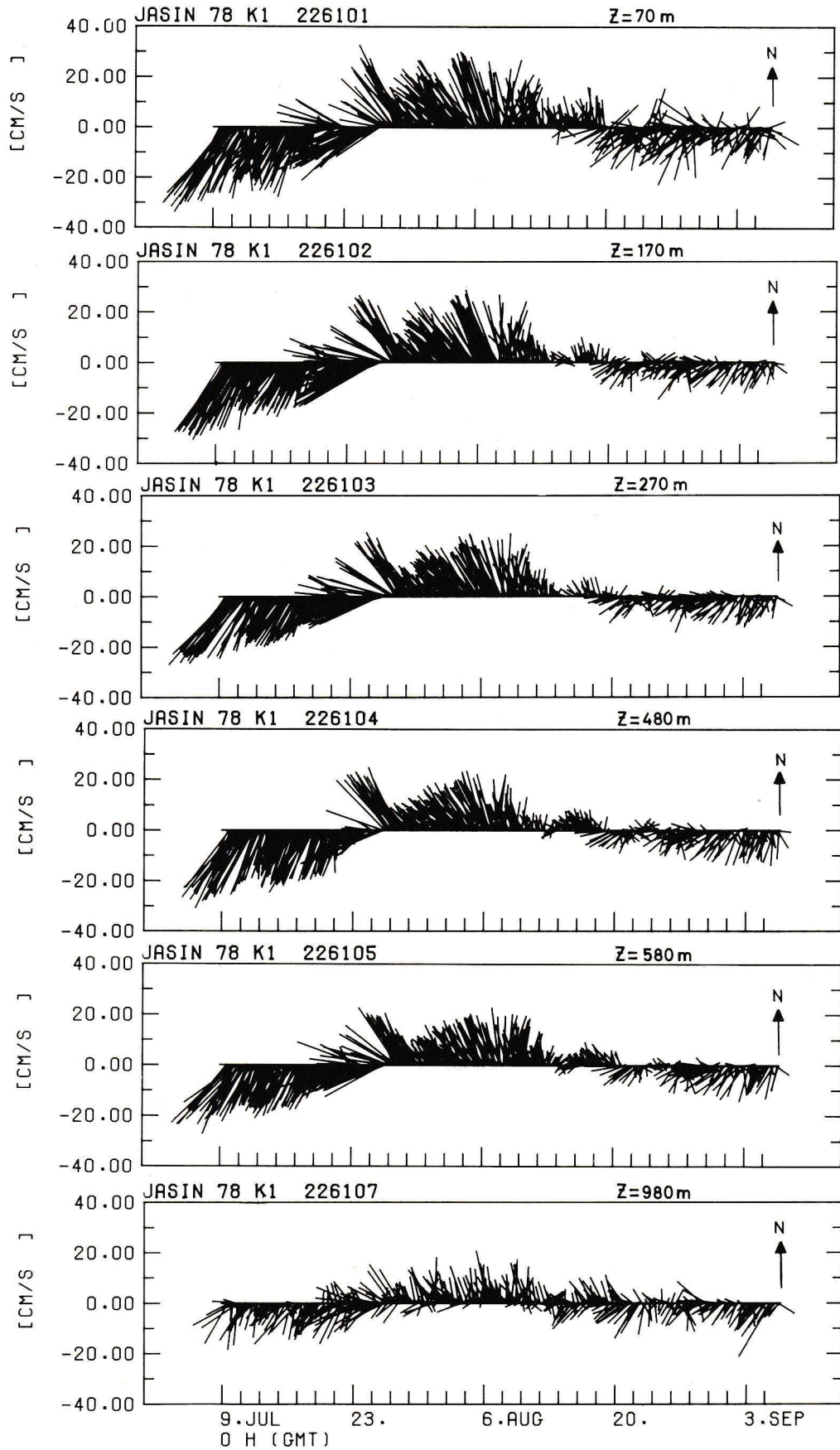


Fig. 4. Stick plots of K1 current meters.

Abb. 4. Vektordiagramme der K1-Strömungsmesser.

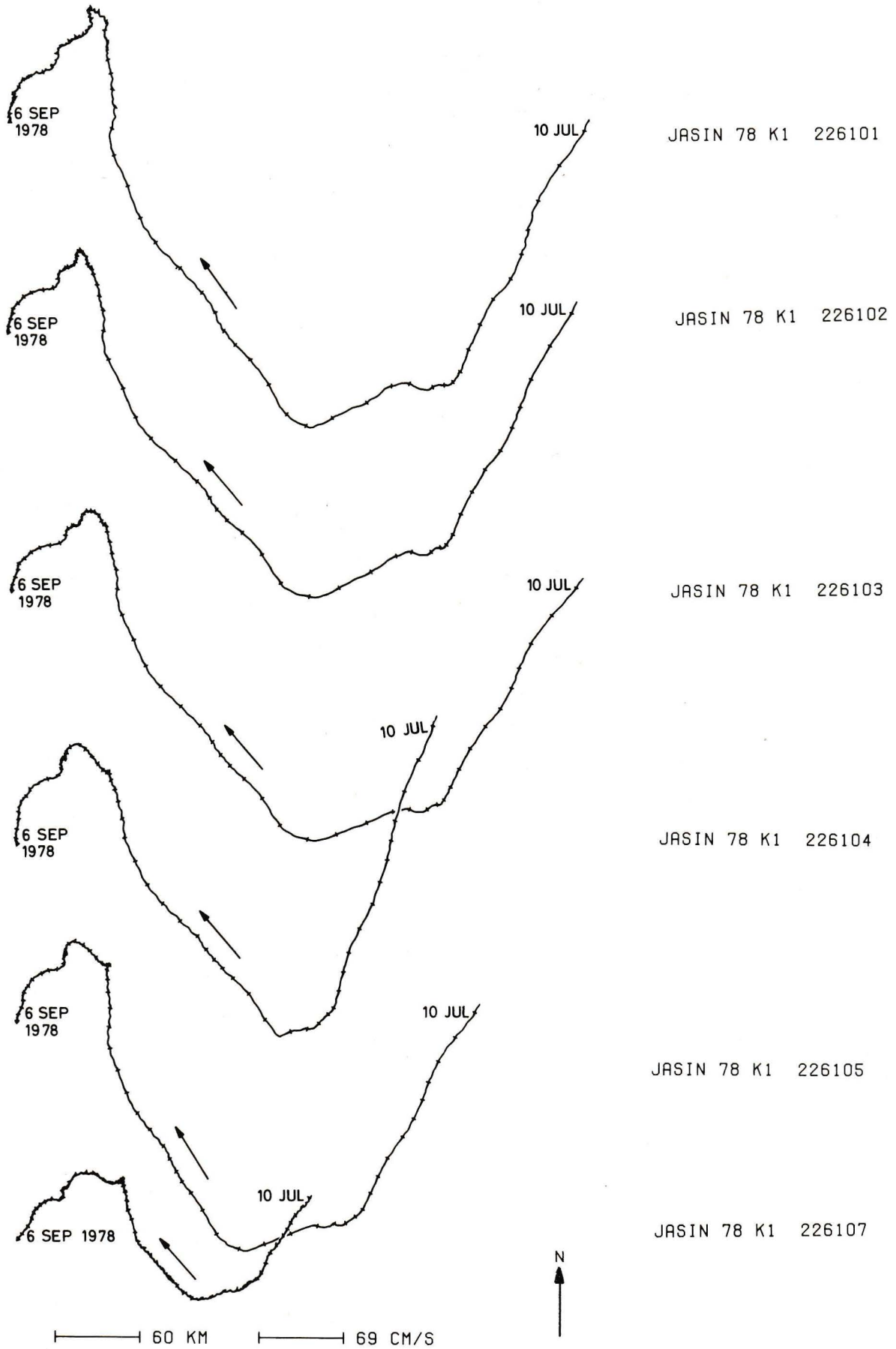


Fig. 5. Progressive vector diagrammes of K1 current meters. Tick marks indicate beginning of each day.

Abb. 5. Fortschreitende Vektordiagramme der K1-Strömungsmesser. Die Markierungen zeigen den Beginn der einzelnen Tage an.

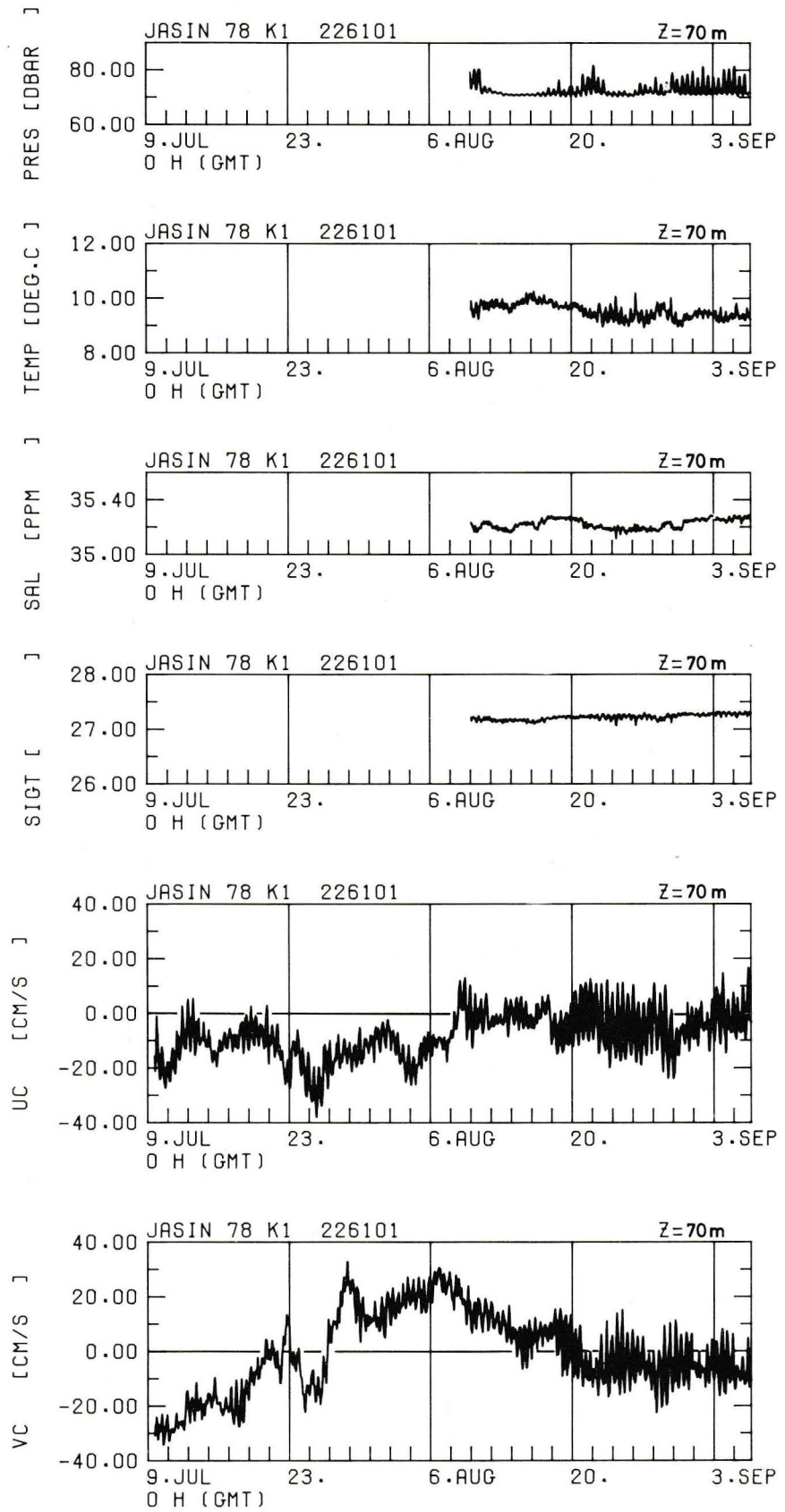


Fig. 6. Time series of K1 records 226 101.

Abb. 6. Zeitreihen der K1-Messungen 226 101.

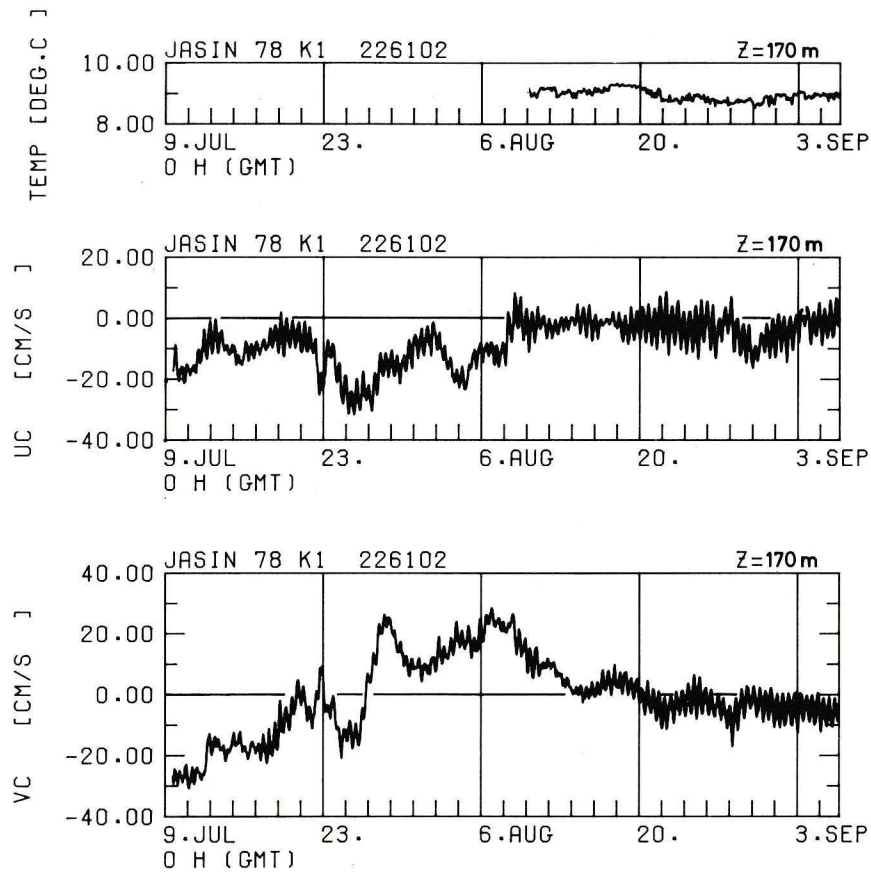


Fig. 7. Time series of K1 records 226 102.
 Abb. 7. Zeitreihen der K1-Messungen 226 102.

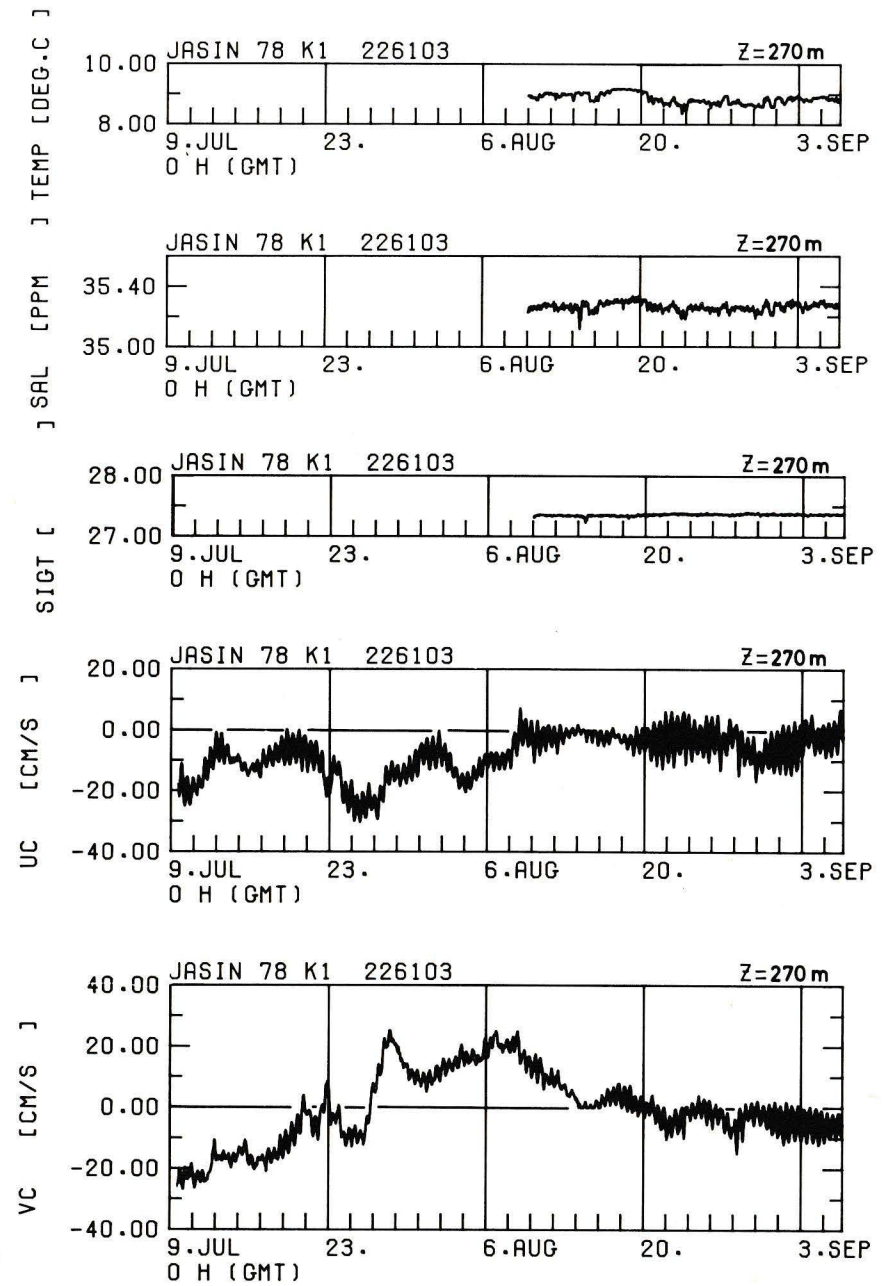


Fig. 8. Time series of K1 records 226 103.
 Abb. 8. Zeitreihen der K1-Messungen 226 103.

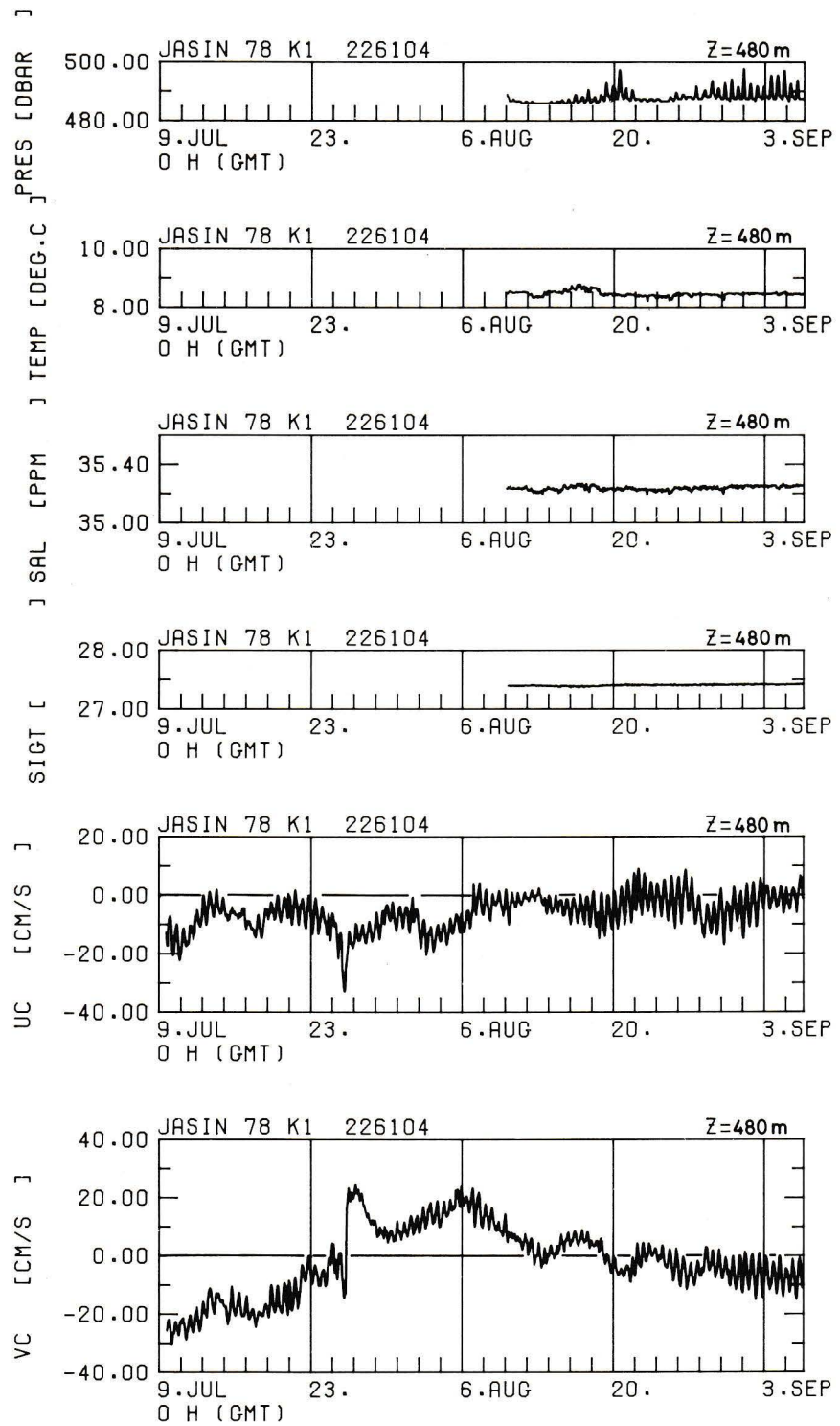


Fig. 9. Time series of K1 records 226 104.

Abb. 9. Zeitreihen der K1-Messungen 226 104.

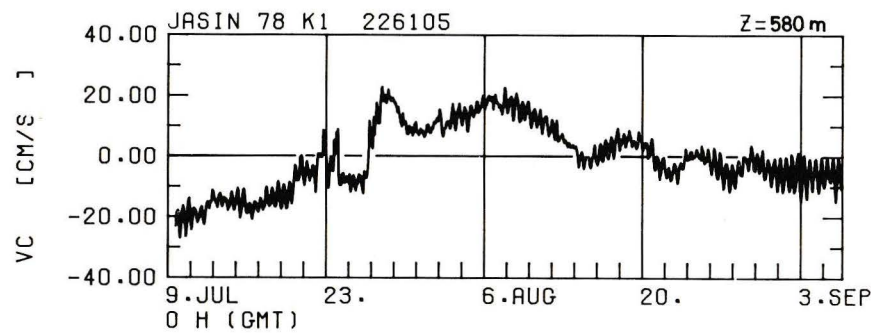
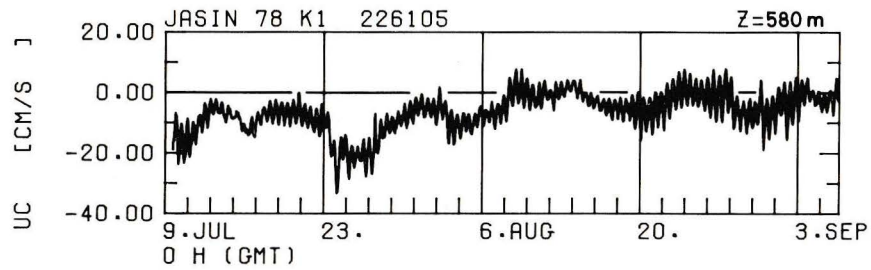
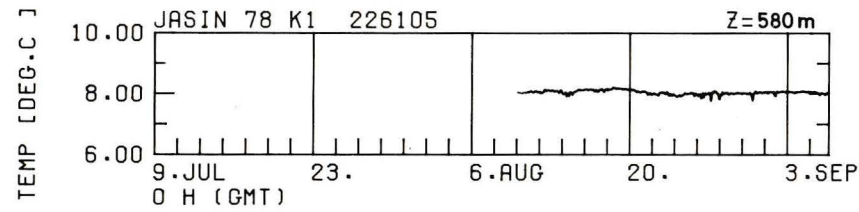


Fig. 10. Time series of K1 records 226 105.
 Abb. 10. Zeitreihen der K1-Messungen 226 105.

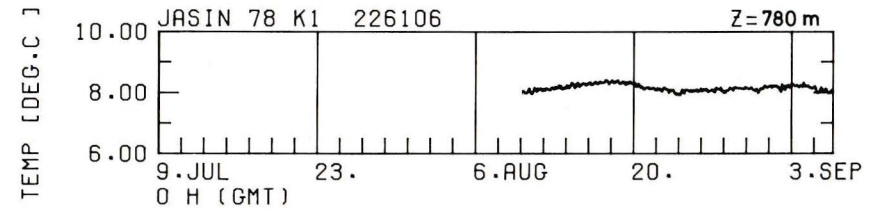


Fig. 11. Time series of K1 temperature record 226 106.
 Abb. 11. Zeitreihen der K1-Temperaturmessung 226 106.

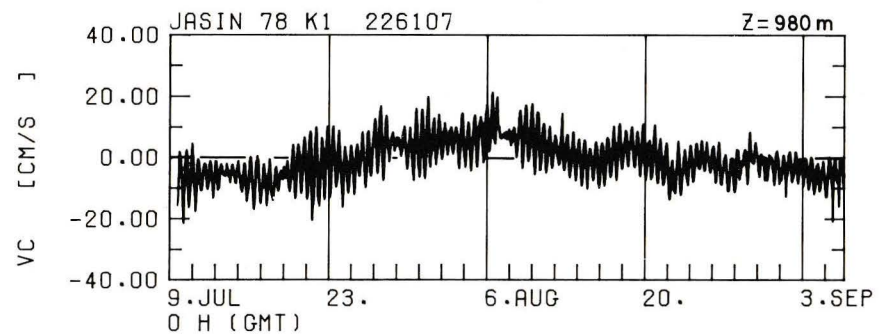
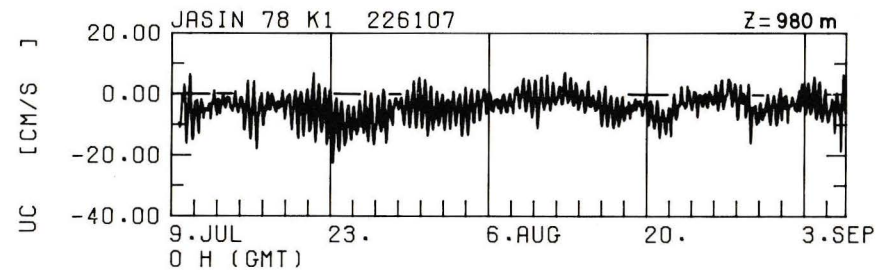
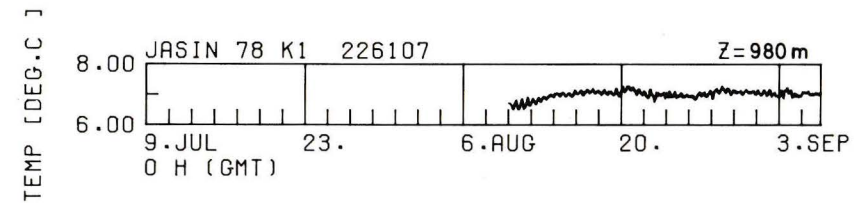


Fig. 12. Time series of K1 records 226 107.
 Abb. 12. Zeitreihen der K1-Messungen 226 107.

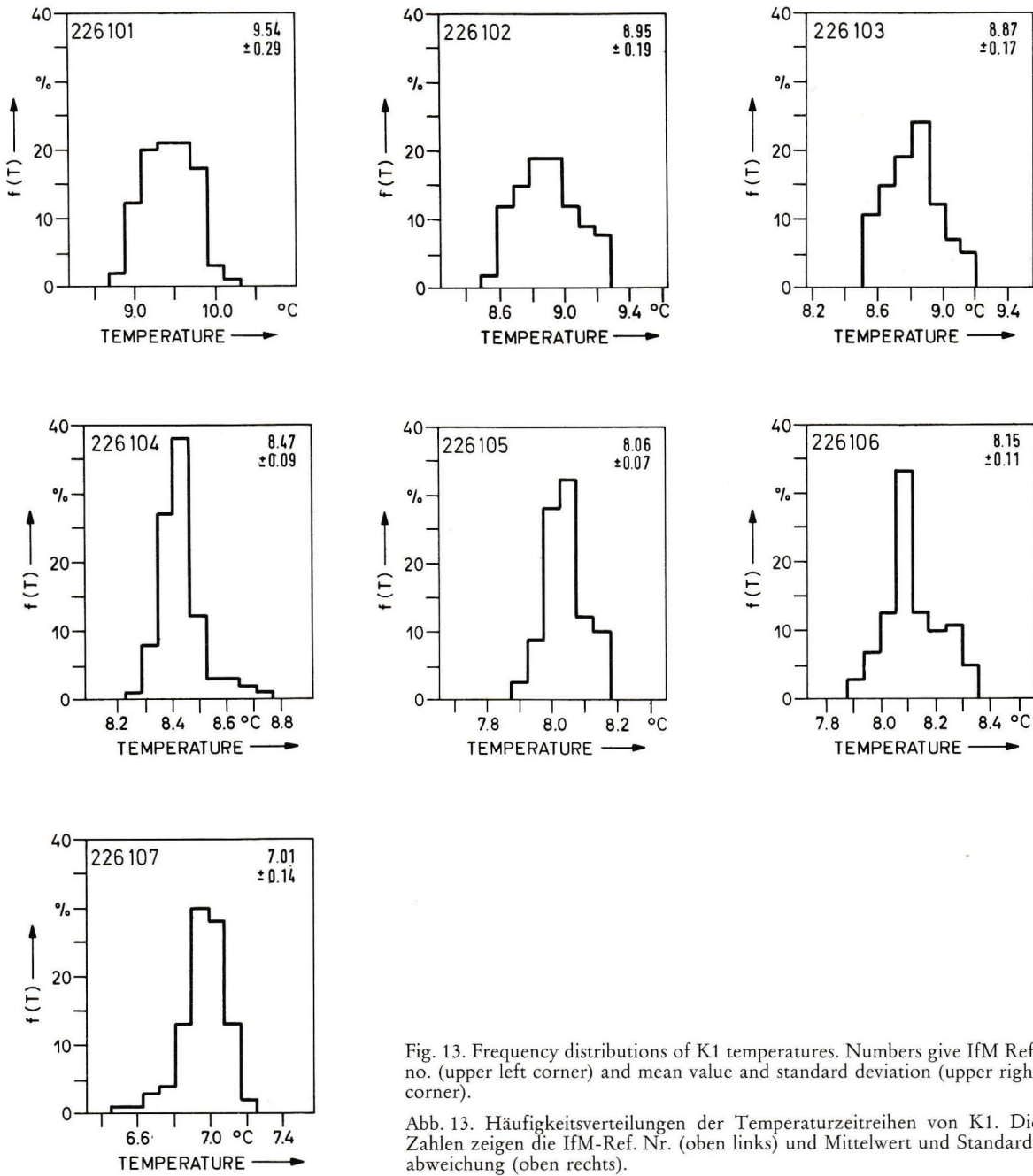


Fig. 13. Frequency distributions of K1 temperatures. Numbers give IfM Ref. no. (upper left corner) and mean value and standard deviation (upper right corner).

Abb. 13. Häufigkeitsverteilungen der Temperaturzeitreihen von K1. Die Zahlen zeigen die IfM-Ref. Nr. (oben links) und Mittelwert und Standardabweichung (oben rechts).

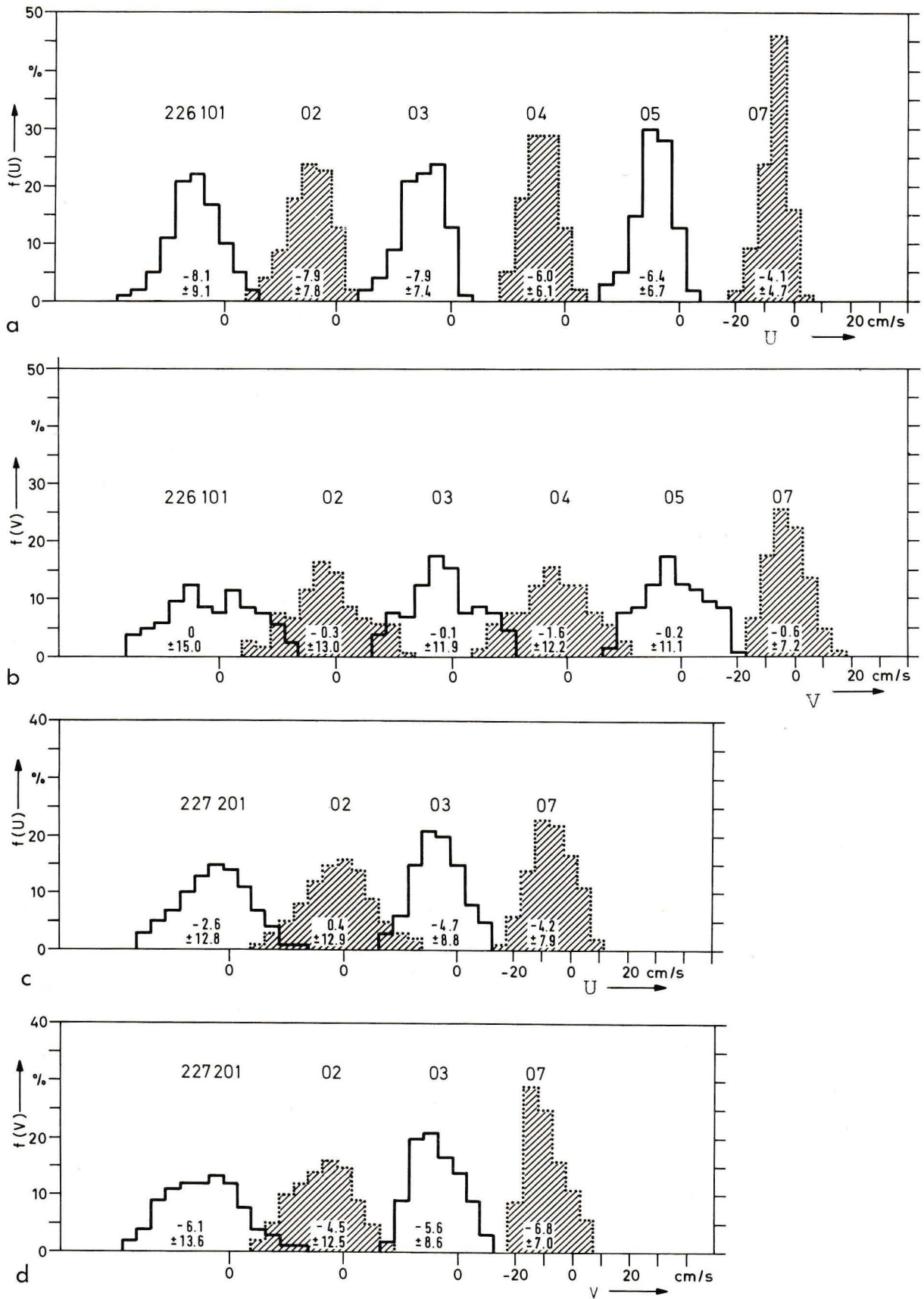


Fig. 14. Frequency distributions of current components of moorings K1 (a, b) and K2 (c, d). Numbers give IfM Ref. no. (on top) and mean value and standard deviation (below).

Abb. 14. Häufigkeitsverteilung der Strömungskomponenten der Verankerungen K1 (a,b) und K2 (c, d). Die Zahlen zeigen die IfM-Ref. Nr. (oben) und Mittelwert und Standardabweichung (unten).

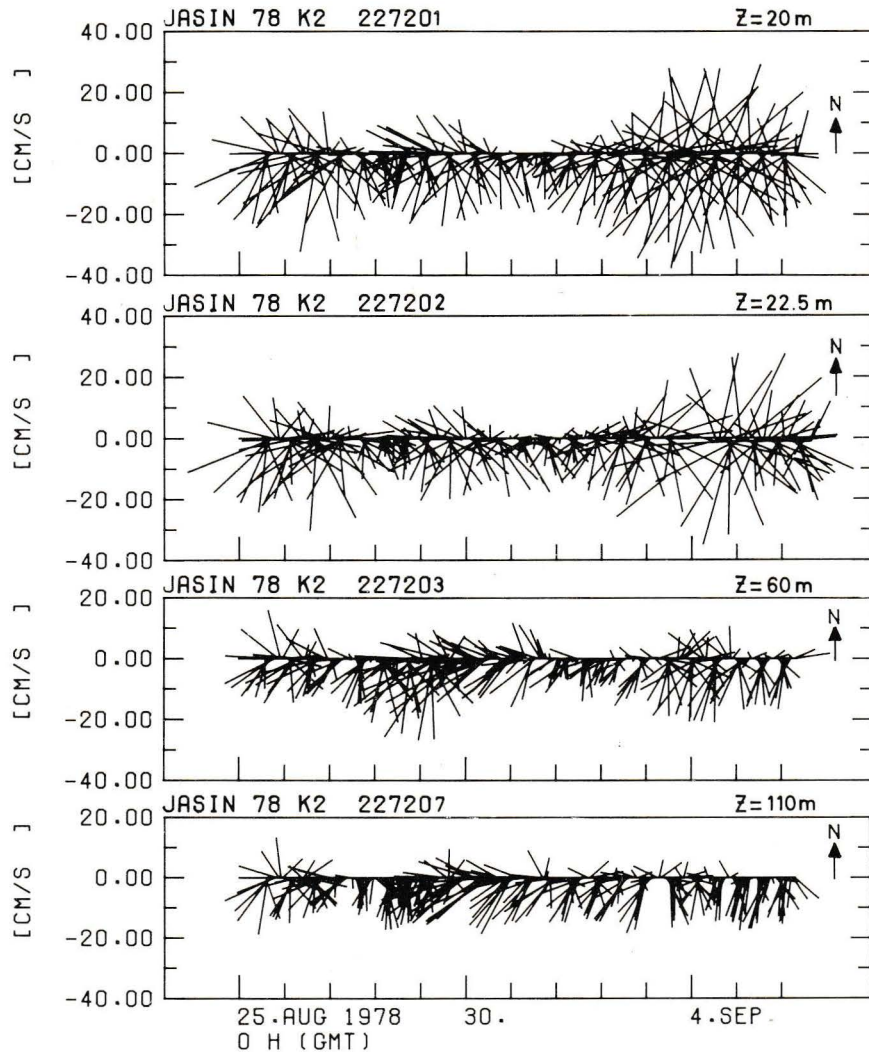


Fig. 15. Stick plots of K2-current meters.

Abb. 15. Vektordiagramme der K2-Strömungsmesser.

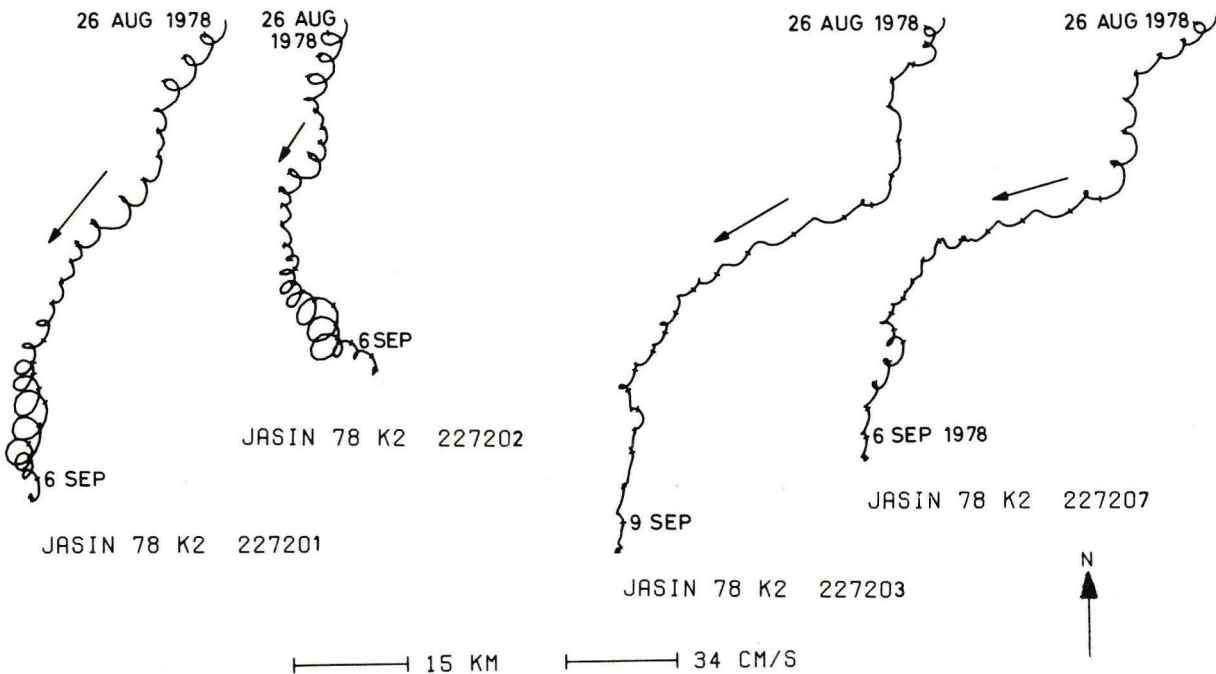


Fig. 16. Progressive vector diagrammes of K2 current meters. Tick marks indicate beginning of each day.

Abb. 16. Fortschreitende Vektordiagramme der K2-Strömungsmesser. Die Markierungen zeigen den Beginn der einzelnen Tage an.

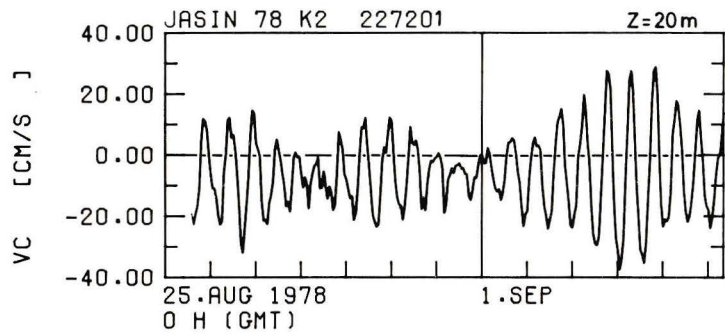
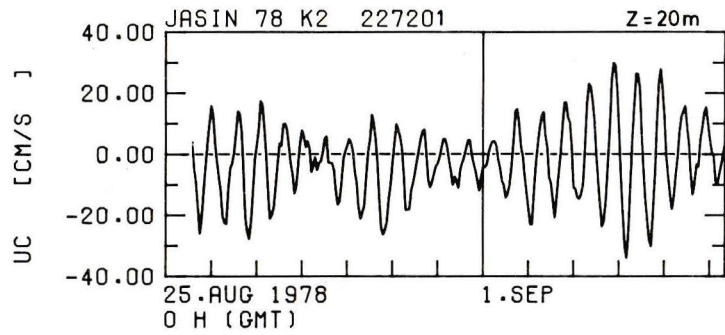
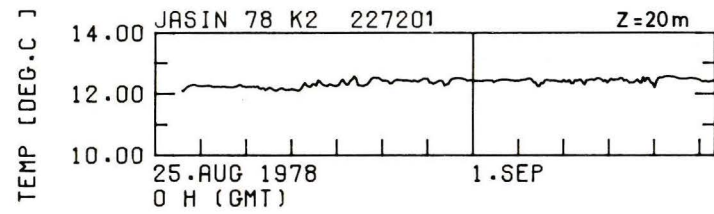


Fig. 17. Time series of K2 records 227 201.

Abb. 17. Zeitreihen der K2-Messungen 227 201.

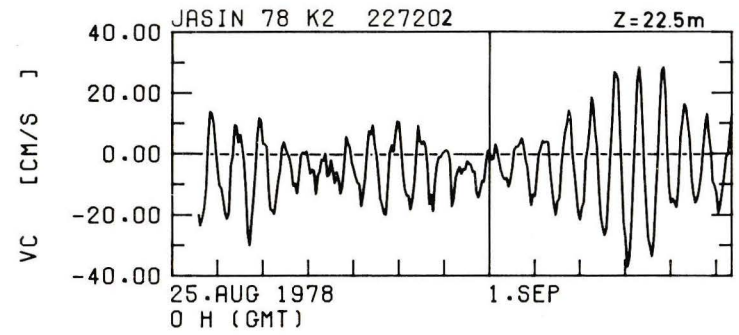
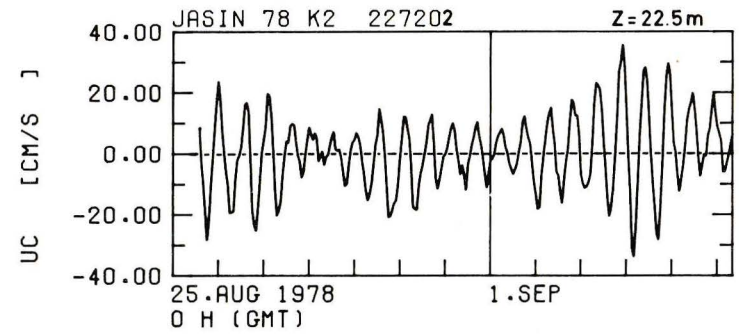
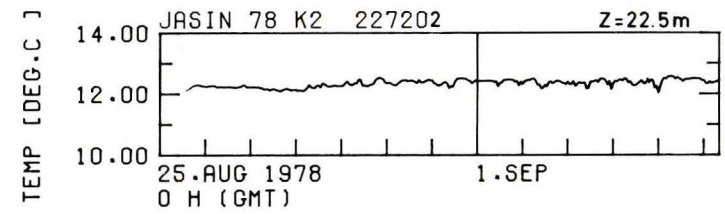


Fig. 18. Time series of K2 records 227 202.

Abb. 18. Zeitreihen der K2-Messungen 227 202.

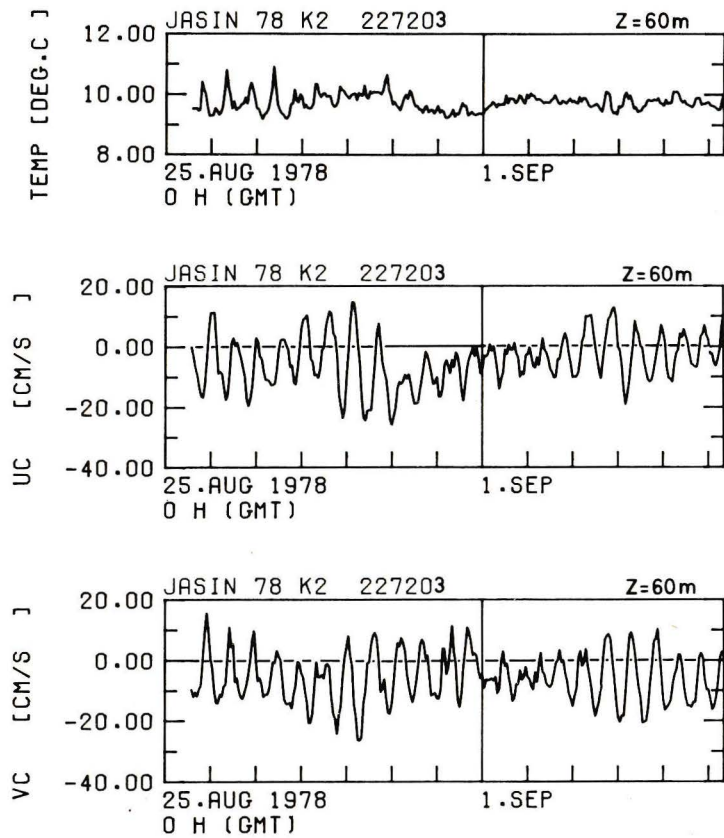


Fig. 19. Time series of K2 records 227 203.
Abb. 19. Zeitreihen der K2-Messungen 227 203.

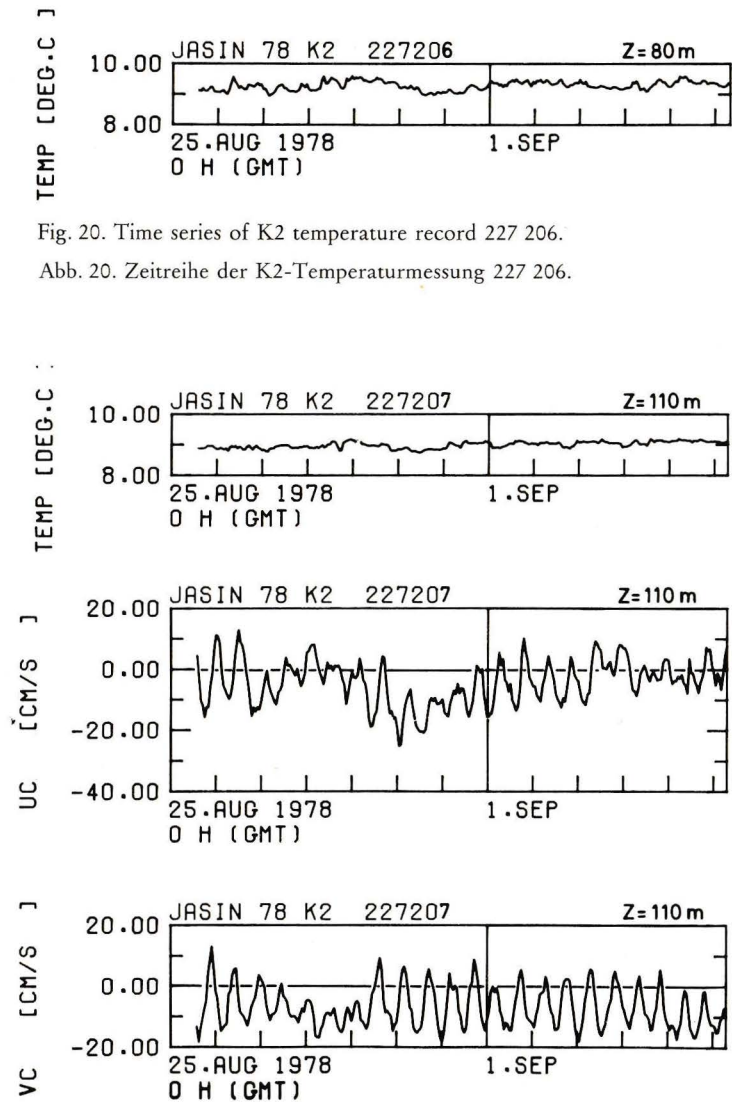


Fig. 20. Time series of K2 temperature record 227 206.
Abb. 20. Zeitreihe der K2-Temperaturmessung 227 206.

Fig. 21. Time series of K2 records 227 207.
Abb. 21. Zeitreihen der K2-Messungen 227 207.

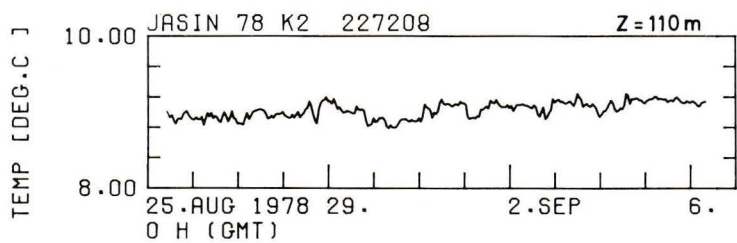


Fig. 22. Legend see opposite p.

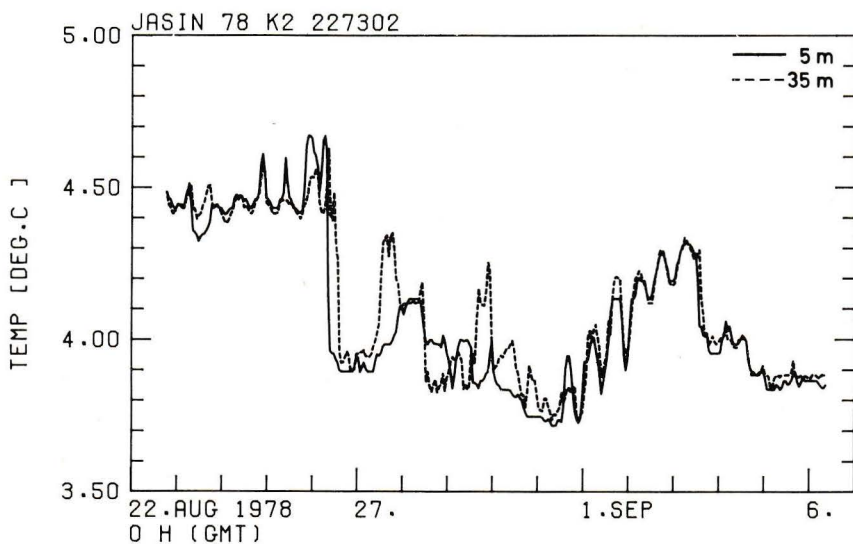


Fig. 23. Legend see opposite p.

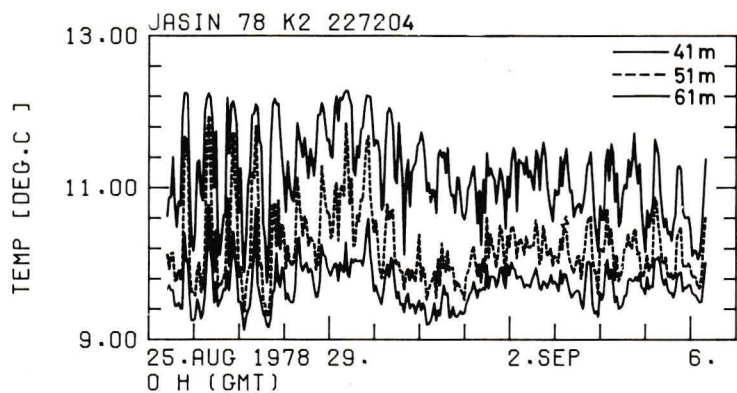


Fig. 24. Legend see opposite p.

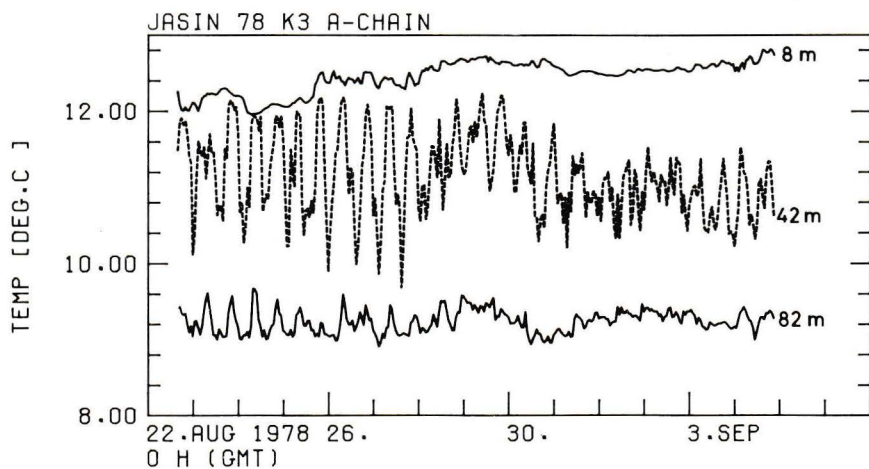


Fig. 25. Legend see opposite p.

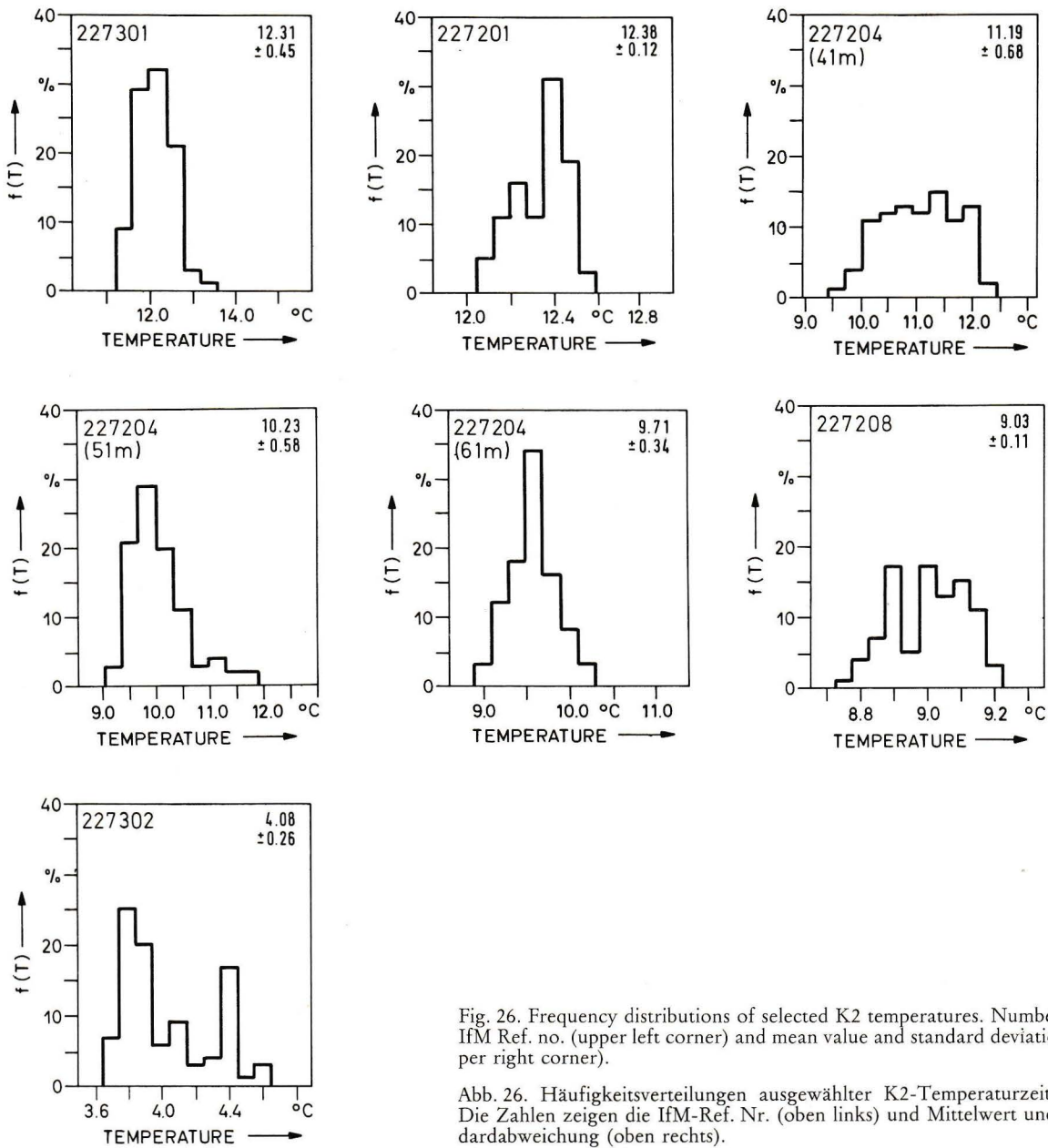


Fig. 26. Frequency distributions of selected K2 temperatures. Numbers give IfM Ref. no. (upper left corner) and mean value and standard deviation (upper right corner).

Abb. 26. Häufigkeitsverteilungen ausgewählter K2-Temperaturzeitreihen. Die Zahlen zeigen die IfM-Ref. Nr. (oben links) und Mittelwert und Standardabweichung (oben rechts).

Fig. 22. Temperature time series of K2 thermistor chain 227 208.

Abb. 22. Temperatur-Zeitreihe der K2-Thermistorkette 227 208.

Fig. 23. Selected temperature time series of the K2 near bottom thermistor chain 227 302. Numbers indicate clearance from bottom.

Abb. 23. Ausgewählte Temperatur-Zeitreihen der K2-Thermistorkette 227 302, die in Bodennähe registriert hat. Die Zahlen beinhalten den Sensorabstand vom Boden.

Fig. 24. Selected temperature time series of K2 thermistor chain 227 204. Numbers indicate sensor depths.

Abb. 24. Ausgewählte Temperatur-Zeitreihen der K2-Thermistorkette 227 204. Die Zahlen beinhalten die Sensortiefen.

Fig. 25. Selected temperature time series of K3 thermistor chain 228 103. Numbers indicate sensor depths.

Abb. 25. Ausgewählte Temperatur-Zeitreihen der K3-Thermistorkette 228 103. Die Zahlen beinhalten die Sensortiefen.

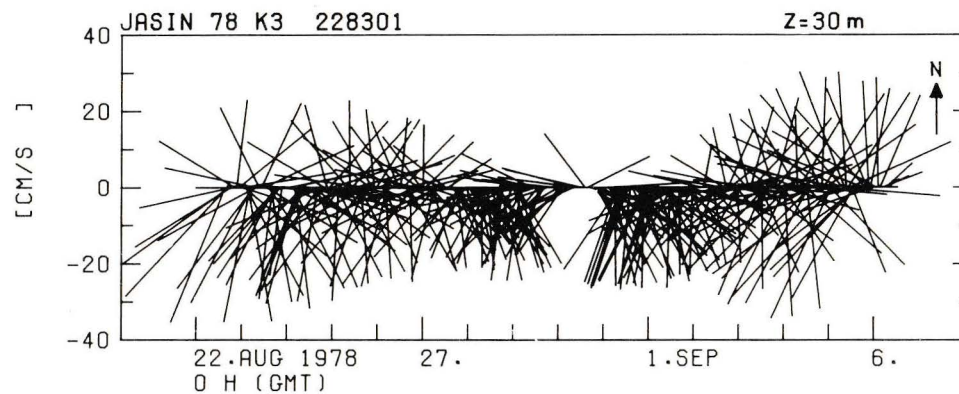


Fig. 27. Stick plot of K3 current meter 228 301.

Abb. 27. Vektordiagramm des K3-Strömungsmessers 228 301.

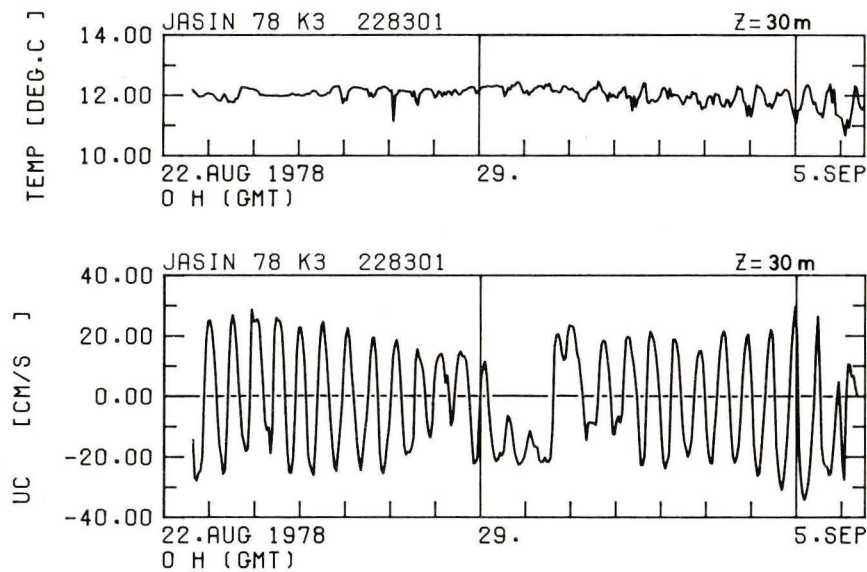


Fig. 28. Time series of K3 current meter 228 301. The instrument vane was attached to the horizontal mooring rope.

Abb. 28. Zeitreihen der K3-Strömungsmesser 228 301. Die Instrumentenfahne war fest mit dem horizontalen Verankerungsseil verbunden.

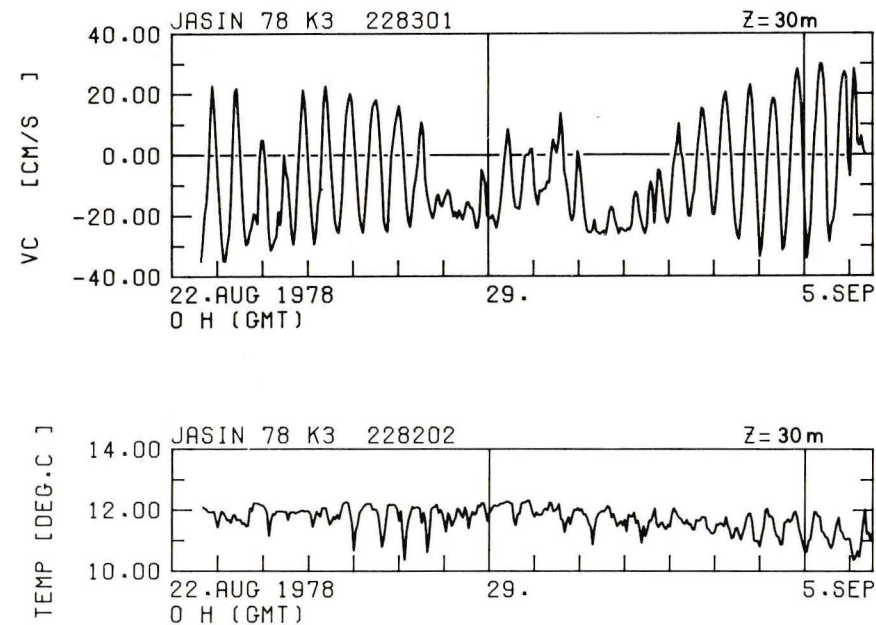


Fig. 29. Temperature time series 228 202.

Abb. 29. Temperatur-Zeitreihe 228 202.

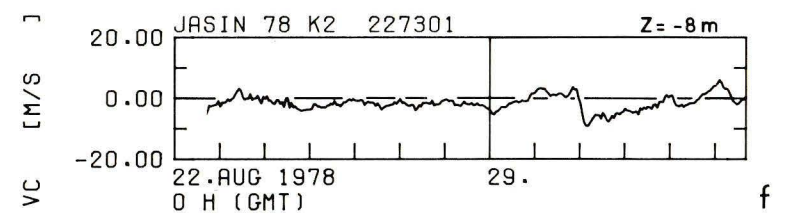
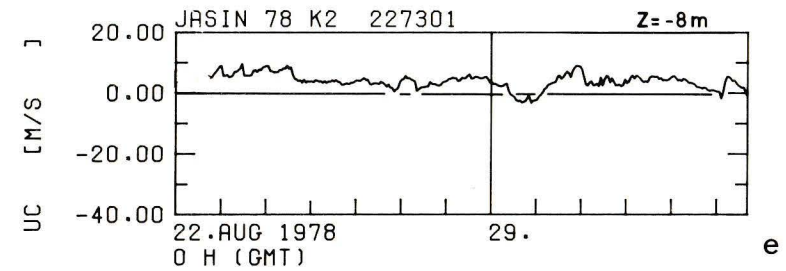
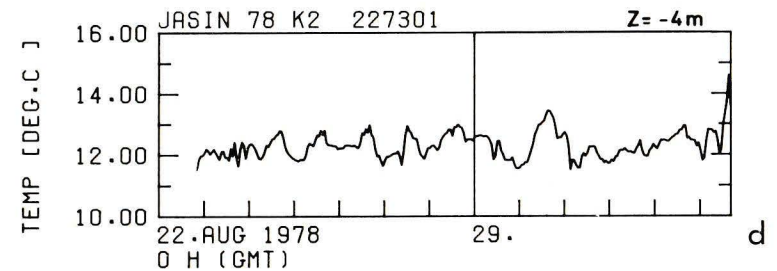
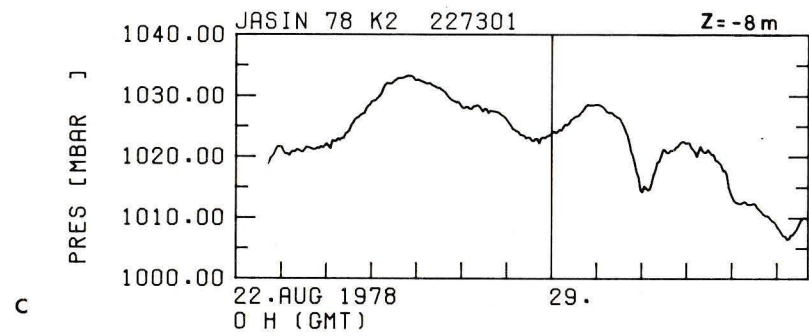
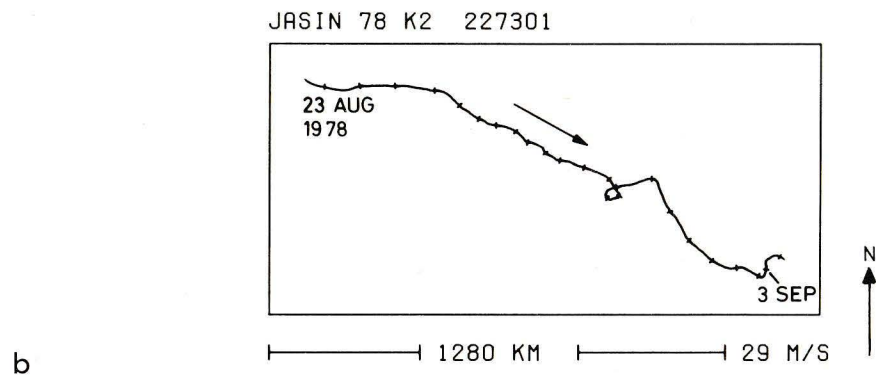
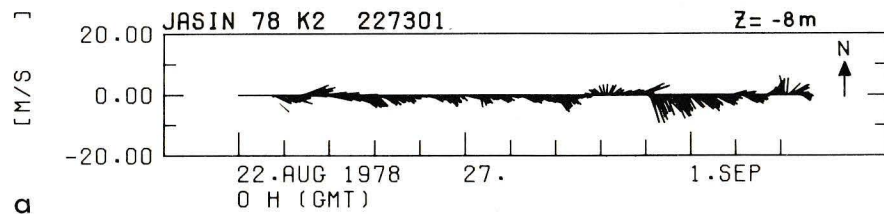


Fig. 30. Meteorological observations from K2 buoy: Stick plot (a), progressive vector diagramme (b), barometric pressure (c), air temperature (d), and wind speed components (e, f). Directions are given in oceanographic notation.

Abb. 30. Meteorologische Beobachtungen von der K2-Boje: Vektordiagramm (a), fortschreitendes Vektordiagramm (b), Luftdruck (c), Lufttemperatur (d) sowie Windgeschwindigkeitskomponenten (e, f). Richtungen sind in ozeanographischer Bezeichnungswiese angegeben.

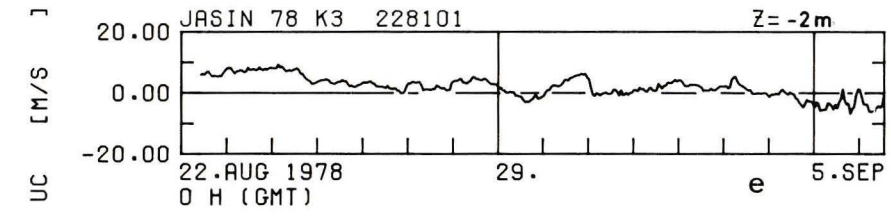
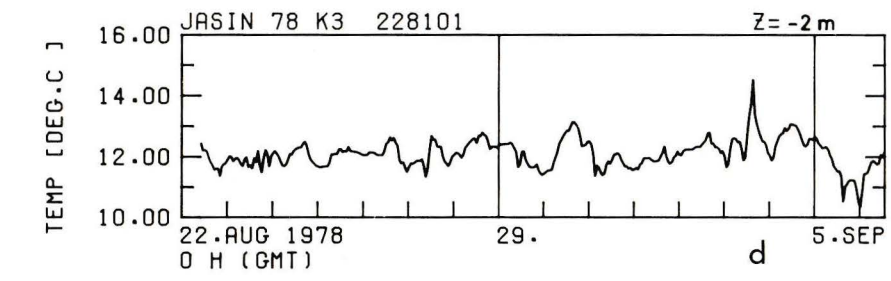
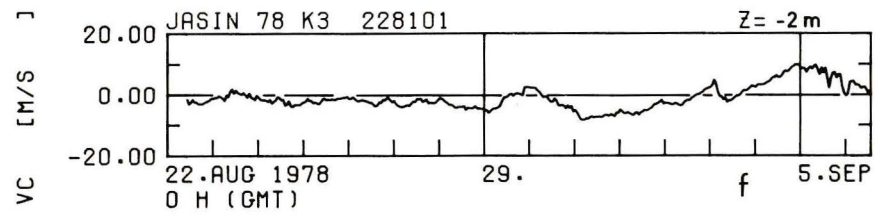
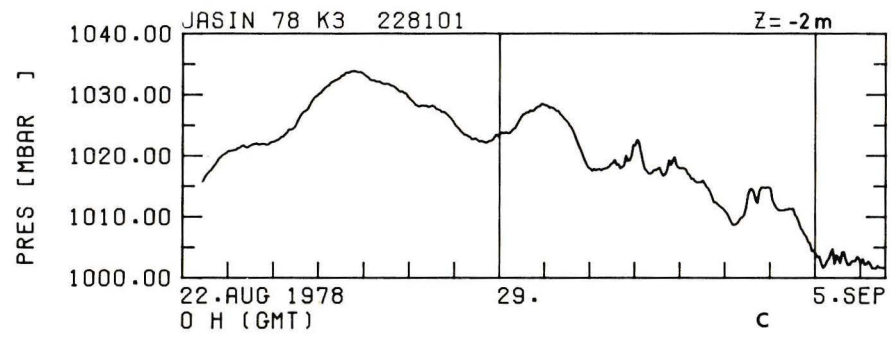
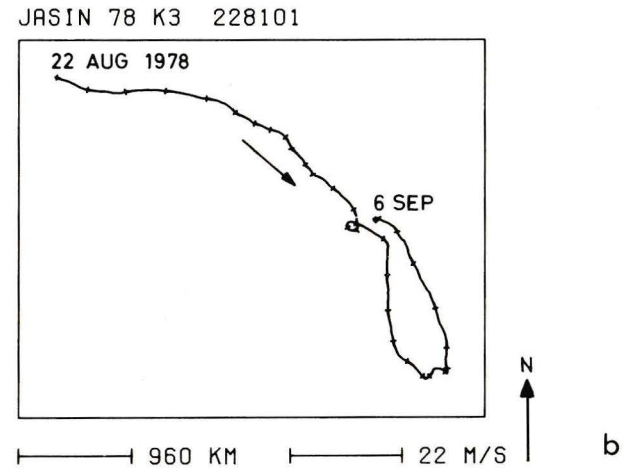
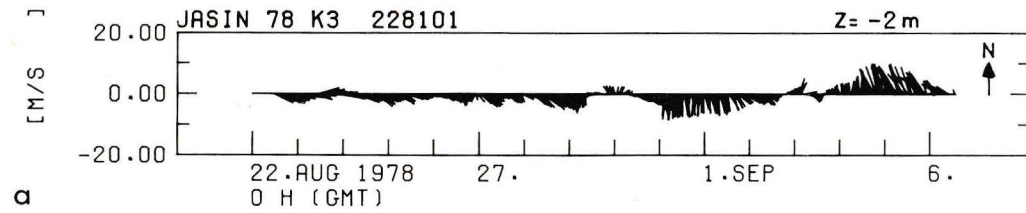


Fig. 31. Meteorological observations from K3 buoy: Stick plot (a), progressive vector diagramme (b), barometric pressure (c), air temperature (d), and wind speed components (e, f). Directions are given in oceanographic notation.

Abb. 31. Meteorologische Beobachtungen von der K3-Boje: Vektordiagramm (a), fortschreitendes Vektordiagramm (b), Luftdruck (c), Lufttemperatur (d) sowie Windgeschwindigkeitskomponenten (e, f). Richtungen sind in ozeanographischer Bezeichnung angegeben.