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International Council for
the Exploration of the Sea

C.M. 1974/C:16
Hydrography Committee

The Prediction of major Baltic inflows: Situation Report
at 1 July 1974

by

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Three recent papers (Dickson, 1971, 1972, 1973) have developed the theory of Baltic inflow prediction to which this paper refers. The reader is referred to these for a full explanation of the theory, but the essentials may be summarised as follows:

- (i) That in addition to the occurrence of favourable short-term meteorological conditions over the Baltic, an augmented deep saline influx to the Skagerrak is an essential precondition for the generation of major Baltic inflows.
- (ii) That the periodic salinification of the north-west European Shelf (including the deeper layers of the Skagerrak) is attributable to the recurrence of a particular persistent anomaly in the Atlantic windfield.
- (iii) Accordingly, the incidence of major Baltic inflows appears to be at least partly determined by the large-scale Atlantic windfield rather than by purely local meteorological events over the Baltic.
- (iv) Thus, if the recurrence of this Atlantic circulation anomaly could be detected by a close monitoring of suitable indices, we may take advantage of the expected time-lag between cause and ultimate effect to interpose a short-term forecast of Baltic inflow when this specific circulation anomaly becomes established.

A first attempt at inflow prediction using this method was completed in January 1972, when meteorological and hydrographic evidence suggested that inflow to the Baltic was imminent (Dickson 1972). This forecast was successful, with the inflow beginning in April 1972. Since this result appeared to show that the theory has some validity, monitoring of the relevant atmospheric indices has been continued in the hope of making further tests of this simple technique.

The cyclonicity and meridionality indices for the British Isles, developed by staff at the Meteorological Office, Bracknell, appear to be valuable and sensitive indicators of the type of atmospheric circulation anomaly which leads to the inflow situation. A progressive rise in anticyclonicity over Britain will indicate the re-establishment of this specific circulation anomaly, while a simultaneous sustained increase in southerly meridionality over Britain will confirm that the pressure-anomaly field is 'correctly centred' over north-west Europe. This 'ideal' (parallel) behaviour of the two indices is followed, after an advective time-lag, by a striking salinification of the European shelf, culminating in a major inflow to the Baltic (see for example the period 1959-60, Figure 1). These same hydrographic events will also follow (in perhaps a less striking form) in cases where the pressure anomaly pattern is slightly misaligned relative to its 'ideal' configuration and where, as a result, one index will tend to show a slight lag relative to the other.

Figure 1 illustrates the post-war trends of the two circulation indices up to the end of June 1974 and these are compared with the patterns of salinity variation at Danish lightvessels up to the end of March 1974. Figure 1(i) shows that anticyclonicity has been generally above normal over northwest Europe since the early part of 1971 but figure 1(ii) shows, more significantly from the point of view of inflow prediction, that it was 'correctly centred' for only a part of this time, giving peak southerly meridionality over Britain in the first half of 1972. Salinity levels in the North Sea, and in the deeper layers of the Skagerrak, Kattegat and Belts, rose in parallel with this southerly meridionality index, eventually giving rise to the 1972 inflow to the Baltic already described (Dickson, 1972). Since then, the southerly airflow off northwest Europe has weakened markedly and salinity levels in the North Sea and Transition Area have shown a parallel decline.

As regards the current situation, Figure 1(ii) would appear to indicate that a turning point has again been reached. The decline in the southerly meridionality index has recently been reversed, and by the second quarter of 1974 the incidence of the southerly circulation type over Britain was once again above average (arrowed in Figure 1). Salinity levels on the shelf remained generally low in the first quarter of 1974 (the most recent period for which data are available) but past

experience would suggest that if the incidence of the southerly circulation type off Northwest Europe continues to increase, it will shortly be accompanied by a renewed salinification of the European shelf.

At present this changeover is insufficiently advanced to permit any meaningful prediction as to the timing of the next major Baltic inflow. Monitoring of these events will continue however, and if the present tendencies continue to develop, a second test of this simple predictive technique will be attempted.

The author is indebted to the Nautisk Afdeling, Danske Meteorologiske Institut, Copenhagen for the prompt provision of salinity observations from Danish lightvessels, and to the Climatology Division of the Meteorological Office, Bracknell for providing monthly values of the atmospheric circulation indices.

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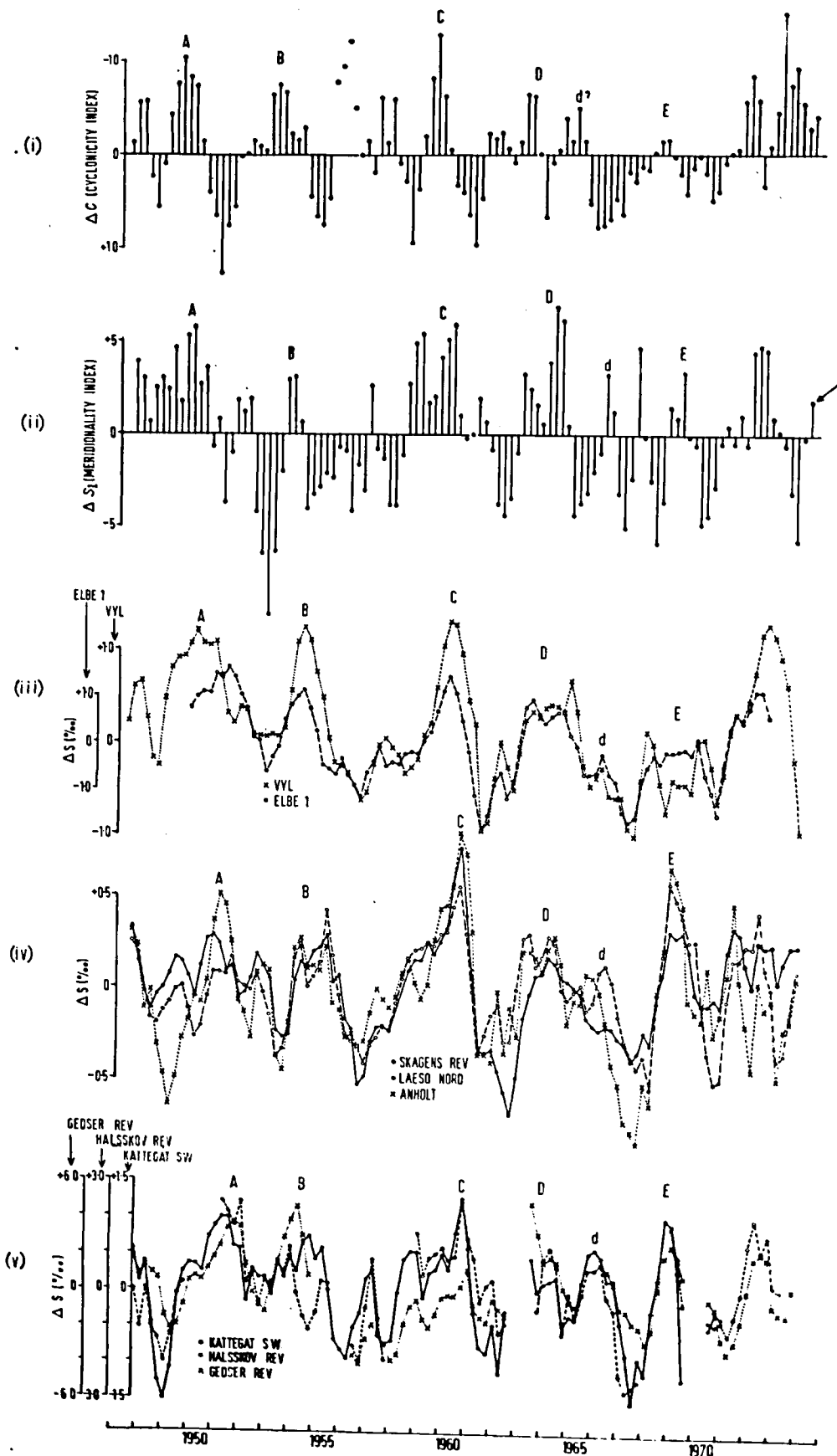


Fig. 1 Running 3-quarterly means (postwar period) of: (i) Cyclonicity Index anomaly, British Isles (anticyclonic tendency negative, but graph inverted); (ii) Meridional Index anomaly (southerlies positive), British Isles; (iii) Surface salinity anomaly at lightvessels VYL and ELBE I, German Bight (for explanation of scales see text); (iv) Near-bottom salinity anomaly at lightvessels SKAGENS REV, LAESO NORD and ANHOLT, Skagerak and Kattegat; (v) Near-bottom salinity anomaly at lightvessels KATTEGAT SW, HALSSKOV REV and GEDSER REV, Danish Belts.