Geophysical Research Abstracts
Vol. 17, EGU2015-5587-1, 2015
EGU General Assembly 2015

Assessment of atmospheric conditions forcing large volume changes and major inflows to the Baltic Sea for the period 1887-2014

Andreas Lehmann (1), Piia Post (2), Katharina Höflich (1), Kai Myrberg (3), and Klaus Getzlaff (1)

(1) GEOMAR Helmholtz Centre for Ocean Research, Ocean Circulation and Climate Dynamics, Kiel, Germany (alehmann@geomar.de, khoeflich@geomar.de, kgetzlaff@geomar.de), (2) Institute of Physics, University of Tartu, Estonia (piia.post@ut.ee), (3) SYKE, Finnish Environment Institute/Marine Research Centre, Helsinki, Finland (Kai.Myrberg@ymparisto.fi)

The salt budget of the Baltic Sea is determined by a balance between saline inflow from the Kattegat and brackish water outflow from the Baltic through the Danish Straits. Generally, during dry periods with less river runoff the mean salinity of the Baltic Sea increases while during wet periods a decrease will happen. These long-term changes are overlaid by the atmospheric-driven water exchange between North Sea and Baltic Sea. The salinity and the stratification in the deep basins are linked to the occurrence of Major Baltic Inflows (MBIs) of higher saline water of North Sea origin, which occur sporadically and transport higher saline and oxygenated water to deeper layers. These major inflows are often followed by stagnation periods with no strong saline inflows, during which the permanent halocline weakens, even disappears in some basins, and extended areas of oxygen deficiency develop in those regions where the salinity stratification remains. Since the mid-1970s, the frequency and intensity of MBIs have decreased. They were completely absent between February 1983 and January 1993. However, inspite of the decreasing frequency of MBIs, there was no obviuos decrease of larger Baltic Sea volume changes (LVCs). A LVC is defined by the volume change of at least 60 km^3. LVCs can be identified from the sea level changes at Landsort which is known to represent the mean sea level of the Baltic Sea very well. Strong inflows leading to LVCs are associated with certain sequences of atmospheric flow patterns over the larger North Atlantic/North European region. We studied the atmospheric circulation forcing of LVCs by two different approaches: Eulerian and Lagrangian. Lamb automated weather types or synoptic weather types were used as Eulerian approach and the tracks of cyclones that cause the changing circulation patterns as Lagrangian approach. Mean sea level pressures from NCEP/NCAR and ERA Interim SLP reanalysis data for the period 1950-2014 were used as initial data. Our results confirm that about a month before the main inflow period eastern air flow with anticyclonic vorticity over the western Baltic prevail which then turns to strong western/northwestern flow. Furthermore, most effective inflows occur if deep cyclones follow particular pathways in a certain frequency over the Baltic Sea area. In December 2014 a MBI comparable to the very strong event in January 1993 happened. It occurred after a period of easterly winds in November leading to an extremely low mean water level (-0.4 m) of the Baltic Sea on 2nd December. On 24th December after the passage of a number of deep cyclones the water level increased to 0.5 m above mean water. The sea level difference was associated with a total water volume change of about 300 km^3. This LVC/MBI will be discussed in detail.