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Variability in iodine isotopes (129I and 127I) in the Baltic Sea water

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Since the early 1960s, accelerated industrialization and exploitations of natural resources pose a threat to the semi-closed Baltic Sea environment. The present concern over the environmental conditions in the Baltic Sea has derived many governmental agencies and scientists to focus their research on defining the magnitude of the problems and providing suggestions for remedial measures. The concentrations of the radioactive iodine-129 represent one of the contamination loads in the Baltic Sea for which a proper evaluation of spatial and temporal distribution is scarce. We here present the first investigation of the spatial and temporal variability of the radioactive 129I and the stable isotope of iodine (iodine-127) as well as their chemical species. Depth-profiles of seawaters were collected from 20 sites in August 2006 and April 2007. The sites cover the low salinity surface waters that form in the Baltic Proper and the high salinity deep water from the North Sea. The 129I was measured by accelerator mass spectrometry (AMS) whereas 127I was measured by an ICP-MS . The results reveal considerable differences of 129I concentration and its species in terms of spatial and temporal variability. Concentration of 129I appears to be consistently lower in the surface compared to deep waters. Intruding plumes of North Sea water, characterized by relatively high salinity, also carry relatively high concentration of 129I. The predominant species for 129I and 127I in Skagerrak-Kattegat basin change with seasons whereas iodide is the only prevailing form in the rest of Baltic Sea. During period of April, total 129I concentration in surface waters was highest in Skagerrak and decreased at the Oresund, but reached a relatively constant value at the rest of Baltic Sea Proper. The pattern of 129I distribution in August 2006 follows more or less the horizontal pattern observed in April 2007, but shows over a triple times increase at some sites. Similar to 129I, the highest values of 127I in the surface water were found in the Kattegat basin. The depth profile of 127I is also consistent with the pattern of salinity, where the highest value being found at a depth of 50-100 m. Correlation between salinity and iodine isotopes suggests involvement of both local conditions and inflow of North Sea water in the distribution of the isotopes species. Calculated inventories for total and different species of 129I evidently expose increasing trends relative to sparse data from earlier works.