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Atmospheric phosphorus load to the Baltic Sea – first measurements at the Utö Atmospheric and Marine Research station

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The HELCOM (Baltic Marine Environment Protection Commission) Baltic Sea Action Plan (BSAP) has the overall objective of reaching the Baltic Sea in a good environmental status by 2021. The HELCOM Contracting Parties have agreed to restrict their nutrient loads to the Baltic Sea according to the BSAP Maximum Allowable Inputs (MAI) of nitrogen and phosphorus (P), which base on the eutrophication targets. Both waterborne and airborne loads should be taken into account in the implementation of the country allocation of nutrient reductions. The waterborne P load is regularly assessed in detail, whereas for the airborne part a very preliminary estimate is available due to insufficient monitoring data. At present a fixed estimate of 5 mg m-2 of atmospheric P deposition per year is used in the BSAP implementation.

Measurements of bulk deposition and particulate concentration of P have been performed at the Utö Atmospheric and Marine Research station (59º 46'50N, 21º 22'23E) at the outer edge of the Archipelago Sea. Utö is a small rocky island without any arable land, so the local anthropogenic P emissions are low. Weekly bulk deposition measurements started in February, 2013 and the weekly sampling for the PM2.5 and the daily sampling for PM10 in 2014.

Based on the results of the first year of the bulk deposition measurements, the annual wet deposition of total P in precipitation was nearly 5 mg m-2. For soluble PO4-P, the wet deposition in precipitation was about 2 mg m-2. The maximum concentrations were measured in late spring and in summer during the biological growing period.

The level of the soluble PO4-P concentration in the PM10 particles was lower during the winter months (median 6 ng m-3) compared to the growing season (median 10 ng m-3). In fine particles (PM2.5), the PO4-P level was lower (1-2 ng m-3) than in the PM10 samples, often under the detection level of the IC method used. Natural biogenic aerosols like pollen, algae and fragments of leaves are supposed to be important emission sources for the atmospheric P, which explains the measured seasonal behavior of the P concentration.