Three-dimensional numerical simulation of microplastics dispersal from point sources in the Baltic Sea region

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Introduction

- Microplastics are found to be dispersed over a large geographical extend between continents, in oceans and on beaches (Barnes et al., 2009; Cozar et al., 2014).
- Physical processes, such as wind, tides or water surface waves affect the dispersal of plastic over large areas (Isobe et al., 2014; Chubarenko & Stepanova, 2017).
- Relevance of physical processes is tested on a relatively smaller scale by using an Eulerian numerical model.
- Himmerfjärden bay (near Stockholm, Sweden) and Oslo Fjord (Norway) chosen as study areas.

Combining physical processes in a numerical model

TELEMAC 3D numerical modeling suite used (www.OpenTELEMAC.org)

3D models nested in 2DH Baltic Sea model

- Computed: currents, waves, turbulence, particle fluxes
- Tides (TPXO tidal database: http://volkov.oce.ornst.edu/tides/global.html)
- Wind (ECMWF wind database: https://www.ecmwf.int/en/forecasts/datasets)
- Simplification: passive tracers assumption (i.e. turbulence counteracts small buoyancy)

Preliminary findings

- Data validation requires much more and more detailed field data in the study locations.
- Spatial dispersal of MP relatively close to source point due to sheltered locations

Next steps

- Additional processes: buoyancy, wave drift, evolving MP size distribution (incl. weathering), biofouling and aggregation into marine snow
- Investigation and simulation of generation and dispersal of MP from beaches
- Long-term simulations

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