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Modelling nutrient distributions in a large-scale river plume

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Nutrients transported into the marine environment by large rivers can have significant effects on the ecology of coastal regions. It is therefore of interest to have a good understanding of the processes of river plume circulation and propagation. Numerical modelling allows detailed investigations of the physical processes controlling these nutrient distributions.
The 3-dimensional MIT general circulation model (MITgcm) has been used to simulate the Columbia River Plume over a period of several tidal cycles. Variable wind forcing, representative of real meteorological conditions, has been used to induce upwelling and downwelling as well as steering of the plume. Passive tracers have been incorporated to represent nutrients such as silicate, nitrate and iron within the plume and surrounding waters. The results of the modelling investigation have been compared with extensive data collected from the area as part of the River Influences on Shelf Ecosystems (RISE) project. It was found that MITgcm reproduces the process of passive tracer dispersion reasonably well, especially in the near-field plume. The model also generated good approximations of plume propagation under the variable forcing conditions.