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Using satellite altimetry and magnetometer to detect magnetic signals from ocean circulation

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We present an application of satellite altimetry to estimate the magnetic signals from ocean circulation for their possible detection.

Due to the global wind-driven ocean circulations, electrically conducting sea-water moves through Earth's magnetic field and generates electromagnetic signals itself. These signals have already been successfully modelled, but they are still unidentified in observations, like the Swarm satellite magnetometer mission. However, the ocean-induced electromagnetic signals depend on temperature, salinity, and vertically integrated water transport, and therefore would provide an additional, interesting source of information and possible validation.

A combination of sea surface height measurements from satellite altimetry and in situ observations allows estimating current velocities by using the geostrophic approximation. With the resulting integrated electric current density, the magnetic signals from ocean circulation can be calculated using an electromagnetic induction solver.

Finally, the estimations are a basis for the separation of magnetic signals from ocean circulation in Swarm satellite magnetometer data. The key aspect of this separation is the predictability of the temporal behaviour of the magnetic signals from ocean circulation by the estimations from satellite altimetry. For this separation, we try to use a Kalman filter and impose the temporal behaviour of the magnetic signals from ocean circulation with the estimations from satellite altimetry.

Here, we report on the status of the ongoing research about the use of satellite altimetry to detect the magnetic signals from the ocean circulation in magnetometer observations.