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Magnetic signals generated by ocean flow in Swarm satellite data: prediction and observation

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Motion of sea water in the Earth's main magnetic field generates the secondary induced field which can be decomposed into its poloidal and toroidal components. While the toroidal component is not directly observable outside the oceans, the poloidal magnetic field have been already validated by CHAMP satellite magnetic observations, land-based magnetic measurements and sea surface magnetic field measurements, despite the poloidal field being rather weak, reaching an intensity of up to a few nT. New possibilities of observations of the ocean-induced magnetic field came with the launching of ESA's Swarm mission satellites which have provided a valuable amount of high-precision and high-resolution measurements of the Earth's magnetic field. For a detection of weak ocean-induced signals and their interpretation, numerical modelling is crucial. We present results of modelling of the secondary magnetic field generated by ocean flow. Two ocean flow models are incorporated: 1) DEBOT, a barotropic model of ocean tide flow and 2) LSOMG, a baroclinic model of global ocean circulation. The secondary magnetic field is modelled by two different approaches: 1) a single-layer approximation model and 2) a three-dimensional time-domain electromagnetic induction model. A preliminary comparison of predicted signals and observed signals extracted from Swarm satellite data will be shown. The future aim is to assimilate magnetic data provided by Swarm mission into the models.