The magnetic signatures of oceanic tides in satellite data: A virtual-observatory approach

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The magnetic signatures of the M₂, and more recently also the N₂, and O₁ oceanic tides have been successfully extracted from satellite observations (Grayver & Olsen, 2019). The traditional method uses the spatial representation of the tidal signals by spherical harmonics. Here we present an alternative approach based on the concept of virtual observatories, motivated by similar development in the analysis of the core field (Mandea & Olsen 2006). All quiet-time, night-side vector magnetic field values observed by the satellite(s) in the proximity of a selected virtual observatory are parameterized by a scalar magnetic potential represented by a cubic harmonic polynomial in a local Cartesian coordinate system. The time-dependence of the polynomial coefficients is constrained by selected tidal frequency, taking into account also the phase and amplitude corrections. The local approach offers several advantages over the use of the global spherical-harmonic base. The disturbances from external field in the polar areas have no impact on the inversion at lower latitudes, and local error estimates can be also provided. In this initial report, we will explore the possibilities of the new technique in terms of resolution, the combination of datasets from multiple satellites and the use of NS and EW field differences from the Swarm A-C pair.