# Signatures of the global ocean circulation in geomagnetic secular variation and acceleration

C.C. Finlay[1], J. Velímský[2] and C. Kloss[1]
[1] DTU Space, National Space Institute, Copenhagen, Denmark, cfinlay@space.dtu.dk
[2]Dept. of Geophysics, Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic, jakub.velimsky@mff.cuni.cz

## SUMMARY

Changes in the global ocean circulation driven by winds and density gradients produce, via motional induction, time-varying geomagnetic signals. On long length and time scales these signals are hidden beneath larger core-generated signals but, due to their location at Earth's surface, on sufficiently short length scales and considering month to interannual timescales they could be detectable. Such signals would provide valuable information related to ocean circulation and conductivity variations. Here, we investigate this question using advanced forward simulations of the magnetic signals generated by (i) the oceans, using the ECCO v4r4 ocean circulation model and a realistic electrical conductivity model for the Earth's oceans, sediments, and upper mantle, (ii) the core dynamo, using an advanced numerical model that correctly simulates the relevant timescales of core processes (waves, advection etc.), and (iii) the ionospheric field, based on an empirical model derived from satellite measurements and scaled by the solar radio flux index. We use these to generate synthetic satellite observations on real Swarm orbits, and for simulated orbits of the proposed NanoMagSat mission. We find it is possible to recover ocean-generated secular variation (SV) and secular acceleration (SA) signals from 6 months of low-earth-orbit satellite data. It is expected that there will be significant benefits from using NanoMagSat data when considering shorter periods; further work is needed in this direction.

**Keywords:** global ocean circulation, motional induction, secular variations and acceleration