



Contact

Uncertainties in the modelling of the ocean-induced magnetic field

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? How large is the model uncertainty of the ocean-induced magnetic field?

Ocean-induced magnetic field signals (Fig. 2) have the potential to be used as **indirect observations** of the general ocean circulation.

The modelling of the induced magnetic field is affected by various uncertainties that arise from errors in input data and from the applied model.

For many applications, **the knowledge of model uncertainties is essential**, e.g. for comparison of observational data and model results, or in data assimilation methods.

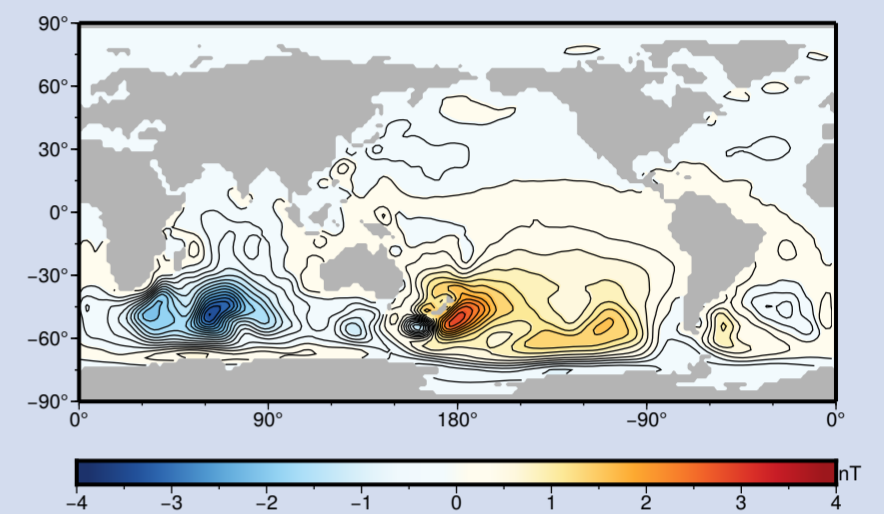


Fig. 2: Annual mean magnetic field induced by ocean general circulation.

Ensemble simulations of the **ocean model for circulation and tides** (Thomas et al.) and an electromagnetic induction model were performed over one year with the **parallel data assimilation framework** (Fig. 3, more details in Irrgang et al., 2016).

For different error scenarios, monthly **error covariance matrices** were calculated to account for errors in input data, their temporal evolution, and to identify the major source of the introduced uncertainties.

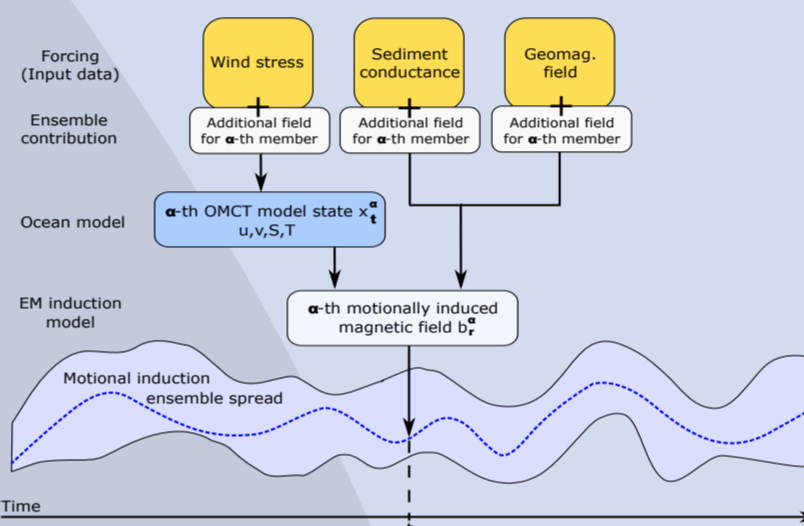


Fig. 3: Setup of the ensemble simulation.

! The estimated error of the magnetic field reaches up to 30% of the signal strength.

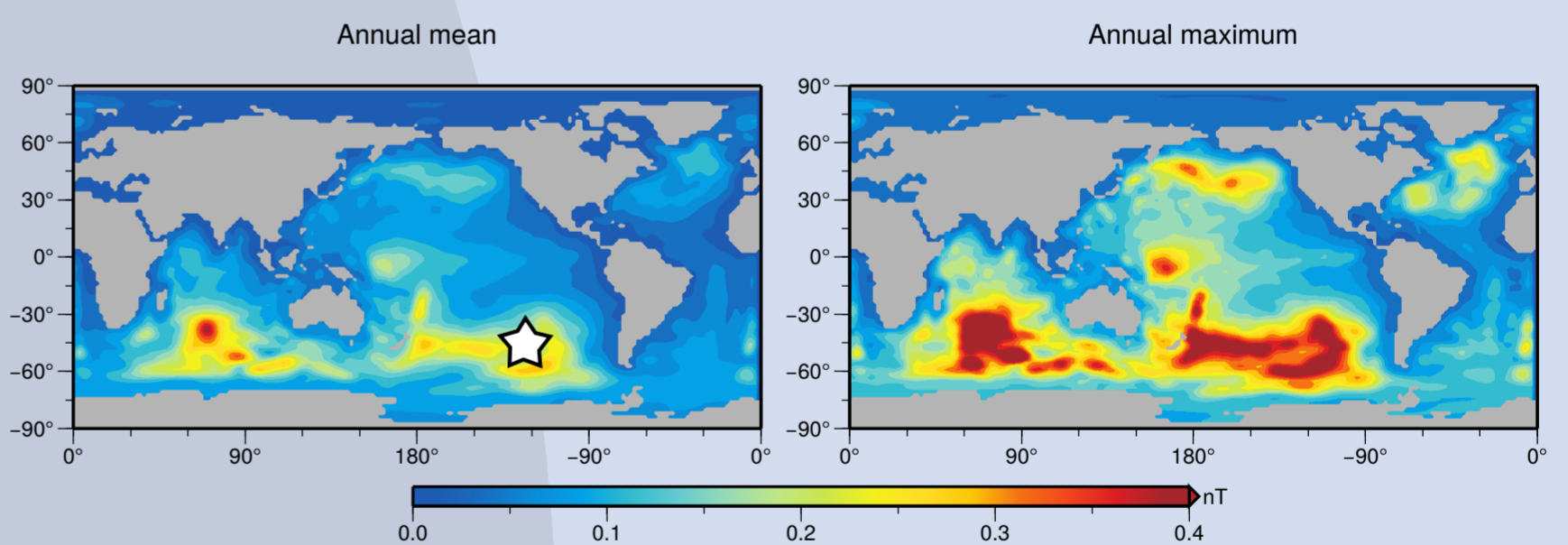


Fig. 4: Annual mean and maximum ensemble spreads of the ocean-induced magnetic field.

The annual mean uncertainty of the ocean-induced magnetic field was found to range from 0.1 to 0.4 nT. Largest maxima reach values **between 0.2 and 0.7 nT** (Fig. 4). The relative uncertainty of the ocean-

induced magnetic field reaches values up to **30% of the signal strength** (Fig. 5). The ensemble spread shows distinct seasonal variations and local robust regions which are insensitive towards the introduced errors.

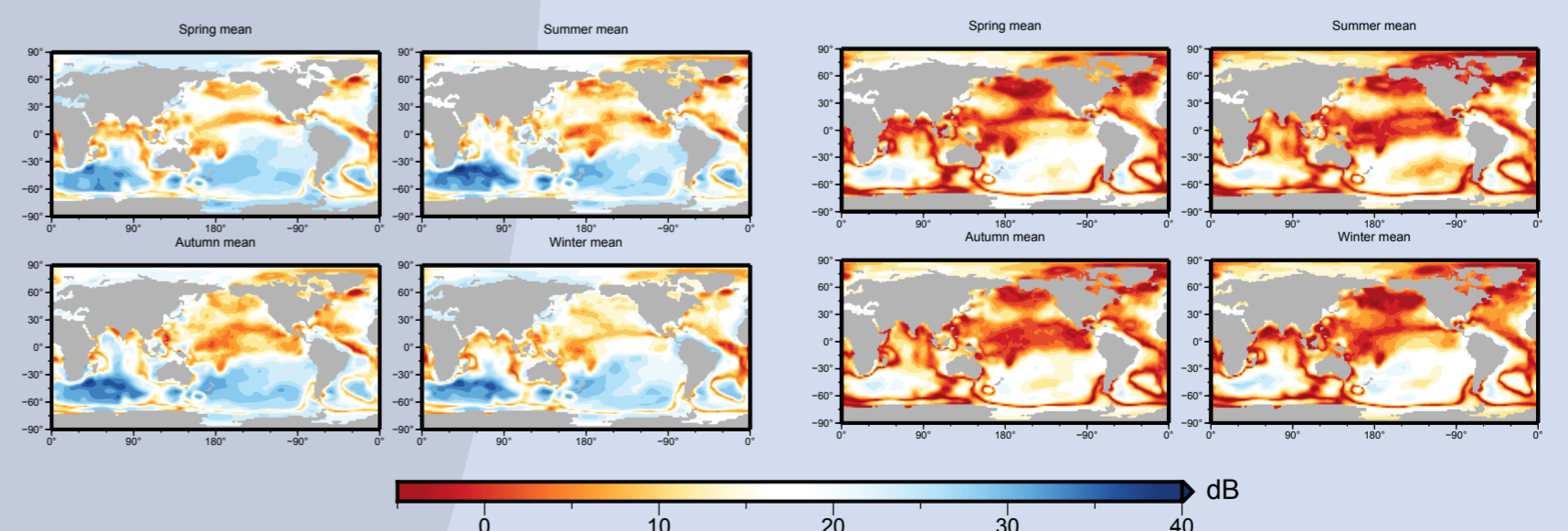


Fig. 5: Relative uncertainty of the ocean-induced magnetic field for two error scenarios (signal to-noise-ratio in Decibels): low-error-scenario (left) and high-error-scenario (right).

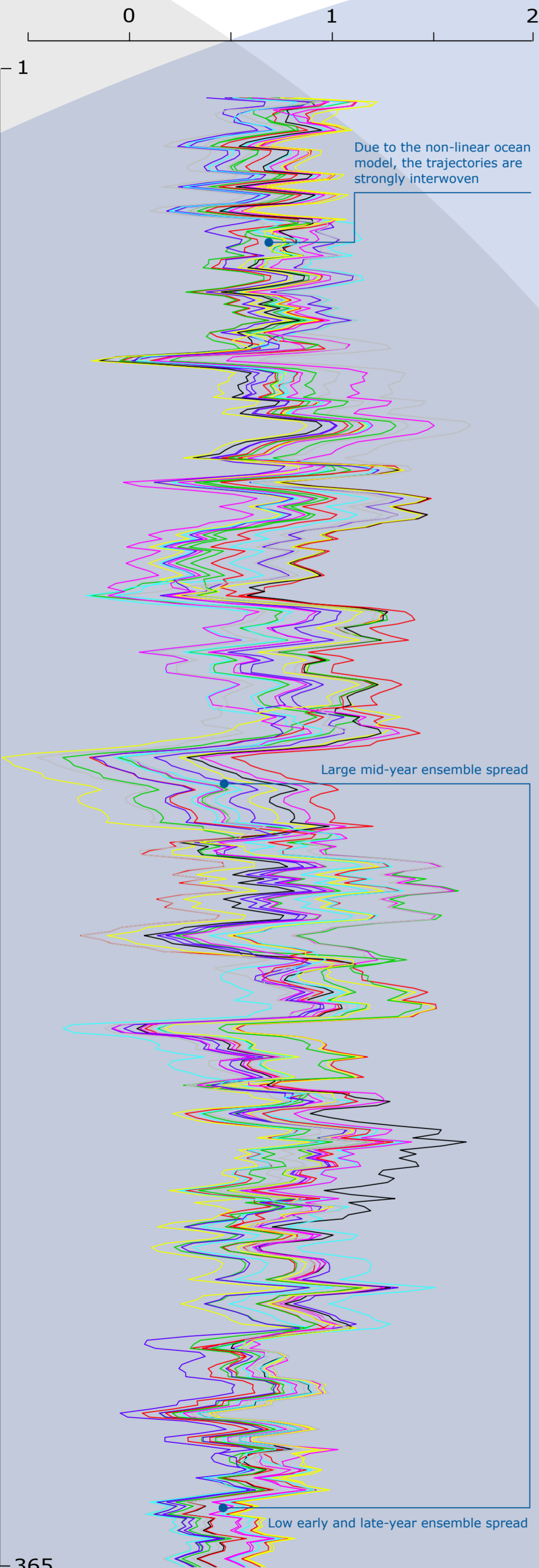


Fig. 1: Temporal trajectories of the ocean-induced magnetic field ensemble members (in Nanotesla) at \star in Fig. 4.