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A multi-model assessment of sub-monthly polar motion and the associated ocean bottom pressure variability

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Budgeting geophysical fluid excitations against space-geodetic observations of polar motion reveals non-negligible residuals on sub-monthly time scales, typically 1−2 cm when projected onto the Earth's surface. A possible source for these discrepancies are imperfections in the hydrodynamic models used to derive the required ocean excitation functions. To guide future model improvements, we present a systematic assessment of the oceanic component of sub-monthly polar motion based on three global time-stepping models which are forced by the same atmospheric data but considerably differ in their numerical setup and physical parameterizations. In particular, we use ocean bottom pressure output and angular momenta from (i) the finite-element 2 Dimensions Gravity Wave Model (Mog2D), (ii) the baroclinic Max-Planck-Institute Ocean Model (MPIOM) at 1° horizontal resolution, representing the current industry standard, and (iii) a more experimental, eddy-permitting setup of the MITgcm (MIT General Circulation Model). Validations of data from 2007 to 2008 are performed against observed polar motion and daily GRACE (Gravity Recovery and Climate Experiment) solutions, which resolve the broad scales of ocean bottom pressure variability relevant for angular momentum considerations. No definite quantitative results are available at the time of this writing, but a specific question we aim to answer is whether the MITgcm run outperforms the other models in our validations, given its higher resolution and partial representation of flow interactions with major topographic features.