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The extended Burgers material (EBM) model provides a linear viscoelastic theory for interpreting a variety of rock deformation phenomena in geophysics, playing an increasingly important role in parameterizing laboratory data, providing seismic wave velocity and attenuation interpretations, and in analyses of solid planetary tidal dispersion and quality factor Q. At the heart of the EBM approach is the assumption of a distribution of relaxation spectra tied to rock grain boundary and interior granular mobility. Furthermore, the model incorporates an asymptotic long-term limiting behavior that is Maxwellian. Using newly developped Love number computation cababilities in the Ice-sheet and Sea-level system Model (ISSM), we compute a large ensemble of models exploring an EBM parameter space including both the upper and lower mantle properties. We compare the resulting tidal Love numbers with constraints derived from satellite laser ranging, satellite gravity time series, geodetic observations of the Earth rotation rate and polar motion and global positioning systems, for periods ranging from 12 h to 18.6 years. We find that models with EBM rheology successfully meet these constraints while retaining a steady-state viscosity consistent with glacial isostatic adjustment analysis, and that the results are more sensitive to lower mantle properties. We highlight significant parameter correlation between the time scale and amplitude of the transient relaxation, such that both fast low-amplitude relaxation and slow high-amplitude solutions are compatible with observations.
The isolated EBM parameters should also apply to theoretical and geodetic studies of glacial isostatic adjustment, and contemporary surface loading in the cyrosphere, oceans and terrestrial water storage. The results are expected to impact GRACE-FO Level 3 solutions for degrees up to 30.
Presentation file
caron-lambert.pdf
Meeting homepage
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