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Lithosphere flexure estimation of an non-uniform flexural rigidity plate□A quantitative modeling approach

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Lithosphere motion is one of the fundamental processes in Earth tectonics. To understand the processes involving the nature of tectonic evolution and dynamics, it is critical to figure out the lithosphere flexure of tectonic plates. Over long-term (> 10^5 yr) geological timescales, the lithosphere can be modelled as flexing like a thin, elastic plate, using the partial differential equation for flexure of an orthotropic plate. The partial differential equation is used indirectly to form theoretical admittance and coherence curves, which are then compared against the observed admittance and coherence to invert a non-uniform flexural rigidity (or effective elastic thickness, T_e) plate. The non-uniform flexural rigidity lithosphere flexure amplitude can be estimated after that.

In this presentation, we use the classic lithosphere model with applied surface load at ground and internal load at Moho, but assume that the compensation material is denser than the mantle material beneath Moho. The density contrast between compensation material and mantle material beneath Moho is set to be 200 kg/m^3 referring to the density contrast of the uppermost and bottom lithosphere mantle. In such a lithosphere model, errors of lithosphere flexure estimation are mainly contributed by the errors of T_e and Moho recovering. Synthetic modelling is then performed to analyze the incoming influence deriving from T_e and Moho errors.

The synthetic modelling reflects 1) the lithosphere flexure estimation errors are not sensitive to the errors of T_e recovering, even an error of about 10 km of T_e only result in an error within 1km of lithosphere flexure, 2) the influence of Moho errors to lithosphere flexure errors will be magnified in regions where T_e is low, as lithosphere flexure errors over 1km mainly occur in regions where T_e is lower than 8km.