Simple Elastic Dislocation Models for Interseismic Deformation in Subduction Zones

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1. ESPM: An Alternative Motivation for the BSM

In this study, we aim to understand the physical rationale behind the essence of the block model (BSM) for predicting the interseismic deformation in subduction zones. We consider a more constrained model for subduction. Specifically, we want to know under what condition the block model is a good approximation for predicting surface deformation.

2. Principal Difference between the ESPM and the BSM: Plate Bending

As illustrated in the top panel of Box 1, adding the deformation field due to the long-term steady state of plate bending to the deformation field due to slip on the subduction boundary (the BSM) is tantamount to adding a steady state plate-bending field to the block model. This is tantamount to adding a steady state plate-bending field to the block model. This is tantamount to the damping of the BSM by the interplate strain and the horizontal motion of the over-riding plate.

3. Influence of Geodetic Observation Locations: Monte-Carlo Simulations

In the ESPM, a larger value for the dimensionless parameter (kPa/yr) is a better estimator of the magnitude of plate bending and thereby of the magnitude of the surface deformation in the region, whereas in the BSM and BFM both horizontal and vertical synthetic data (bottom row of part (b)).

4. Influence of Geodetic Observation Locations: Monte-Carlo Simulations

The ESPM is a more general model of surface deformation than the BSM, as it includes the BSM as a special case. The ESPM allows for a more realistic description of the interseismic deformation, taking into account the interaction between the subduction zone and the over-riding plate.

5. Characterizing BSM Surface Observables

As illustrated schematically in the bottom panel of Box 1, the BSM predicts that the interseismic motion between the trench and the forearc is entirely due to the slip on the subduction boundary. The ESPM predicts that the interseismic motion is due to both the slip on the subduction boundary and the plate bending. This is because the ESPM allows for a more realistic description of the interseismic deformation, taking into account the interaction between the subduction zone and the over-riding plate.

NOTE: There is a tradeoff between the plate thickness estimated for the ESPM from geodetic inversions and the plate thickness estimated for the BSM from geodetic inversions. The ESPM can be used to predict the interseismic deformation, taking into account the interaction between the subduction zone and the over-riding plate.

6. Conclusions

The ESPM is a more general model of surface deformation than the BSM, as it includes the BSM as a special case. The ESPM allows for a more realistic description of the interseismic deformation, taking into account the interaction between the subduction zone and the over-riding plate. The ESPM is a better constraint on the plate bending and thereby on the magnitude of the surface deformation in the region, whereas in the BSM and BFM both horizontal and vertical synthetic data (bottom row of part (b)).

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