Linking surface deformation with mantle dynamics from numerical modeling with data assimilation

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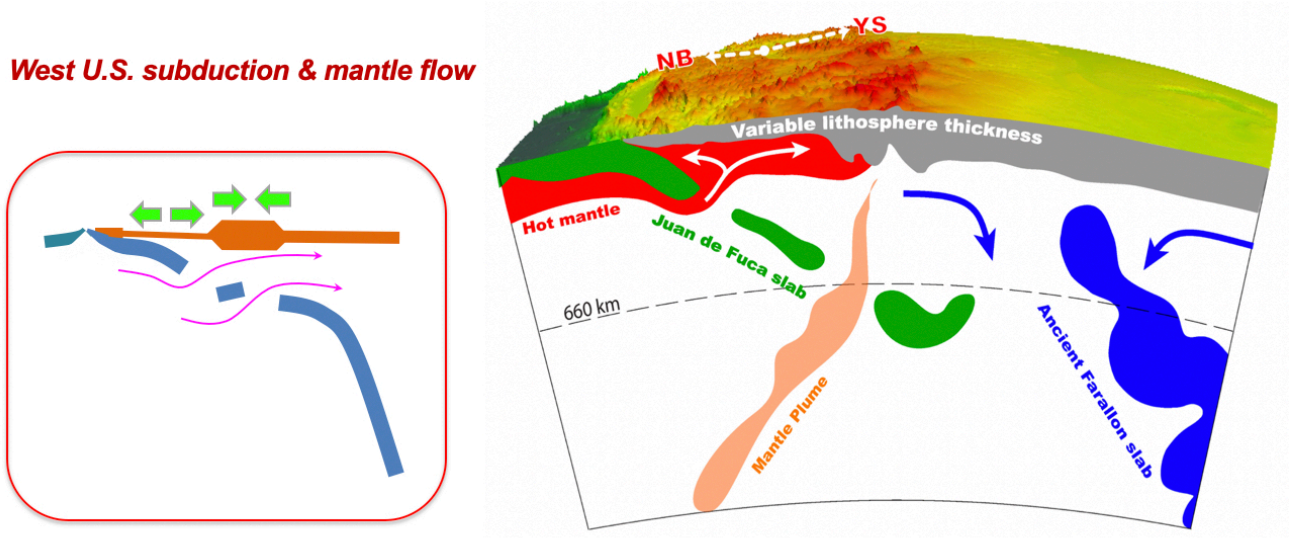
Abstract:
Quantifying surface manifestations of deep mantle dynamics represents an ultimate goal of Earth science. This calculation has remained challenging due to the many uncertainties in the associated initial and boundary conditions of the intrinsic 4D nature of the problem. A promising solution forward is through data assimilation, which substantiates a large number of model parameters with available data, thus greatly reducing model uncertainties. During the past decade, our group has developed both forward-in-time and backward-in-time data assimilation techniques that have greatly improved the quantitative expressions on the linkage between deep mantle dynamics and surface tectonics. Here, I will demonstrate how these data-assimilation models work in practice, and how oceanic subduction and the resulting mantle flow influence the Earth surface through generating 3D lithospheric deformation, intraplate volcanism, and earthquakes. Specific examples include the Cenozoic Farallon subduction beneath the western United States and the Pacific plate subducting below East Asia.



(Zhou et al., *Nature Geosci.*, 2018)