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Mechanics of forearc basins

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In this study, the mechanics of forearc basins will be the object of a numerical investigation to understand the relationships between wedge deformation and forearc basin formation. The aim of this work is to gain an insight into the dynamics of the formation of the forearc basin, in particular the mechanism of formation of accommodation space and the preservation of basin stratigraphy. Our tool is a two-dimensional numerical model that includes the rheological properties of the rock, including effective internal friction angle, effective basal friction angle and thermally-dependent viscosity. We also simulate different sedimentation rates in the basin, to study the influence of underfilled and overfilled basin conditions on wedge deformation. The stratigraphy of the basin will also be studied, because in underfilled conditions the sediments are more likely to undergo tectonic deformation due to inner wedge deformation.
We compare the numerical model with basins along the Sunda-Java Trench. This margin shows a variety of structural-settings and basin types including underfilled and overfilled basins and different wedge geometries. We interpret and document these structural styles, using depth migrated seismic sections of the Sunda Trench, obtained in three surveys, GINCO (11/98 – 01/99), MERAMEX (16/09/04 – 7/10/04) and SINDBAD (9/10/06 – 9/11/06) and made available through the IFM-GEOMAR and the Bundesanstalt für Geowissenschaften and Rohsto[U+FB00]e (BGR).
One important aspect of these margins that we observe is the presence of a dynamic backstop, characterized by older accreted material, that, although deformed during and after accretion, later becomes a stable part of the upper plate. We argue that, following critical wedge theory, it entered into the stable field of a wedge either by steepening or weakening of the underlying detachment. As a stable wedge, this older segment of the wedge acts as a mechanical backstop for the frontal deforming wedge. This dynamic backstop moves seaward in time, in response to isostatic loading by the growing wedge, or due to seaward retreat of the slab with a consequent steepening of the base of the wedge.