Buckling an orocline: Supplementary material

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Abstract

The scaling and experimental procedure are detailed. Experiments are detailed.

Introduction

Plate tectonic processes are characterized by very large spatial and temporal scales. Consequently, geological data often provide partial insights into their mechanics, and geodynamic modeling, using either experimental or numerical techniques, is routinely employed to better understand their development in space and time. The experimental modeling technique is particularly efficient to investigate three-dimensional phenomena (Davy and Cobbold, 1991; Bellahsen et al., 2003; Funiciello et al., 2003; Schellart et al., 2003; Cruden et al., 2006; Luth et al., 2010). However, in multiple experimental models, the rheological stratification of the lithosphere is simplified and the strength variations induced by the temperature gradient through the lithosphere are simulated using various analogue materials with different physical properties (Davy and Cobbold, 1991; Schellart et al., 2003; Cruden et al., 2006; Luth et al., 2010). A drawback of this simplification is that the mechanical properties are retained throughout the entire experiment regardless of temperature variations associated with vertical displacement.

Experimental modeling with temperature-sensitive analogue materials allows incorporating these temperature variations and their mechanical consequences (Turner, 1973; Jacoby, 1976; Jacoby and Schmeling, 1982; Kincaid and Olson, 1987; Chemenda et al., 2000; Rossetti et al., 2000, 2001, 2002; Wosnitza et al., 2001; Boutelier et al., 2002, 2003, 2004; Boutelier and Chemenda, 2008; Lujan et al., 2010). A conductive temperature gradient imposed in the model lithosphere controls the rheological stratification prior to deformation (Boutelier et al., 2002, 2003, 2004). During deformation, heat is naturally advected and diffused so that temperature and strength change with time in various parts of the model lithosphere (e.g. in the subducted lithosphere). However, due to the complexity of the thermo-mechanical analogue modeling technique, most thermo-mechanical models used a two dimensional approximation.

Methods

General setup

Scaling

Analogue materials

Particle Imaging Velocimetry

Principles

Cumulative displacements

Experimental results

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$$\int_a^b u \frac{d^2 v}{dx^2}\, dx = u \frac{dv}{dx}\bigg|_a^b - \int_a^b \frac{du}{dx}\frac{dv}{dx}\, dx. \tag{1}$$

Figure 1: Lorem ipsum dolor sit amet, consectetur adipiscing elit. Cras egestas auctor molestie. In hac habitasse platea dictumst. $\tilde{f}(\omega) = \frac{1}{2\pi}$ Lorem ipsum dolor sit amet, consectetur adipiscing elit. Cras egestas auctor molestie. In hac habitasse platea dictumst. Cras egestas auctor molestie.

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Section

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Table 1: Different quantities and qualities of $T_{\rm shell}$

Heading	r_c (km)	$T_{\rm shell}$ (s)	$t_{\rm waves}$ (s)	$\mathcal{M}$	$\omega_{\rm c}$ (rad/s)	$P_{\rm min}$ (s)	$P_{\rm min,Fe}$ (s)	$P_{\rm min,NS}$ (s)
Row	1.6×10^7	4×10^{13}	2×10^5	0.06	3×10^{-6}	2×10^5	40	2×10^{-3}
Row	9.7×10^3	3×10^8	10^6	0.002	4×10^{-3}	2×10^3	50	2.5×10^{-3}
Row	3.6×10^3	4×10^6	10^5	0.004	2×10^{-2}	-	-	-
Row	1.7×10^3	7×10^3	2×10^3	0.02	4×10^{-1}	-	-	-

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Non-LaTeX Section

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