Solid Earth Discuss., 3, C57–C59, 2011
www.solid-earth-discuss.net/3/C57/2011/

Solid Earth Discussions

Interactive comment on "3-D thermo-mechanical laboratory modelling of plate-tectonics" *by* D. Boutelier and O. Oncken

F. Funiciello (Referee)

ffunicie@uniroma3.it

Received and published: 12 April 2011

The authors presents in detail a new experimental apparatus for 3D thermomechanical analog modelling focused on shallow response (i.e. stress field recorded in the over-riding plate and along the subduction fault) of a large scale tectonic process such as the subduction. Technical details about the apparatus and the experimental procedure are associated to preliminary results obtained using 2D-like models.

The info presented in this paper can interest not only analog modellers but also geologists and geophysicists planning to experimentally test their working hypothesis made on real data.

I strongly support the publication on Solid Earth. However, the paper needs for few

improvements.

MAIN COMMENTS

1) I suggest to clearly specify the technical nature of your paper, starting from the title.

The goal of the paper is clearly to give a technical description of the potentiality of this new apparatus, including preliminary rheological analysis of the adopted analog material and analysis techniques used to quantify the experimental data. Very preliminary results are presented but they are not helping too much in showing the 3D potential of the new apparatus/technique since built up only using 2D-like configurations (as clearly stated only at the end of section 7.1; 2D-like means cylindrical system and, possibly, a not trivial role of box boundary effects).

2) Temperature is implemented as a strength controlling factor of the system (i.e. mechanical consequences of temperature variations) and not properly scaled to nature. It must be specified into the revised version of the text.

3) Page 108, lines 5-11: The assumption to simulate the viscosity ratio between the lithosphere and the asthenosphere using a high value could be correct. But the Authors are modelling depths scaling to almost 900 km depth in nature. These are depths no more related to the asthenosphere while including both the upper and part of the lower mantle. Several papers have been speculated about the viscosity ratio between the lithosphere and the upper mantle in nature as ranging between 10^2 and 10^3. Under this condition, the role of slab-mantle coupling cannot be neglected anymore since giving an important contribution to the force balancing. The Authors should thus discuss in detail their strong assumption and related (important!) limitations of experimental results.

4) Sections 4.2 & 4.3: Why are Authors presenting only a rotational test (i.e. creep test) forgetting oscillatory tests (slightly cited at page 113 lines 5-8)? Oscillatory tests are mandatory to i) check if and how the viscous component can be really neglected; ii)

verify - using the amplitude sweep test- if and where your experiments are performed in the linear viscoelastic range of the sample (i.e. where the original structure is preserved).

This paper is structured to give exhaustive technical details about a new experimental system, including quantification analysis techniques and rheology of the adopted analog material. The latter point needs to be further expanded, presenting a more complete analysis.

5) Table 1 needs a double-check since several values are not compatible with what expressed into the text.

MINOR COMMENTS

a) Page 111, line 21: write "cone-plane geometry" instead of "cone-and-plate geometry"

b) page 115 line 1: write 50x50x30 cm^3.

c) page 117 line 16: write 25x40x2 cm^3.

Rome (Italy) April 12, 2011

Francesca Funiciello

Interactive comment on Solid Earth Discuss., 3, 105, 2011.