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eEarth Discussions

Interactive comment on "Horizontal versus vertical plate motions" *by* M. Cuffaro et al.

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General comment Cuffaro et al. compare values for vertical and horizontal displacement at 23 continuously observing GPS stations from the literature. The used stations are globally distributed and located in the vicinity of plate boundaries. They find that the vertical motions are about 1-2 magnitudes higher compared to the horizontal ones. They also give a number of examples from the literature for vertical displacement which are representative on geological time scales (fission-track, isostatic rebound, cooling processes, structural causes from restraining and releasing bends etc.). This data presentation is followed by the conclusions where the authors address a number of interesting questions related to the unresolved question to which extend the basal drag on the lithospheric plates contribute or maybe even control the plate motion, the vertical displacements, and the plastic deformation.

However, none of these questions have been addressed in a systematic analysis of the presented data or with a numerical/analytical or new conceptual model which could have contributed to the debate. This would have been essential to reach the standard of a scientific paper.

Further comments

1.) The start of the introduction gives the impression that something is wrong with the rigid plate motion models such as NUVEL-1. The given formula velocity=omega x radius only describes the movement of a rigid plate on a sphere. It hasn't got anything to do with vertical movements or internal deformation, but is a first order description of the horizontal plate motion on the Earth. After this the authors come up with their claim by stating in line 1 and 2 on page 65 "We test this idea measuring some present and past horizontal and vertical rates of plate motion". From my point of view there is two things which are misleading: a.) They do not measure anything, but compiling existing data from the literature and b.) This is not the claim of the work. To my understanding the real and interesting claim of this work is stated on page 71 line11-13 in the conclusions.

2.) The focus and order of the paper is not clear to me. If I am right that the authors want to discuss the role of tangential forces in global plate dynamics in general and in particular its role on vertical displacement. I suggest to change the order of the paper in the following way: 1. Introduction: a) give a brief review what has been done in this field of research, b) state what you claim to add to this research field and c) state how you intend to do this (e.g. numerical model). 2. Data: Present the compiled data you need for your analysis, 3. Analysis/Model results; 4. Discussion; 5. Conclusions.

3.) The compilation of vertical displacement from a wide range of methods covers more than half of the paper. It also is relatively unstructured and incomplete. It would have been enough to summarize these data in a table and use the remaining space for a sound investigation of the hypothesis.

eED

1, S20–S22, 2006

4.) The 23 locations of GPS data are not related to the presented vertical uplift data from geological indicators.

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