

## ***Interactive comment on “Horizontal versus vertical plate motions” by M. Cuffaro et al.***

**M. Cuffaro et al.**

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The evaluation of the Referee Oliver Heidbach suggests useful remarks on how to improve and clarify the ms and we acknowledge his constructive criticism. However, it does not explain whether our velocity computations are wrong, whether the ratio between horizontal and vertical velocity is questionable, and how the geodynamic speculations are unsupported.

These below are some of our comments to the points he raised:

Referee comment: The given formula  $\text{velocity} = \omega \times \text{radius}$  only describes the movement of a rigid plate on a sphere. It hasn't got anything to do with vertical movement

In the ms we affirm the same: This idealized relationship is only a description of the horizontal motions and does not make any physically meaningful prediction about the relative importance of the vertical component in tectonically deforming zones. This

sentence is neither arguing against the validity of the equation, nor against the NUVEL-1, it simply states that the relation between horizontal and vertical motions was not taken into account.

Referee comment: They do not measure anything, but compiling existing data from the literature

The all life of a large number of scientists would not be sufficient to "measure" systematically global plate motions. It is true, we did not collect the NASA data set, we simply used their data to compute relative motions along the most representative plate boundaries in the Earth. The "measurement" is the mere computation from the data set, but still is a semantic problem. Regardless the data set used, the ratio between horizontal and vertical motion does not change.

Referee comment: 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

Partly true. The focus is only to show the high ratio between horizontal motion of plates and vertical motions at plate boundaries, which implies the passive role of plate boundaries in the plate dynamics. This is a fundamental statement that clearly contrasts the present opposite paradigm, i.e., plate boundary forces dominate plate tectonics.

Referee comment: 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.

We thank the referee for the suggestions that could improve the ms. We are prone to reorganize the text according to his suggestion. Our only concern is that the ms is already mostly structured as he is suggesting.

Referee comment: 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

The ms already includes a table that is summarizing the data set of the present day motion. Space limitation of the journal inhibits other tables.

Referee comment: The 23 locations of GPS data are not related to the presented vertical uplift data from geological indicators

We selected the 23 cross-sections in order to cover the most important Earth's plate boundaries of any type. We preferred to choose those independent locations because the geological data of uplift rates are rather scattered, whereas horizontal data on plate motions based on magnetic anomalies are consistent with present motion also along the cross-section shown in the figures 1 and 2.

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Interactive comment on eEarth Discuss., 1, 63, 2006.

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