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Solid Earth Discussions

Interactive comment on "Effect of glacial-interglacial sea-level changes on the displacement and stress field in the forearc and along the plate interface of subduction zones" *by* T. Li and A. Hampel

I. Stewart (Referee)

iain.stewart@plymouth.ac.uk

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This is an excellent paper and one which tackles an importantbut surprisingly neglected topic, namely the eustatic loading/unloading effects on the earthquake cycle. The authors bring their experience in modelling the effect of glacial loadinga and unloading on faults to the question of sea level rise on coastal fault systems, namely major subduction systems. In this regard, the substance of the paper is approriate for both SE and for the thematic set. To my knowledge the work is absolutely novel - the authors correctly note the pioneering work of Luttrell & Sandwell (2010; an earlier paper on the effects

of lake level changes in the Salton Sea to stress changes on the San Andreas Fault might also be relevant here but I'm sure the authors are well aware of that work)but the modelling aspects here are more sophisticated and the research questions are different.

The findings of the paper are substantive in that they indicate appreciable vertical and horizontal strains ought to have accrued through glacial-interglacial cycles and so ought to contributed to earthquake cycles along subduction zones. Moreover, it makes specific predictions as to how and where uplift/subsidence and shortening/extension can be expected to be partitioned. In that regard, it has quite far-reaching implications when directed at resolving the background tectonic strains derived from Holocene/postglacial earthquake records from coastal stratigraphies along subduction zones and demands that palaeosesimologists explore the extent to which fault displacement histories along a subduction coast evaluate the eustatic loading component.

Arguably the one element of the eustatic component that the authors rightly note as perhaps being significant is the rate of sea-level rise. In the models a simple linear rate of change is assumed, but as they acknowledge the real pattern of interglacial-glacial water loading change is far more dramatic. Future work is needed to better refine the effects of these short-lived sea-level perturbations(e.g. the Postglacial Catastropphic Rise Events)on the earthquake cycle, as conceivably these could be important triggers or inhibitors for seismic rupture in times of dynamic eustatic change. It is clear from the discussion that the authors are well aware of this implication, and it will certainly be interesting to see how subsequent work develops this aspect.

In short, I think this elegant conceptual and predictive paper will stimulate more detailed studies along specific subduction zones to better resolve how displacement and stress field histories vary in space and time. This ambition is far beyond the scope of this paper - it is sufficient to establish the broad framework of study. In general the paper succinctly sets out the modelling case, although more information on the stress state encountered in the subduction zones might be useful.

The paper is extremely well written - it is clear, concise and well structured. The written English is fluent and the argument can be readily followed. The figures are also excellent and the References appropriate.

In summary, I fully support publication of the paper.

Interactive comment on Solid Earth Discuss., 3, 1001, 2011.