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Toward the Coupling of Seismotectonics and Geodynamics Through Thermo-Mechanics

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Slow earthquake instabilities, of the order of several days, haverecently been reported to have been come out from millions of years ofthermal-mechanical deformation in several large-scale numerical simulations . Here we use this occasion tocompare and discuss for the first time one and the samethermal-mechanical simulation occurring on vastly different time scales. Our modelinvestigates a cross section (80 x 80) km, dealing a randomly perturbedelasto-visco-plastic continental lithosphere without any other initialstructures. This model has been subject to a constant extension velocityapplied on both sides. We have used the multiscale output capabiliities of these arduous simulations for displaying the resultsearthquakes. We note that these calculations have taken several months of computer timeon many SGI Altix processors at Univ. Minnesota. We have obtained results from vastly different, temporaland length scales. They reveal clearly the following: 1. Geological Time Scale:* Continental breakup hasbeen followed to formation of an ocean (time scale, over millions of years)*2. Geodetic Time Scale:* Crustal deformation (time scale over several years) and this has been compared to high resolution geodetic data, such as GPS. . *3. Towards Seismological timescales: *Slowly slipping events (time scale of several days to months) are obtained. We have also found results for different crustal rheologies.