Rupture processes of recent large subduction earthquakes

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Abstract

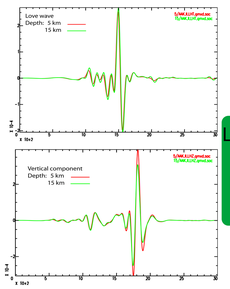
Recent studies reveal a statistically significant correlation between the high slip regions of large subduction earthquakes and local geological and geophysical anomalies in the forearc, such as trench parallel gravity anomalies (TPGA, Song and Simons, 2003) and deep-sea terrace lows (DSTL, Wells, et al., 2003). To verify and further quantify such a relationship and to explore the relationship between rupture initiation and these local observations, we start to revisit (Ms>8) large shallow megathrust earthquakes that occurred since 1990, using an a wavelet based finite fault inverse approach. In our procedure, we constrain the slip process by combined inverting teleseismic body waves and long period surface waves, which signficantly improve the spatial resolution in downdip direction, (Ji, 2006). This poster summarizes our preliminary results. Their relationship with local observations, including background seismicity, aftershock distributions, bathometry and gravity, will be addressed in a future effect.

What can we gain by including long period surface waves into finite fault inversions ?

Constraining the total moment.

When rupture duration is long, the total seismic moment of a low angle thrust earthquake is poorly resolved by teleseismic body waves, presumably due to the free surface interference.

Constraining the centroid depth



Love wave + Rayleigh wave

Resolving the trade-off between the fault dip and total seismic moment

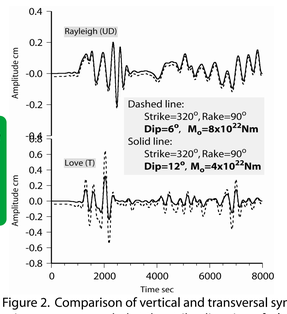
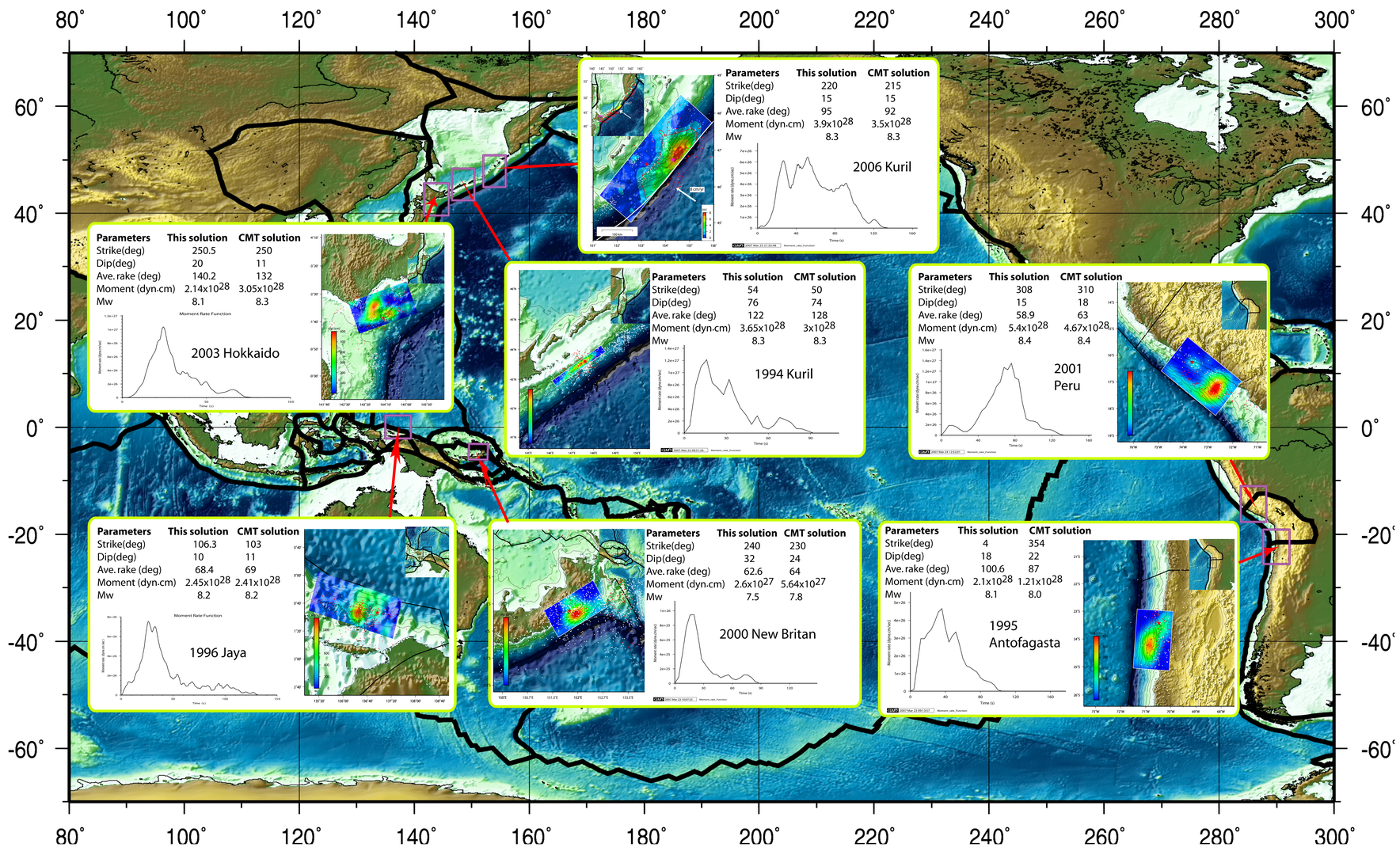


Figure 1. Comparison of normal modes synthetic seismograms at station AAK for point source at depth of 5 km (red) and 15 km (green). The CMT solution of the 2006 JAVA earthquake was used. Note the obvious difference between long period Love and Rayleigh waves.

Figure 2. Comparison of vertical and transversal synthetic seismograms recorded at the strike direction of a low angle thrust fault. Note that the amplitude of long period Rayleigh waves is only sensitive to the product of fault dip and scalar seismic moment but long period love waves are sensitive to the total scalar moment directly.



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