AOB & COE Seminar

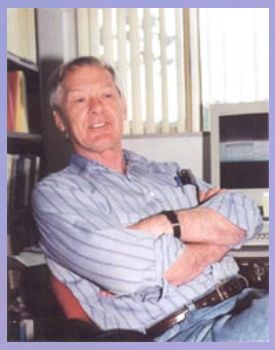
14:00-16:00
Date and Time: ~~10:00-12:00~~ on Tuesday, March 18, 2008

Place: Conference Room 1, Recearch Center for Prediction of Earthquakes and Volcanic Eruptions Tohoku University

“ Slow Earthquakes Triggered by Typhoons ”

1. 14:00-15:00

Dr. Alan T. Linde (Department of Terrestrial Magnetism, Carnegie Institution of Washington)



Taiwan experiences very high deformation rates, particularly along its eastern margins. To investigate this region, we hare working with Academica Sinica to install several small networks of Sacks-Evertson strainmeters. The initial data from all sites show characteristics of good quality: tidal signals with very high signal to noise ratio and large (~10,000 counts on 24 bit ADC system) amplitudes; strains trending into contraction with rates that decrease exponentially with time and earthquakes clearly recorded. Additionally the instruments have recorded about 20 slow strain change events with durations ranging from about an hour up to a few days; we interpret these signals in terms of slow earthquakes. About half of the slow events identified to date occur at the times of typhoons passing over or very close to the study area, and not all typhoons are associated with slow strain events. The chance that the slow events occur randomly at the times of the typhoons is less than 1 in 1,000,000. Seismicity for the area deliniates a roughly north-south striking steeply dipping (to the west) zone with reverse slip; the shallowest extent of the zone is just inland. We look for source solutions consistent with that tectonic setting. The slow events exhibit a considerable range of amplitude and complexity; small, short amplitude events have a quite simple and smooth waveform; the longest (2 days) and largest (100 to 350 nanostrain at 3 sites) has waveforms with a lot of structure.

We are able to match the essential character of the data with a very simple model of a downward propagating line source with uniform slip; the largest slow event appears to be comprised of 3 sub-events (total equivalent magnitude about 5) all starting at a depth of ~3 km with the final sub-event propagating to a depth ~10 km. Typhoon activity produces a large increase in short period (~ sec) energy so it is not possible to determine whether these slow events are accompanied by non-volcanic tremor, as has been reported for the Nankai subduction and Cascadia slow events. We hypothesize that the slow earthquakes are triggered by the typhoon activity due to the resultant low air pressure over land reducing the locking force on the fault zone. Such repeated slow events may explain why this area of high deformation does not experience very large earthquakes.

“ Mountain Building in Japan,and Subduction Angle Changes. ”

2. 15:00-16:00

Dr. Selwyn I. Sacks (Department of Terrestrial Magnetism, Carnegie Institution of Washington)

The Pacific plate subduction beneath North-East Japan has been relatively constant in direction and fairly steady in rate over more than 20 my. However, the tectonics and volcanism have changed markedly. The westward migration of the volcanic front over the last 20 my, and the change in tectonic stress from tension to compression at about 14 my is well documented. We postulate that subduction geometry changed from "Marianas-type" with steep dip and weak coupling to its present 30 degree dip and strong coupling. Once the present geometry is approached, the apex of the mantle wedge is cooled sufficiently by conduction to the cold subducting slab and overlying plate, that its viscosity increases, flow avoids the corner, leading to further conductive cooling. Convection modeling (Kincaid and Sacks, 1997) suggests that the growth of a stiff, cold region trenchward of the volcanic front takes of order 3 million years. The depth range over which strong interplate coupling occurs would therefore increase. Finite element deformation and faulting modeling constrained by observed gravity residual anomalies, topography and heat flow (Huang et al., 1998) show mountain building and erosion strongly affected by this coupling force. The overlying plate is warped, and mountains (Kitakami range) build, and erosion increases. The cores retrieved from holes drilled into the sea floor during leg 186 of the ODP and legs 56 and 57 of the DSDP off the east coast of Japan show a spatially consistent increase in sedimentation rate at about 7 my. The timing is consistent with the modeling and the migration of the volcanic front.

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