Summary of Session 6:

Simulation based prediction, preliminary forecasting models and forecast tests and evaluations

X-C. Yin (China) [1] and N. Hirata (Japan)[2]

(1) Center for analysis and Prediction (CAP), China Seismological Bureau (CSB) and National key Laboratory of Nonlinear Mechanics (LNM), Institute of Mechanics, CAS 63 Fuxing Rd, Beijing 100036,and China (e-mail xcyin@public.bta.net.cn; phone: +86-10-6252-8760; fax: +86-10-6256-1284) (2) Earthquake Research Institute (ERI), The University of Tokyo, 1-1-1 Yayoi Bunkyo-ku Tokyo 113-0032, Japan (e-mail:hirata@eri.u-tokyo.ac.jp; phone: +81-3-3818-3697 ; FAX :+81-3-3816-1159)

Earthquake prediction is difficult but not impossible. Despite reliable precise short-term prediction (with time scale of days) is impossible at this stage, remarkable progress in intermediate-term prediction has been made. It is found that a lot of precursors below can be observed prior to a large earthquake. They includes :

(1) Accelerating seismic activity of moderate-sized earthquakes.
(2) AMR-- Accelerating seismic moment release (time-to-failure power law).
(3) Establishment of long-range correlations in the regional stress field.
(4) Critical sensitivity.
(5) Triggering earthquakes significantly by tidal stress.
(6) Anomaly LURR (high value of Load-Unload Response Ratio).

Most of them could be served as predictors of large earthquakes.

Muneo Hori and others reported the development of stress state monitoring system based on GPS data. The stress inversion regards the Japanese Island as a thin plate at plane stress state during a period of GPS measurement so that the calculated results are stress increment for three in-plane stress components. Robert Granat and Andrea Donnellan also dealt with GPS data. They have applied HMM (hidden Markov model) to scientific analysis of seismicity and GPS data from the Southern California region. Their preliminary results indicate that the technique can isolate distinct classes of earthquakes from seismicity data, as well as different modes of ground motion from GPS data. The GPS network is most advanced technology to monitor the crustal deformation and stress. Undoubtedly, its development and application will be helpful to earthquake hazard quantification.

Xiang-chu Yin and others reported the development on LURR (load/unload response ratio). After analysis of several earthquake cases occurred in China and Australia, they believe that LURR and other phenomena prior to a large earthquake such as AMR may have a common physical mechanism so that LURR can be used as a predictor of a large

earthquake. Their prediction on Japanese future seismicity in terms of LURR at the "International Workshop on Solid Earth Simulation" (January, 2000, University of Tokyo) has been verified preliminary. They have predicted the future seismic tendency for three regions in Japan once again in this Workshop.

K.F. Tiampo and others in their report titled "Pattern dynamics and forecast methods in seismically active regions" suggested that a new pattern dynamic methodology could be used to define a unique, finite set of seismicity pattern for a given fault system. They found systematic space-time variations in seismicity of southern California using a new technique and show examples of this technique on data obtained prior to events in seismically active areas that show coherent regions associated with the future occurrence of major earthquake in the same areas. This theory and technique may prove useful in analysis of future trends in seismic activity.

Mario Chavez gives us two case examples in Mexico on strong ground motion in his poster.

Based on these results the author believes that the use of simulated records opens new possibilities in the very complex task of estimating the seismic hazard in different seismic environments. All of the above studies illustrate the importance of making earthquake prediction very specific, testing them prospectively against independent data, and constructing adequate null hypotheses.