the measurement points, and they receive the data transmitted from GPS artificial satellites. The data received from satellites are transmitted to the server computer through optical fiber or the telephone line. The server analyzes the data automatically and provides the measurement results together with information on the geological conditions, the weather, etc. to the client via the Internet. The three components of the displacement, i.e. lateral and longitudinal directions and height, are plotted in relation to time. The accuracy of measurement is ±1 mm for horizontal displacement and ±1.5 mm for vertical displacement. The good points of the system are 1) long-term monitoring, 2) high accuracy of the measurements of displacements, 3) quick data acquisition, analysis, and evaluation for many slopes at once, 4) rapid notification of the monitoring results to the users, and 5) low cost, as compared with conventional surveying methods using extentionmeters, inclinometers, electronic distance meters, etc. The system is the most effective for monitoring safely the displacements of the slopes and artificial structures due to landslide, creep, active folding and crypto-doming as well as the movement of glacier. However, the system is not applicable for monitoring the topographic changes due to erosion and deposition, because the GPS sensor unit is not stably set on the sites such as river bed and beach.

**Key words:** GPS, monitoring system

**Simulator of Landform Development**

Michio NOGAMI (Tokyo Metropolitan University)

The author advanced the formation of a simulator of landform development for the period of ca 100 thousand years which corresponded to one cycle of glacial-interglacial climatic change in the late Quaternary. He gave mathematical and logical expression for landform changes observed in slope, river and coastal domains. In the slope domain processes of landform change, that is, material transportation were assumed to a two dimensional diffusion phenomenon, so mass movement and landslide were excluded. In this domain the most important parameter is diffusion coefficient numerically defined after rock types and climate types. The parameters control the speed of landform change and amount of sediment supply from slope to river. In the river domain sediment transportation was recognized on drainage networks. The model for the domain is a diffusion equation of which coefficient is not constant but variable of the distance, which is defined as the mean channel length at any point of drainage basin upstream. Materials such as fine sands and silts was assumed to be transported as suspended loads, therefore the materials to be passed in gravely river bed section (alluvial fan), to be deposited in meandering section and river mouth or shallow sea. Initial condition must be given as a detailed DEM, but it is difficult to obtain. The DEM needs to include the submarine region because the next 100 thousand years are mainly belong to the glacial period of low sea-level. Therefore he, the author started the simulation from the DEM virtually submerged. In this paper Deming Butte in New Mexico of US was used as a virtual initial condition, because it has an ideal landform because its pediment landform is adequately presumable to continental shelf. External conditions such as the sea level change, local crustal movement, climatic change, volcanic ash fall, etc have controlled strongly the landform development during the last Quaternary, but nobody knows how they will be in future. Despite this these conditions must be given
for the simulation. He assumed sea level change would repeat in future as shown in the past sea level curve for the last Quaternary. And climate would be judged to be interglacial type for the stage of relatively high or rising sea levels. The volcanic ash fall itself is not necessary for simulation run, but it is convenient to know the tephro-chronological age of terrace surfaces or slopes. Water catchment area of valley head from which the river domain starts would be determined by rock types, exactly saying by characteristics of soil or weathered materials from base rocks, and also by climate types. Sediment balance of the river domain was strictly registered during the simulation. A given percent of supplied materials from the slope domain is only one term of input as traction load of river domain. The percent value would depend on rock and climate type, that is, on characteristics of slope materials. Outputs of traction loads are ablation of gravels which progresses exponentially downstream (Sternberg's law) and discharge to the sea at river mouse. Inputs as suspended load are ablation of the gravels and bedrocks, and a given percent of the supplied materials to river. Outputs of suspended load are deposition at river bed and lateral bank (natural levee) in the meandering section with low gradient and discharge at river mouse and neighboring shallow sea. The progressive landform development of the simulations during 122 ka in future will be shown as animations.

**Key words:** simulation, landform development, model

**Modeling the development of major alluvial terraces in Taiwan**

Shyh-Jeng CHYI (National Kaohsiung Normal University)

Base on the properties and the radiocarbon dates of alluvial terraces located on the drainage basins of different geologic province in Taiwan, a bungee-jumping model is suggested to explain the landscape evolution since Late Glacial to Holocene. This model suggests the major climatic changes after the maximum of Last Glacial, differential tectonic uplift and subsequently valley and channel slope adjustment are the most important factors that initiated the incision of streams, and the drainage systems response to the quickly downcutting induced by tectonic uplift and climatic changes is likely the most important factors caused river aggradation. Its means climatic fluctuation during Holocene might be not always the direct cause of river aggradation.

**Key words:** bungee-jumping model, fluvial terrace, environmental changes

**Processes and forms of the Erh-Jen River Basin: a stochastic approach**

Hung-Fei LEI (Chinese Culture University)

In this paper, a stochastic approach is adopted to describe processes and forms of the Erh-Jen River Basin, in southwestern of Taiwan, where the river meandering takes place upon the surface material consisted of mainly mudstones under significant seasonal change in both rainfall and runoff. Firstly, several probability density functions are chosen to model respectively rainfall data from two weather stations, runoff and sediment yield data from two hydro stations, and the morphology of river channel networks abstracted from 40-by-40-meter DEM. Then, a mathematically argument is presented to build the relationship between those processes and morphology based upon the previous probability analysis. The convolution among rainfall events and landforms of the river basin and its implications for sediment