Invited Lecture（Toshio Koike）

In Asia, we have a lot of water-related issues; flood and drought problem, landslides problem, the water scarcity from rapid increase of the population, water pollution and the ecosystem degradation due to the human activity. Under these vulnerable conditions, the climate change impact on the water cycle is one of the most serious problems in this region.

By using the satellite, we can identify the cloud system in Eastern Asia which caused this heavy rainfall. Next, we can also identify the flow of the water vapor by the mixing of various systems; cyclonic system, anti-cyclonic system and the water vapor seam or source from the Arabian Sea and Bay of Bengal. The convergence of the water vapor flow leads to Japan. To reduce the flood damage of a river in Japan, we need to consider and improve our understanding of this system including our prediction ability of this system. It can be used not only in Japan, but also in all of the Asian countries. The interesting question is how to generate this system?

The system in Asia can be explained as follow. In spring from March to April, a very strong sunshine and a very thin air mass are over the Tibetan Plateau and very effective atmospheric heating happens. In the Indian Ocean, a cold air mass exists and the difference of the air temperature is called this Monsoon Circulation. From the Arabian Sea and the Bay of Bengal, a lot of water vapor is released and there is the orthographic effect of the Himalayan Mountains. The very big cloud system is generated and huge energy is also released. Then, this Monsoon system is enforced and maintained. This system provides a lot of rain in this region and for some reason, some weakness of the heating over the Asian continent causes the weak Monsoon and causes drought. So this entire operation is also very important. This is a natural variation of the water cycle in Asia.

We predicted this phenomenon of a change in the water cycle associated with global warming at the end of the 1980’s by using a super computer. In the middle of the 1990’s our super computing power is much improved and annum variation of the rainfall can be predicted. In case of South India, the average of the rainfall increases. This is a very good signal for India but at the same time, the variation of the annual variation also becomes bigger. It means that India will face heavy flood and drought more often. This kind of bigger annual variation makes water resource management more difficult. Nowadays we have an earth simulator. This is one of the highest performances of the computing system developed by Japan. It can simulate the past 100 years from 1900 and predict up to 2100. However, we need a cooperation framework and people who work

together. I have been developing the down scale system from the global model output to the local water cycle information by combining satellite observation or with a numerical weather prediction model. Next, the prediction ability of the heavy rainfall is improved. That output is passed to the river runoff model and optimization scheme can reduce the flood in downstream. By using the improved rainfall prediction, we developed the Dam Operation Optimization System for reduction of the flood peak and to keep the water for water use. We applied this system to the Tone River basin in cooperation with the Ministry of Land Infrastructure and Transport. By using this system, we can predict the heavy rainfall. Then, before the flood event, we release the water and the dam storage decreases due to the flood. Finally, the downstream flood peak can be reduced very effectively.

In 1998, I proposed the Coordinated Enhanced Observation period known as CEO, the framework of the world climate research program this is sponsored by UNESCO and the World Meteorological Organization a United Nations organization and ICSU International Council of Sciences.

From July 2001 to December 2004, I proposed the integration of the data set of the global water cycle and we got three unique capabilities through this project. We organized 35 science communities who are now implementing the field observation in the world. They can cover almost all varieties of the climate of this earth. In cooperation with space agencies, the Japan Aerospace and Exploration Agency, NASA, NOR, ISA, and the other space agencies are all providing satellites for that.

I’m very happy that political leaders recognize the importance of this kind of function also, based on the discussion at (1) the World Summit for Sustainable Development in Johannesburg, September 2002, (2) the G-8 summit in France in June 2003, (3) Tokyo, February 2005. The 10 years implementation plan and the Global Earth Observation System (GEOS) were established in Tokyo. The 91 countries, 45 national organizations gathered together in this framework. The vision of GEOS is to realize a future wherein decisions and actions for the benefit of human kind are informed by coordinated and comprehensive and sustained Earth observations and information. We established the international framework. Then, to address the water issue in Asia to promote integrated water resources management by making usable information from GEOS, I proposed at the Asian Water Cycle Initiative to my colleagues in Asia.