The concept and agenda for the Climate Change Working Group in IAHR

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Many hydrological disasters such as flood, drought, glacier collapse, typhoon (hurricane) and so on have caused big and frequent damages to human lives and societies with physical, economical and physiological impacts. Though many kinds of GCMs (General Circulation Models) linking with ocean analysis has been developed to take downscaling for river basin scale through regional climate model (RCM), the horizontal resolution of 1 km is requested and the time unit of 1 hour is also necessary to describe daily human and living thing activities.

World-wide economical linkages through trade, immigration, regional development, industry investment and so on have high relationship with both of greenhouse gas emission and countermeasure strategies against global warming. GCM outputs, economical data and simulated results are handled as meta-information in global scale. Setting these results as regional boundary conditions, the detailed river basin simulation for land slide, river ecology, typhoon and so on, is taken through downscaled GCM outputs according to the coincident resolutions. Moreover, water utilization with human and social activities is applied for simulated river basin circumstances. It is obvious that GCM output is the basic information for future meteorological and hydrological situations. The following research topics should be developed under the linkage with other topics;

i) Accuracy modification and downscaling of GCM output: GCM outputs are transformed into the designated input data from in global scale to in regional / basin scale through bias correction and downscaling technologies.

ii) Water circulation with present and future conditions: The long-term circulations for water quantity and quality are simulated through GIS-based runoff model to grasp the physical changes of river basin comparing the present and future circumstances.

iii) Unsteady probability of flood and drought: Hydrological events of precipitation may be changed from probabilistic viewpoints according to the considered global warming. The unsteady probability analysis should be developed to decide the flood and drought control plans.

iv) Land slide and debris flow: Meteorological, topographical and geological conditions in and out of river channels are changed with precipitation and temperature change. River engineering, Sabo engineering, fluvial engineering, River ecology, etc. are proposed to estimate the affected impacts with global warming. The changed future circumstances in the year of 2050 and 2100 are presented.

v) Estimation of inundation process and inland floods: Flood runoff processes are changed due to rainfall pattern changes which are affected with global warming and urban heating. Inland flood for underground shopping arcade and parking lot may be flooded to kill the human lives and activities. The new countermeasures are proposed.

vi) Change of cropping, vegetation and ecosystem in river basin: Since meteorological, topographical and geological conditions in and out of river channels are changed, the affected circumstances such as cropping, vegetation and fishery with ecosystem in 2050 and 2100 should be estimated. Water amenity can be also estimated in the future situation. These information are delivered to water and economical dynamics models to evaluate the human activities.

vii) Water quality, quantity, and land subsidence on ground water: As groundwater is an important natural resource, the basin-wide simulation model on water quantity, quality and land subsidence must be developed to manage the conjunctive use between surface and ground water.

viii) Change of Typhoon (hurricane) occurrence and storm surge: Occurrence location and number of typhoon are changed through GCM outputs because of change of sea surface temperature. The physical and economical damage should be analyzed.

ix) Risk management and optimized operation for drought and water supply: The design and real-time operations for system management considering environmental or disaster risk under changing circumstances are important topics.

x) Trans-boundary conflicts along continental rivers: Continental rivers have many trans-boundary conflicts on water quantity and quality among the countries or regions. Not only political negotiation but also citizen agreement processes are proposed.

xi) Global water dynamics with trade, economics and natural source: GCM (meteorology), runoff process, water utilization and human activities with world trade, economical activities and world natural source are linked to model the global water dynamics.

xii) Water utilization processes on agriculture, industry and human life: After meta-information through the global water dynamics and other river basin simulations, water utilization processes are analyzed to estimate the change of agriculture and industry products, and the affected results on human every day life.

xiii) Sustainable water politics against safety and poverty: Through the estimated human and economical activities, water politics must be proposed to reduce or mitigate water damage and poverty.

xiv) Blue prints of our future water circumstances in 2050 and 2100: Integrating all of research outputs, the future water circumstances in 2050 and 2100 are presented as blue prints under the designated scenarios.