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Accounting for surrounding agricultural dithces in hydrological and thermal monitoring and coupling modeling of groundwa

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Functions and values of wetlands (marshes, swamps, peat bogs, and etc.), in particular theri rich natural resources and biological diversity, have come to be recognized as significant elements int natural environments (Ramsar convention, 1971). Among developed countries, their functions such as water storage, flood control, and water filtration/purification with srrounding watershed and environment. On the other hand, among developong countries, the wetlands including surrounding areas are important landfill and infrastructure development sites for cultivated and residential lands. Thus, there is growth of the demands for applicable management and wise-use of wetlands. In spite of this, due to lack of information, scientific evidences, etc., measures or engineering tools have not been sufficiently taken for evaluation ongoing methods/techniques for wetland conservation and restoration.

Our study aims to characterize mass movement and circulation systems in wetlands combining with geoengineering properties such as consolidation and strength. Based on such scientific/engineering knowledge, our final goal of the study is to develop an integrated tool which predicts water flow and transport of greenhouse gases, energy, and nutrients simulaneously in marshes by taking geoengineering properties and behaviors of wetland soils into account, and to evaluate conservation and restoration methos at natural and constructed wetlands in pursuit of site-specific management and wise-use of wetlands.

The study site is Bibai marshland in Hokkaido, Japan. An intensive field monitoring has been conducted at the marsh: methane emission has been monitored since 2003, methane content distributions have been measured since 2006, and groundwater levels and soil temperatures have been monitored since 2008,. At the same time, we have developed and improved integrated flow simulation codes to model movement of water and heat in geospheres from the field scale to the regional scale.

A hydro-thermal coupling modeling and simulation of the water-circulation at Bibai marsh surrounded by agricultural dithes (area of about 1km x 1.5km) have been excuted. The model can simulate changes in water flow, evapotranspiration, and the depth of snow cover. The model verification and update using the ovserved data collected from the Bibai site have been investigated. And as a result of this, it showed that the distribution of the water content, the direction of the groundwater flow, the distribution of evapotranspiration at surface, and the distribution of temperature at surface and subsurface on this site will be adequately calculated. These monitoring and simulation will be continued into the future.

Keywords: hydro-circulation, thermal circulation, evaptranspiration, snow cover and snow melt, hydro-thermal coupling model, marsh