Development of land surface model

PI: Hotaek Park (JAMSTEC)
CO-PI: John Walsh (IARC/UAF)
Participant: H. Yabuki, Y. Iijima, K. Saito (JAMSTEC), Y. Kim, T. Nakai (IARC)
OBJECTIVES:

- Newly parameterizing aerodynamic resistance and its coupling into CHANGE

- To develop a module to assess the variability of water and energy budget of wetland and lake areas

- To assess the influence of permafrost dynamics on eco-hydrological processes over Arctic terrestrial region
METHODOLOGY:

- Collection of observation data (e.g. energy flux, temperature, water level) of wetland/lake in Alaska
- Acquisition of profiles of wind speed, water vapor, temperature, and CO2 at the flux tower of Poker Flat Rocket Range (PFRR)

Park et al. (2011, JGR)
TIME SCHEDULE:

1996

Collection of observation data
Program coding

Parameterization of aerodynamic resistance
Measuring profiles of micrometeorological variables at PFRR

2005

Application of CHANGE to a observation site

Application of CHANGE to PFRR
Preliminary results

Influence of active layer depth on evapotranspiration

- It shows a significant correlation between active layer depth and evapotranspiration at four Arctic basins, which suggests that the deepened active layer depth produced higher soil water, contributing to the higher ET.
Influence of active layer depth on NPP

- The increasing trend of NPP is found at eastern Siberia and Mackenzie basin. NDVI also shows the similar trend.
- The influence of active layer depth on NPP is significant at boreal forest, which may mean that much soil water yielded by active layer depth contributed to higher NPP.

Influence of active layer depth on NPP

(data : GIMMS)
**Expected outcome of FY2011:**

- The developed wetland/lake model will be likely to estimate water and energy budgets of a water body, which will expand the applicability of CHANGE to the Arctic terrestrial region under climate change.

- The updated parameterization of aerodynamic resistance will improve the accuracy of simulation for heat flux at the lower atmospheric boundary layer caused by vegetation changes under climate change.

- It simulates changes in eco-hydrological processes over the Arctic terrestrial region over the past six decades.
Practical problem:

The developing wetland/lake model has to consider the dynamics of the area in water body, because the current version is structured to be run under the static condition.
SUMMARY

Our joint analysis demonstrates that the variation of active layer depth significantly affected eco-hydrological processes (e.g. ET and NPP).

Joint publication for the model (CHANGE) was accepted.