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Development of Global Isotope Circulation Models - Isotopic behavior in atmosphere and land -

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A global Rayleigh-type water isotopes (HDO and $H_2{}^{18}O$) circulation model (Yoshimura et al., 2003), forced by "realistic" reanalysis products, was coupled with an isotopic land surface model, namely Iso-MATSIRO, developed for reasonable estimates of heterogeneity and complexity of isotopes in evapotranspirative fluxes (Fig. 1). The coupled models explicitly diagnose isotopic values of all water fluxes and statuses, and δ-values of precipitation isotopes were reasonably simulated by the model. The results thus indicate the models are useful to evaluate the forcing products by comparing simulations with observed isotopic database, such as GNIP. Over Europe, ERA15 better matched observations at both monthly and interannual timescales than the NCEP/NCAR reanalysis, owing mainly to better precipitation fields in ERA15, while in the tropics both produced similarly accurate isotopic fields.

With Iso-MATSIRO, vertical profiles of isotopic compositions of soil water are also reasonably reproduced (Fig. 2). Moreover, great heterogeneity of isotopic compositions of soil water storages, runoff, and evapotranspiration are simulated (Fig. 3). Impacts of these heterogeneity on atmosphere and precipitation isotopes are inneglegible. They largely affect variations of d-excess ($\delta D - 8 * \delta^{18}O$), which currently no global model has been able to reasonably reproduce, yet.

Keywords: Stable water isotopes; Reanalysis; LSM; Evapotranspiration

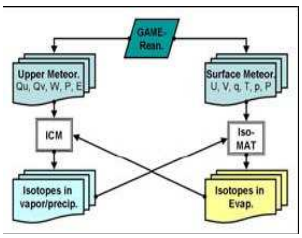

Fig.1: Schematics of land-atmosphere coupled isotope circulationmodels.

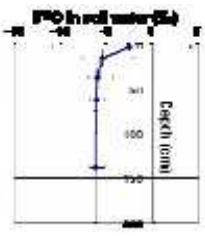

Fig.2: Annual average of vertical profiles of $\delta^{18}O$ in soilwateratThailand.

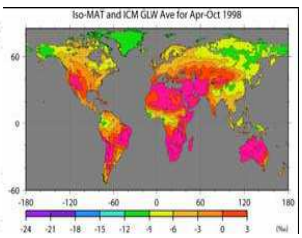

Fig.3: Annual average of $\delta^{18}O$ in global surface soil water.

References

[1] K. Yoshimura, T. Oki, N. Ohte, and S. Kanae, *J. Geophys. Res.* **108(D20)**, 4647 (2003).