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Simulation of molecular hydrogen in the troposphere using global CTM coupled with land process model

Hisashi Yashiro (1), Masayuki Takigawa (1), Kengo Sudo (1,2)

(1) Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Yokohama, Japan (h.yashiro@jamstec.go.jp, +81-45-778-5496), (2) Graduate School of Environmental Studies, Nagoya University, Nagoya, Aichi, Japan

The distribution and budgets of atmospheric molecular hydrogen (H2) are simulated with a global 3-dimensional chemical transport model, CHASER. The model is coupled with land process model (MATSIRO) and improved dry deposition scheme, which includes the effect of both soil moisture and soil temperature, calculates H2 uptake by enzymes in soil.

The model reproduced spatial distributions and seasonal variations of observation stations on the surface and airborne observations well. Simulated H2 concentrations show large seasonal amplitudes on the continent surface of northern high latitudes, with the maximum and minimum in boreal spring and autumn, respectively. The global burden of H2 in the troposphere is 144 Tg and its overall lifetime in the troposphere is 1.9 years. Soil uptake is 58.7 Tg, with the contribution of 76% of total H2 sink. Our results agree well with the previous estimates for the budget term from bottom-up analysis and global model simulations constrained by the observed concentration and isotopic ratio of H2. The results show that not only soil moisture but also soil temperature plays an important role in the seasonal variation of soil uptake and H2 concentration at northern high latitudes.