Estimating the origin of rain water by stable isotopes in Sumatra Island, Indonesia

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Stable isotopes of water (d18O, dD) are hydrologically conservative, and their signals can contribute to better understanding of the hydrological cycle including information such as origin, transportation process and water balance.

In the Asia Pacific region, Ichiyanagi and Yamanaka (2003) found a strong positive correlation between d18O in precipitation

at Bangkok and El Nino/Southern Oscillation (ENSO). And also Araguas-Araguaas et al. (1998) showed spatial and temporal variability of the stable isotopes in precipitation. They pointed out that there is a clear precipitation amount effect caused by the Asian summer monsoon. However, their temporal resolutions were monthly or more. It is necessary to simulate the isotopic variation of precipitation in daily time-scale. The purpose of this paper is to estimate the origin of rain water around Indonesian area using stable isotopes of water. The daily rain water was sampled from May to December in 2001 at Bukittinggi and Jumbi, Indonesia. The d18O was ranged from

-14 permil to 0 permil and temporal pattern was almost same in both place. The d-excess was ranged 10 to 15 permil in Bukittinggi,

whereas sometimes ranged below 5 in Jumbi. This fact indicates the origin of rain water was much different between these two places.

Furthermore, the time series in d18O and the origin of rain water was simulated using Isotope Circulation Model (ICM) developed by Yoshimura et al. (2003). The temporal and spatial resolution is daily time-scale and 2.5 degrees in latitude and longitude, respectively. Notice that this model devises to integrate all vertical atmospheric- and isotopic-physics in each grid. When water transit its phase among solid, liquid and gas, the evoluation of the isotopic composition is described by the Rayleigh distillation process. The atmospheric water budgets were culculated by using the variables from NCEP/NCAR renalysis. From the preliminary result of the ICM simulation, the time series of d18O in two places were almost same pattern during May to December in 2001. However, the origin of rain water was much difference between these two places. Most of rain water in Bukittinggi was originated from the Indian Ocean through whole year. From a half to two third of rain water in Jumbi was originated from the Indian Ocean, and the ramain was from Java

Island and Java Sea. The mixing ratio of different original water was changed weekly or smaller time-scale. This results coincides with the observed d-excess variations.