Stable isotopes in precipitation over Indonesia observed for 2010-2013

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There are a lot of paleo-climate studies that analyzed stable isotopes in ice cores, corals, speleothems, tree-rings, and others over the Indonesia Maritime Continent (IMC). Stable isotopes are good indicator of climatic change, such as temperature and/or precipitation amount. Factors controlling stable isotopes in precipitation are various, therefore, it is necessary to investigate them in the present climate. Previous observational studies found three types of seasonal pattern in stable isotopes across the IMC, namely annual, semi-annual and anti-monsoonal type based on monthly data from only six stations. However, spatial resolution is not enough to investigate spatial and temporal variability of stable isotopes in precipitation over the IMC. The objectives of this study are to show the spatial distributions of stable isotopes in precipitation and to classify the regions based on their seasonal patterns. Stable isotopes in precipitation were observed weekly at 33 observation stations over the IMC belong to Indonesia Agency for Meteorological, Climatological and Geophysical (BMKG) from October 2010 to March 2013. The Cluster analysis was used to distinguish the spatial grouping of seasonal variability of monthly mean Oxygen-18 in precipitation from the BMKG dataset. As a result, the clusters 1 and 2 had similar seasonal patterns with the highest in the dry season (June–November) and the lowest in the wet season (December–May). These clusters were widely distributed over the IMC regions. The cluster 3 had a semi-annual pattern with two peaks in January-February and May-July, which were located only in Sumatera Island. The cluster 4 was only one station located in the Papua Island, which had an opposite type of the monsoonal pattern with the lightest in May–July. To examine the relationships between Oxygen-18 and precipitation amount, a negative correlation (that is amount effect) was found in the clusters 1 and 2. This should be a main factor controlling seasonal variability of Oxygen-18 in these regions. Meanwhile, the amount effect was observed only in transition months (March-August) and could not be seen in the cluster 3 and cluster 4 regions, respectively.

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