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Determining the origin of raining air masses in Iran and the Middle East Countries using isotopic composition (^{18}O and ^{2}H) of Precipitations

Hossein Mohammadzadeha[1] & Behzad Delkhahi[2]

[1] Groundwater Research Center (GRC), Faculty of Science, Ferdowsi University of Mashhad, Mashhad, Iran
[2] Department of Geology, Earth Science Faculty, Shahid Beheshti University, Tehran, Iran

The isotopic composition of precipitation is essential to determine the origin of raining air masses as well as to study the surface water and groundwater resources. In this paper, the GNIP (global network of isotopes in precipitation) data obtained from 58 stations belonging to the International Atomic Energy Agency (IAEA, 2015) as well as from conducted studies in different spots of Iran (Mohammadzadeh & Ebrahipour, 2012; Shamsi & Kazemi 2014; Najjar Saligheh 2014) were used to generate the Middle East meteoric water line (MEMWL - $\delta^2H = 6.86\ \delta^{18}O + 9.4$) and Iran meteoric water line (IMWL - $\delta^2H = 6.56\ \delta^{18}O + 4.25$), and to recognize the origin of raining air masses in Iran and the Middle East (ME) Countries. The wide range of isotopic compositions observed in Iran (-8.3 to -0.4‰ and -53.6 to 8.5‰ for $\delta^{18}O$ and δ^2H, respectively) and in the ME Countries (-6.8 to 0.7‰ and -42.6 to 16.1‰ for $\delta^{18}O$ and δ^2H, respectively) indicates the existence of different origin of raining air masses for the precipitations in these areas. Due to similarity between d-excess of the ME precipitations and East of Mediterranean Sea (MS), the major origin of ME precipitations is Mediterranean dry rain-producing air masses (Lambs & Moussa 2013). Discrepancy in d–excess, slope and intercept of LMWLs in different parts of Iran, represents the climate diversity and difference of precipitations origins. The evaporation rate of Iran's rainfall due to less slope of IMWL is more than that of the global and the ME. The map of oxygen-18 distribution confirms the entrance of Sudan warm air masses from the south, Siberia cold mass from the north and Mediterranean dry mass from the west and northwest of Iran.

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