8th International Conference on Fog, Fog Collection and Dew
Taipei, Taiwan, 14–19 July 2019
IFDA2019-172-1

Isotopic investigation of dew origins and formation mechanisms under different climate conditions

Chao Tian (1), Lixin Wang (1), Daniel Beysens (2), Kudzai Farai Kaseke (1,3), and Marie-Gabrielle Medici (2)

(1) Department of Earth Sciences, Indiana University-Purdue University Indianapolis (IUPUI), IN 46202, USA, (2) École Supérieure de Physique et de Chimie Industrielles, ESPCI-PMMH, Pairs 75005, France, (3) Earth Research Institute, University of California Santa Barbra, CA 93106, USA

Dew is an important hydrological input to many ecosystems especially in the arid and semiarid regions. Few studies investigate the sources and formation mechanisms of dew under different climatic conditions. ^{17}O-excess, as a new tracer, is reported to preserve information about water sources and precipitation formation mechanism. Therefore, to fill the knowledge gap in dew sources and formation mechanisms, we investigated the dew and precipitation isotope variations (δ^2H, δ^{18}O and δ^{17}O) including ^{17}O-excess under three different climate regions (i.e., Gobabeb in the central Namib Desert, Nice in France with Mediterranean climate, and Indianapolis in the central United States). We also analyzed and modeled (Rayleigh evaporation model) the effects of meteorological factors (temperature and relative humidity) on ^{17}O-excess variations. The results showed that the dew in the Gobabeb were from three sources: ocean (advective dew), groundwater and shallow soil water, through comparing the local dew water line with local meteoric water line (LMWL) and global meteoric water line (GMWL). The dew in Nice had both ocean-derived dew and local-derived dew. The dew in Indianapolis was likely local-derived. In addition, informed by the $\delta\prime^{18}$O-$\delta\prime^{17}$O relationship and the positive correlation between^{17}O-excess and d-excess, dew in the Gobabeb (0.5191) experienced kinetic fractionation effect, while the dew in the other two sites, were mainly affected by equilibrium fractionation effect. The difference of dew formation under the three different climatic conditions was mainly affected by the local relative humidity, which was also verified by Rayleigh evaporation model. This study provides a practical method to distinguish dew sources and provides mechanistic understanding of dew formation mechanisms in different ecosystems.