

Isotope Fractionation from orographic precipitation

Ronald B. Smith

Dept. of Geology and Geophysics

Yale University

Orographic precipitation plays an important role in the water budget of the atmosphere and the water resources of our planet. A useful measure of orographic precipitation is the “Drying Ratio (DR)”; the fraction of water vapor removed as air passes over a mountain. Several authors have proposed that DR could be estimated using the water isotope fractionation across major mountain ranges with well-defined prevailing wind directions (e.g. Smith et al. 2005; Smith and Evans 2007; Kerr et al. 2015; Moore et al. 2016). Orographic effects may also significantly modify climate isotope records from high-altitude sites.

In this paper, we review cross-mountain fractionation from several mountain ranges including the Cascades, Sierra Nevada, Southern Alps. We compare DR values from isotopes with predictions from simple models. We note the differences between cross-mountain fractionation (with net warming) and poleward fractionation (with net cooling). For the Sierra Nevada, we compare data sets from stream water with data from “stem water”.

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