Isotope Fractionation from orographic precipitation

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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 removes 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”.