Influence of the Santa Cruz Mountains on precipitation from a landfalling atmospheric river

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Atmospheric rivers (ARs) are long, narrow bands of moisture that transport water vapor at a rate equivalent to 7.5-15 times the daily flow of the Mississippi River. An AR event struck California between March 3 and March 6, 2016, bringing close to 30 cm of rain to some parts of the Santa Cruz Mountains and helping to replenish severely stressed reservoirs throughout the state. The role of the Santa Cruz Mountains in driving orographic rainout within storms has not been quantitatively evaluated. The oxygen isotope composition of precipitation (□^{18}O hereafter) has long been used as a tracer of rainout, as ^{18}O preferentially condenses through open-system Rayleigh distillation. Here, we present an hourly □^{18}O time series of precipitation samples collected during this event at Santa Cruz and Santa Clara, California. Event δ^{18}O values vary over an 8‰ range due to fluctuations in the strength of moisture transport over the Santa Cruz Mountains by the AR and the contribution of new vapor sources by a large secondary frontal wave. Santa Clara precipitation δ^{18}O values were 2.50 ± 0.84 ‰ lower than those in Santa Cruz, consistent with orographic rainout over the Santa Cruz Mountains. This corresponds to a 20.2 ± 11.4% decrease in air mass water vapor content. Future work will explore the relationships between rainout efficiency and ice nucleation particle concentration in this and other winter 2016 atmospheric rivers in California.