Coordinated sampling and analytical effort to examine interactions between INPs and rainout in winter 2016 ARs in California

Hari Mix, *Santa Clara University, Dept. of Environmental Studies and Sciences, 500 El Camino Real, Santa Clara, CA 95053; hmix@scu.edu; (408) 551-3423*

Charlotte Beall, *Center for Aerosol Impacts on Climate and the Environment, UC San Diego, La Jolla, CA*

Gavin Cornwell, *Center for Aerosol Impacts on Climate and the Environment, UC San Diego, La Jolla, CA*

Jessie Creamean, *Cooperative Institute for Research in Environmental Sciences, Boulder, CO*

Louise Kristensen, *Dept. of Chemistry and Biochemistry, UC San Diego, La Jolla, CA*

Dolan Lucero, *Dept. of Chemistry and Biochemistry, UC San Diego, La Jolla, CA*

Andrew Martin, *Center for Western Weather and Water Extremes, Scripps Institution of Oceanography, La Jolla, CA*

Winter 2016 presented an outstanding opportunity to examine rainout in California atmospheric rivers (ARs) for two reasons: 1) As California emerged from the exceptional 2012-14 drought, ARs delivered extreme precipitation, associated hazards including flooding and landslides, and replenished water resources in the American West, and 2) Strong El Niño conditions may have affected the characteristics of storms reaching California. While recent research efforts have identified the important role that long-range mineral dust and biological aerosol sources play as ice nucleating particles (INPs) and cloud condensation nuclei, disentangling the complex interactions between aerosols, the meteorological structure of ARs, and their interactions with topography to produce precipitation represents both a great challenge and opportunity. Here, we seek to address three questions: 1) What are the relationships between aerosols and precipitation amount, efficiency and phase? 2) What are the stable isotope signatures of extreme precipitation events and which macro- and micro-scale dynamics are responsible for producing them? and 3) What are the moisture and aerosol sources during extreme precipitation events and how do these change within storms? In order to address these questions, we collected hourly bulk precipitation samples at a network of five northern California sites: Santa Cruz and Bodega Bay along the Pacific coast; Cazadero, located upslope of Bodega Bay to examine orographic rainout and the seeder-feeder mechanism; and Santa Clara and Shasta Lake on the leeward side of the Coast Ranges to examine orographic rainout and the Sierra Barrier Jet. Leveraging the resources of the interagency CalWater project, our field campaign focused its efforts on February 1 – March 14, during which we sampled precipitation for INP analysis using both ice spectrometer (IS) and aerosol time of flight mass spectrometry (ATOFMS), and stable water isotopes during three ARs: February 17-19 (68

samples), March 5-7 (189 samples) and March 9-11 (88 samples) along with numerous smaller precipitation events. Our future efforts will be directed toward: 1) Exploring potential correlations between INP concentration and chemistry (UCSD), aerosol source and load (NOAA), stable water isotopes and how they change along the storm track (SCU), and 2) Using WRF backtrajectory analysis (CW3E) to constrain the relationship between moisture source and stable isotope composition of precipitation (SCU).