Geophysical Research Abstracts,
Vol. 11, EGU2009-7453-2, 2009
EGU General Assembly 2009

Tracking changes in moisture provenance in southwest Alaska using stable isotope analyses of precipitation and storm trajectory models

Y. Wang (*,1), B. Finney (2), and M. Wooller (1)

(*) Current address: Institute of Geosciences, University of Kiel, Kiel D-24118, Germany (yw@gpi.uni-kiel.de), (1) Alaska Stable Isotope Facility, University of Alaska Fairbanks, Fairbanks AK 99775-5860, USA , (2) Department of Biological Sciences, Idaho State University, Pocatello ID 83209-8007, USA

Stable oxygen isotope analyses of fossil carbonates, biogenic silica, invertebrate chitin and tree rings, for example, can be used as proxies to reconstruct stable isotopic composition of past precipitation and subsequently used to infer paleo-climatological conditions related with atmospheric circulation patterns. For instance, variations in the isotopic composition of precipitation could potentially be used to infer past changes in storm path trajectories that carry moisture of differing isotopic composition. However, modern relationships between storm tracks and precipitation need to be examined. The World Metrological Organization (WMO) and International Atomic Energy Agency (IAEA) established the Global Network for Isotopes in Precipitation (GNIP) in the early 1960s. This worldwide network of precipitation-monitoring stations persists and continues to evolve today. However, the GNIP data measurements are currently distributed very unevenly across the globe. For example, Alaska only has three data points (Fairbanks, Barrow, and Nome) and is one of the most sparsely represented states in the United State. Optimal areas in Alaska to examine short-term climate changes are localities representing boundaries between climate zones, where ecosystems are very sensitive to changes in air mass transportation, precipitation and evaporation. Southwest Alaska, extending from central Alaska west to the Alaskan Peninsula and north to the coasts of Bristol Bay, is an ideal region to investigate modern and past climate change. The region is located at the edge of the Aleutian low-pressure cell in the winter and the North Pacific subtropical high-pressure cell in the summer. We measured the stable oxygen and hydrogen isotopic composition of every precipitation event (n = 295) at the King Salmon weather station, southwest Alaska over the period from August 1st 2006 to July 30th 2007. These data were compared with storm trajectory models to examine variability in isotopic composition of storm events of differing origin and trajectory. Storm trajectories were extracted from an online storm track archives at National Oceanic and Atmosphere Administration (NOAA)'s Air Resources Laboratory (ARL). Individual storm tracks were matched with their corresponding isotope compositions of precipitation for that period. These data were also examined relative to the comprehensive suite of climate data (e.g., precipitation amount, air temperature, air pressure, and cloudiness) generated by the King Salmon weather station. The large variation in the oxygen and hydrogen isotopic composition of precipitation over time at King Salmon demonstrates that southwest Alaska receives its moisture sources from several isotopically distinct sources. Monthly mean temperature and precipitation amount were not strongly correlated with the isotopic composition of precipitation. However, storms experienced at King Salmon originated from different moisture sources over time. Our analyses of modern precipitation isotope data from southwest Alaska illustrate the importance of air mass movements.