# Researchers Determine Winter Moisture Linked to Rapid Glacial Climate Shifts

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(PhysOrg.com) -- If past records regarding periods of warming and cooling climate are an accurate indication of weather patterns, then the southwestern United States is likely headed into a period of severe long-term drought say researchers at the University of New Mexico in new research published in the February issue of Nature Geoscience. Variable winter moisture, or the lack thereof in the southwestern United States, is linked to rapid glacial climate shifts say Yemane Asmerom and Victor Polyak, researchers in the Earth and Planetary Sciences Department at the University of New Mexico.

The research, funded by the National Science Foundation, indicates increased winter precipitation in the southwestern United States is associated with cooling in the Northern Hemisphere that's attributed to a shift southward in the polar jet stream which adjusts the position of the winter storm track over North America. Conversely, when the jet stream shifts north, winter storm patterns cause the southwestern United States to receive less moisture in the future.

"The research fits together very nicely," said Asmerom. "Cooling and warming in the northern hemisphere leads to concurrent latitudinal displacement of both the intertropical convergence zone (ITCZ) and the polar jet stream. The data are consistent with modern evidence for a northward shift of the polar jet stream in response to warming. This could lead to increasingly arid conditions in the southwestern United States in the future. The research is important because it shows what the impact of global climate change at a regional scale can be and

underscores the need to build capacity to deal with possible dramatic changes in precipitation."

Asmerom and Polyak, along with Stephen Burns from the University of Massachusetts, conducted the studies from stalagmite samples taken from a kilometer deep inside the Ft. Stanton Cave near Capitan, N.M. in Lincoln County where the cave climate is stable with 100 percent relative humidity year-round, which is makes possible to interpret the isotope data in the stalagmite as record of past climate change. The stalagmite grew continuously for 45,000 years. They obtained nearly 70 high-precision uranium-series dates using a new multi-collector inductively coupled plasma mass spectrometer, with typical age uncertainties of less than one percent.

Climate fluctuations, known as Dansgaard -- Oescher (DO) events, which are warm events and Heinrich events, which were cold reversals, first shown in Greenland ice cores, are present in the stalagmite record, which grew between 56,000 to 11,000 years ago. During DO events, both the ITCZ and the polar jet stream move northward leading to drier conditions in the southwestern U.S.

During HEs the ITCZ and the polar jet stream moves southward The strength of winter storms in North America depends on the position of the polar jet stream. Colder than normal polar temperatures push the jet stream further south resulting in higher levels of Pacific-based precipitation as well as higher annual precipitation and warm temperatures push the jet stream further north leading to reduction in winter precipitation and arid conditions in the southwest U.S. These changes in the stalagmite are expressed as changes in the oxygen and carbon isotope ratios. The researchers estimate up to 75 percent change in the winter moisture budget during the rapid DO and HEs excursions. Currently the annual recharge consists of about 68 percent from summer monsoon and 32 percent from Pacific-sourced winter precipitation.

“Whether one is convinced of global warming and climate change or not, given the enormous stakes involved, no one can deny the need to study the issue” continued Asmerom. “This is the greatest scientific question and potentially the greatest challenge humanity has ever faced. The resulting changes could be very profound, especially in moisture stressed regions like ours. We could be in for a severe sustained drought unlike anything seen for the past 125,000 years. This project was like a good detective story: initial tell-tell signs, an excellent plot and a dramatic ending. We are fortunate to be part of this great research enterprise”.

Provided by University of New Mexico