



INTER-AMERICAN INSTITUTE FOR GLOBAL CHANGE RESEARCH

Documenting, understanding and projecting changes in the hydrological cycle in the American cordillera (SGP-CRA 2047)

Fresh water is an increasingly scarce resource in the warmer, more crowded world resulting from ongoing Global Changes. Mountain regions are the source of much of the water that sustains adjacent arid lowland communities in the Americas. They also provide good high resolution proxy archives that document long records of hydroclimate variability and the significant interrelationships between precipitation, runoff and the climatic variables that control these patterns over time. The project examines past and current changes in hydroclimate, snowpack and glaciers based on selected case studies from the American cordillera in western Canada, Mexico, the Altiplano and Southern South America using tree-ring data, precipitation and streamflow records, glacier studies and basin-wide hydrological balances. It investigates the causes, nature and range of hydroclimate variability from centennial to annual timescales, illustrates the impacts of these changes on society, and explores the implications of these changes for future water management in the adjacent lowlands.

Goals

- Examine and develop contemporary and proxy climate and runoff data and their links with the dominant causes of climate and streamflow variability (ENSO, PDO, AAO, etc.) over the last ca. 300 years and assess whether these instrumental series are representative of climate and streamflow variability over the longer interval
- Document and model mass loss from glaciers and their contributions to streamflow in selected areas
- Assess modelled and projected future changes in precipitation and streamflow to test methodologies for quantitative assessments of climate-driven environmental impacts over the next 50-100 years
- In conjunction with social scientists and water resource managers, assess the impact of these changes on economic and social activities and their implications for future water management scenarios, policies and institutional frameworks.

Activities and results

- Scientific activities include the assembly of databases for streamflow, climate records, glacier fluctuations and mass balances in the target regions; selected monitoring projects; development of tree-ring chronologies and climate reconstructions of hydroclimate variables (precipitation, PDSI, streamflow, etc); training courses; publications and outreach activities.
- Significant results include a drought reconstruction (Palmer Drought Severity Index, PDSI) for central Mexico (771-2008), a precipitation reconstruction for the Bolivian Altiplano (1226-2009), annual regional snowpack reconstruction for the Andes between 30-37°S (1150-2010), and 300 year-long reconstructions for four major rivers draining from the Southern Andes. We have also reconstructed the Antarctic Oscillation (AAO or Southern Annular Mode) from 1409 to 2006.

Project status

The project is a three-year extension of CRN 2047 (2006-2012). Details of activities, annual reports, etc. can be obtained from luckman@uwo.ca. The most recent Annual Reports are CRN 2047 Final report 10 August 2012 (347p), CRA2047 30 November, 2012 (110p).

Principal investigator and lead agency

Brian H. Luckman - luckman@uwo.ca
Department of Geography, University of Western Ontario, Canada

Co-investigators

Jose Villanueva-Diaz (INIFAP, Mexico), Ricardo Villalba (IANIGLA, Argentina), Antonio Lara (Instituto de Silvicultura, Universidad Austral de Chile), Juan Carlos Aravena (CEQUA, Chile), James McPhee (Universidad de Chile) and 14 Co-Pls

Links to other projects

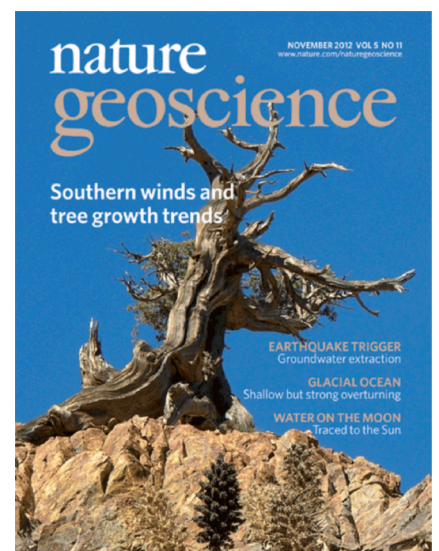
IGBP-PAGES LOTRED-SA Reconstructing climate variation in South America and the Antarctic Peninsula over the last 2000 years, M. Grosjean (U. Berne) and R. Villalba (IANIGLA), coordinators. Collaboration with this project has developed gridded (0.5° x 0.5°) reconstructions of summer (900-1995) and winter (1706-2006) surface air temperature fields and summer (1498-2005) and winter (1590-2005) precipitation patterns for South America south of 20°S. These records show multidecadal variability related to significant atmospheric circulation patterns and sea surface temperatures in both the Pacific and Atlantic Oceans.



Nothofagus pumilio forest devastated by fire in Estancia Canigó, Patagonia



Participants in the first science meeting of the SGP-CRA, Uspallata Argentina, April 21-25, 2013



This image shows a millennial-aged, drought-stressed, *Austrocedrus chilensis* in the northern Patagonian Andes, Villalba et al., *Nat Geosci.*, 5, (11), 793-798



Updated 6/2013