



A REGIONAL HYDROCLIMATE INITIATIVE FOR THE ANDES

Co-Chairs:

Germán Poveda – Universidad Nacional de Colombia

René D. Garreaud – Universidad de Chile

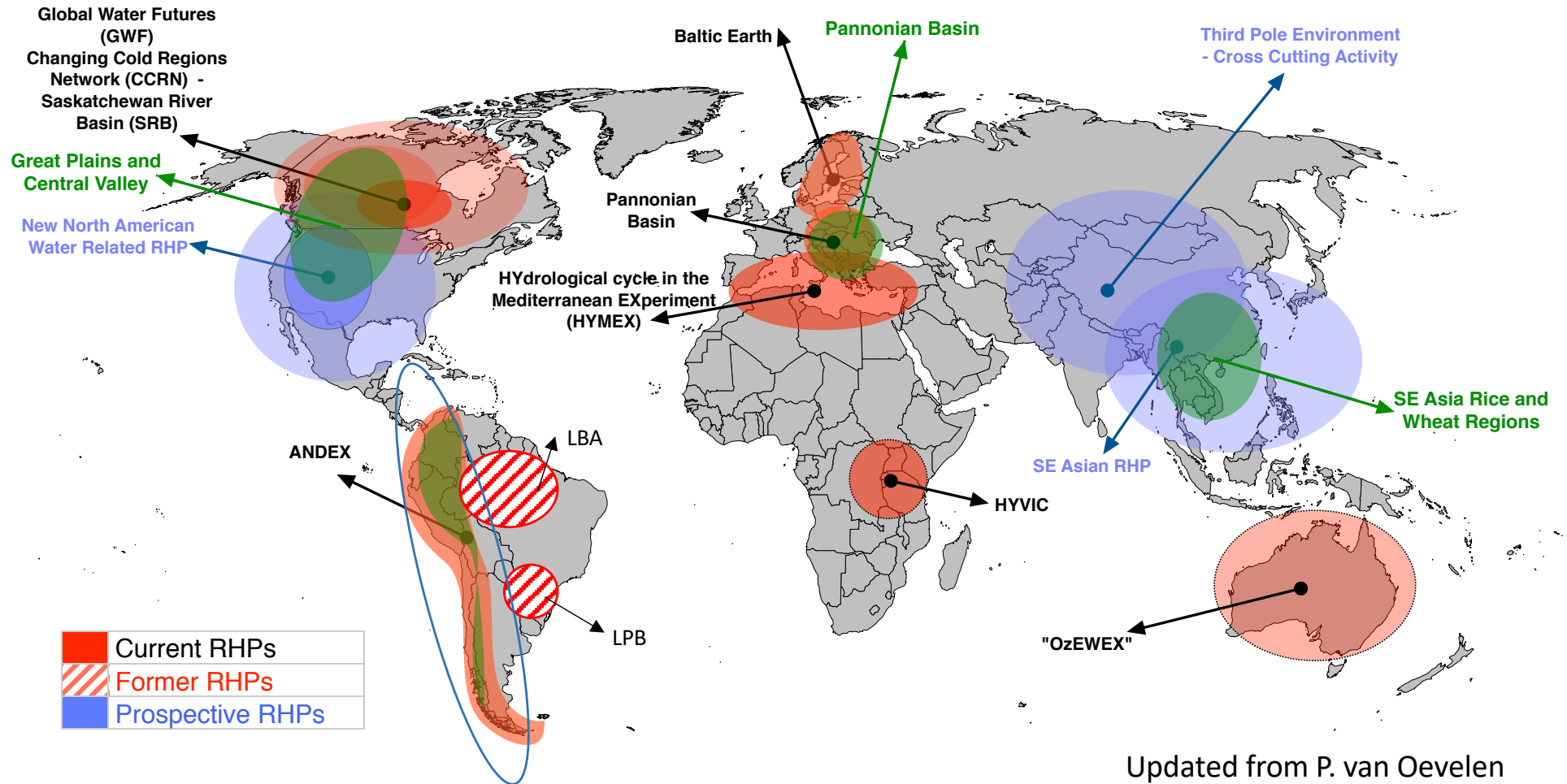
32 GEWEX SSC Meeting

Pasadena, California, January 2#, 2020



A REGIONAL HYDROCLIMATE INITIATIVE FOR THE ANDES

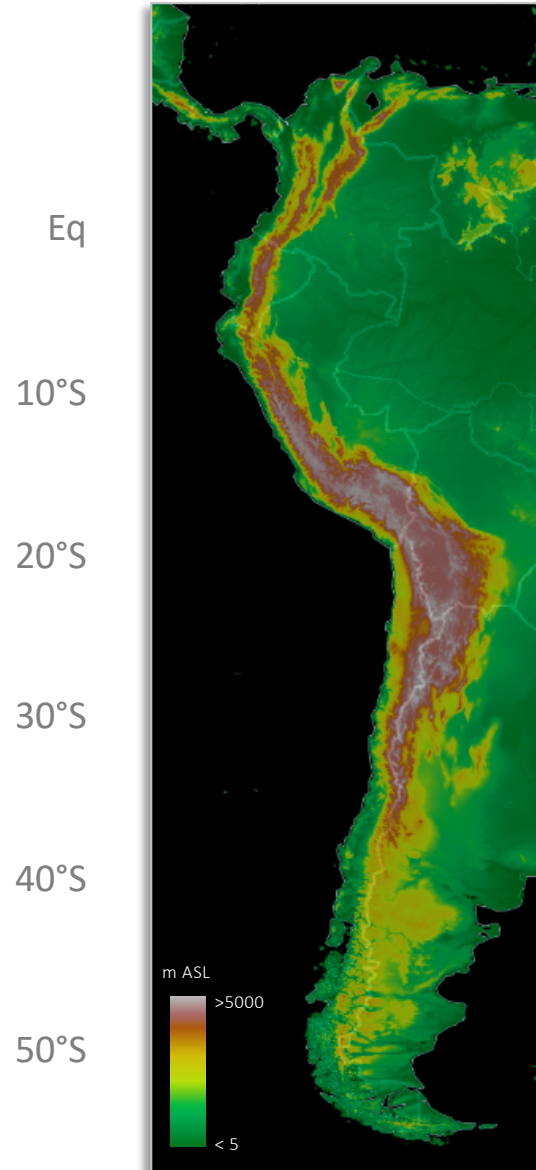
ANDEX – A Prospective Regional Hydroclimate Project (RHP) of GEWEX



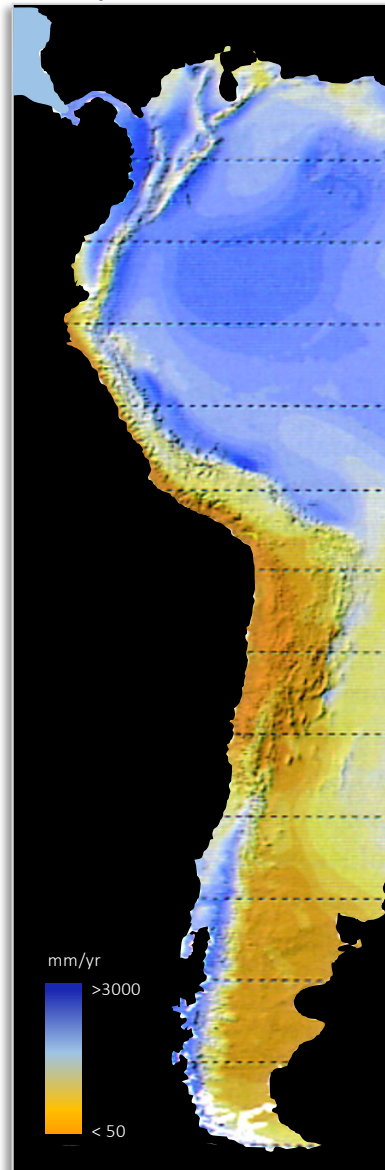


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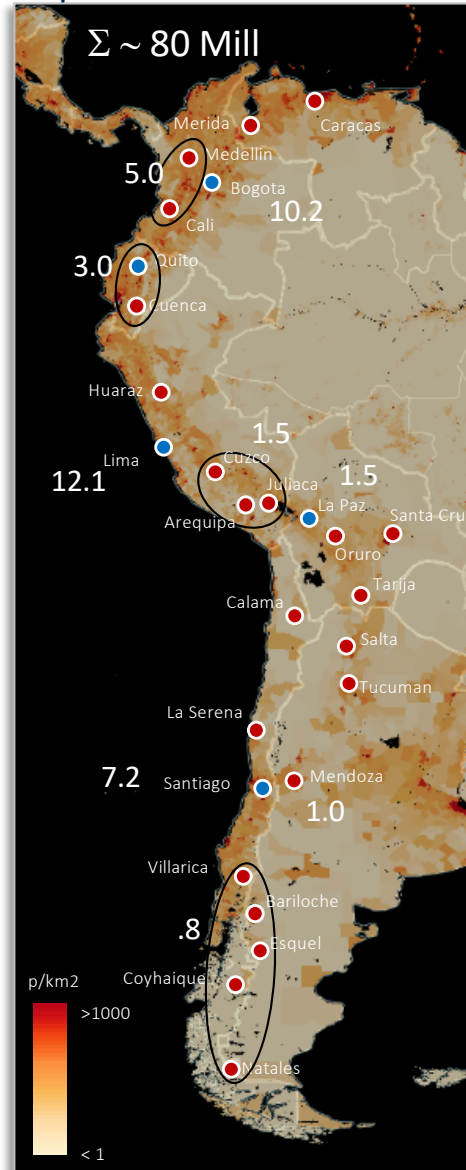
Topography



Precipitation



Population

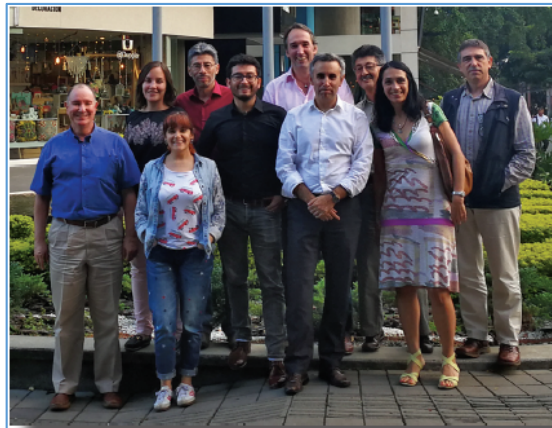




A REGIONAL HYDROCLIMATE INITIATIVE FOR THE ANDES

Three Workshops

Medellín, Colombia
Dec 4-7, 2017



Participants of the ANDEX Workshop.

Santiago, Chile
22-24 Oct 2018
ca. 30 participants



Participants of the 1st ANDEX Workshop

Quito, Ecuador
April 21-25, 2019



Meeting/Workshop Reports

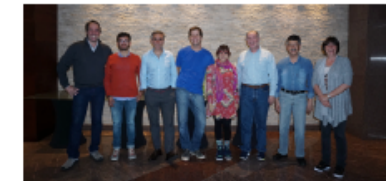
Third ANDEX Workshop

Quito, Ecuador
21-24 April 2019

Germán Poveda¹ and René Garreaud²

¹Universidad Nacional de Colombia, Medellín, Colombia;

²Universidad de Chile, Santiago, Chile



Participants of the 3rd ANDEX Workshop in Quito. Left to right: P. van Oevelen, J.C. Espinoza, R. Garreaud, M. Masiokas, P.A. Arias, G. Poveda, J.D. Pabón and F. Vervoort

First term co-chairs (3 years): Germán Poveda (Colombia) and René Garreaud (Chile).



A REGIONAL HYDROCLIMATE INITIATIVE FOR THE ANDES

Overarching Scientific Questions

1. What are the main physical processes driving the water and energy budgets of the Andes at a broad range of spatial and temporal scales, and their interactions with the neighboring Pacific and Atlantic Oceans and major river basins of South America?
2. How climate change, deforestation and land use changes are affecting the hydroclimatological functioning of the Andes across the altitudinal gradients, from glaciers to *paramos*, *punas*, cloud forests, rainforests, dry forests, deserts?
3. What is the scientific basis underpinning the sustainable development of the Andean region?



A REGIONAL HYDROCLIMATE INITIATIVE FOR THE ANDES

ANDEX White Book

Summarize Science / Identify Gaps

- 1: Introduction
- 2: Geographical Context of the Andes- R. Garreaud et al.
- 3: Hydroclimate of the Andes – R. Garreaud et al.
- 4: Cryosphere of the Andes – M. Masiokas
- 5: High Impact Events in the Andes – G. Poveda et al.
- 6: Observed and Projected Hydroclimatic Changes in the Andes - J. Pabón et al.
- 7: Observations and Data in the Andes - R. Martínez et al.
- 8: Science Underpinning Sustainable Development of the Andes - G. Poveda et al.
- 9: Challenges and Opportunities – P. van Oevelen et al.

Deadline to send out for review: January 2020



A REGIONAL HYDROCLIMATE INITIATIVE FOR THE ANDES

ANDEX White Book Chapters
(1/6) Papers submitted a special issue of Frontiers – Earth Sciences



Research Topic

Connecting Mountain Hydroclimate Through the American Cordilleras

Hydroclimate of the Andes Part I: Main climatic features

Jhan Carlo Espinoza^{1*}, Rene Garreaud², GERMAN POVEDA³, Paola A. Arias⁴, Jorge Molina-Carpio⁵, Mariano Masiokas⁶, Maximiliano Viale⁶, Lucia Scaff⁷

¹UMR5001 Institut des Géosciences de l'Environnement (IGE), France, ²Department of Physics, Faculty of Sciences, University of Santiago, Chile, Chile, ³Department of Geosciences and Environment, Faculty of Mines, National University of Colombia at Medellín, Colombia, ⁴Faculty of Engineering, University of Antioquia, Colombia, ⁵Instituto de Hidráulica e Hidrologia, Universidad Mayor de San Andrés, Bolivia, ⁶CONICET Argentine Institute of Nivology, Glaciology and Environmental Sciences (IANIGLA), Argentina, ⁷Global Institute for Water Security, University of Saskatchewan, Canada

Submitted to Journal:
Frontiers in Earth Science





A REGIONAL HYDROCLIMATE INITIATIVE FOR THE ANDES

ANDEX White Book Chapters
(2/6) Papers submitted a special issue of Frontiers – Earth Sciences

Hydroclimate of the Andes. Part II: Hydroclimate variability and sub-continental patterns

Paola A. Arias^{1, 2*}, Rene Garreaud³, German Poveda⁴, Jhan C. Espinoza⁵, Jorge Molina-Carpio⁶,
Mariano Masiokas⁷, Maximiliano Viale⁷, Lucia Scaff⁸

¹University of Antioquia, Colombia, ²Escuela Ambiental, Faculty of Engineering, University of Antioquia, Colombia, ³Department of Geophysics, Faculty of Physical Sciences and Mathematics, University of Chile, Chile, ⁴Department of Geosciences and Environment, Faculty of Mines, National University of Colombia at Medellin, Colombia, ⁵Université Grenoble Alpes, France, ⁶Instituto de Hidraulica e Hidrologia, Universidad Mayor de San Andrés, Bolivia, ⁷CONICET Argentine Institute of Nivology, Glaciology and Environmental Sciences (IANIGLA), Argentina, ⁸Global Institute for Water Security, University of Saskatchewan, Canada

Submitted to Journal:
Frontiers in Earth Science

Specialty Section:
Hydrosphere

Article type:
Review Article



Research Topic

**Connecting Mountain
Hydroclimate Through the
American Cordilleras**





A REGIONAL HYDROCLIMATE INITIATIVE FOR THE ANDES

ANDEX White Book Chapters
(3/6) Papers submitted a special issue of Frontiers – Earth Sciences

Observed and projected hydroclimate changes in the Andes

Paola A. Arias¹, Andrea F. Carril², Jhan Carlo Espinoza³, Katerina Goubanova⁴, Waldo Lavado⁵, Mariano Masiokas⁶, José Daniel Pabón-Caicedo⁷, Silvina A. Solman², Ricardo Villalba⁶

¹Faculty of Engineering, University of Antioquia, Colombia, ²CONICET Centro de Investigaciones del Mar y la Atmósfera (CIMA), Argentina, ³Université Grenoble Alpes, France, ⁴Center for Advanced Studies in Arid Zones (CEAZA), Chile, ⁵Servicio Nacional de Meteorología e Hidrología del Perú (SENAMHI), Peru, ⁶CONICET Argentine Institute of Nivology, Glaciology and Environmental Sciences (IANIGLA), Argentina, ⁷Departamento de Geografía, Universidad Nacional de Colombia, Colombia

Submitted to Journal:
Frontiers in Earth Science

Specialty Section:
Atmospheric Science

Article type:
Review Article

Manuscript ID:
506439



Research Topic

Connecting Mountain Hydroclimate Through the American Cordilleras





A REGIONAL HYDROCLIMATE INITIATIVE FOR THE ANDES

ANDEX White Book Chapters
(4/6) Papers submitted a special issue of Frontiers – Earth Sciences

High Impact Weather Events in the Andes

GERMAN POVEDA¹, JHAN C. ESPINOZA², MANUEL D. ZULUAGA¹, Silvina A. Solman³, RENE GARREAUD^{4, 5}

¹National University of Colombia at Medellín, Colombia, ²Université Grenoble Alpes, France, ³CONICET Centro de Investigaciones del Mar y la Atmósfera (CIMA), Argentina, ⁴University of Chile, Chile, ⁵Department of Physics, Faculty of Sciences, University of Chile, Chile

Submitted to Journal:
Frontiers in Earth Science

Specialty Section:
Hydrosphere

Article type:
Review Article

Manuscript ID:
509764

Received on:
04 Nov 2019

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www.frontiersin.org



Research Topic

Connecting Mountain Hydroclimate Through the American Cordilleras





A REGIONAL HYDROCLIMATE INITIATIVE FOR THE ANDES

ANDEX White Book Chapters (5/6) Papers submitted a special issue of Frontiers – Earth Sciences

1 **Current state and recent changes of the cryosphere in the Andes**

2

3 Masiokas, M.H.^{1*}; Rabatel, A.²; Rivera, A.^{3,4}; Ruiz, L.¹; Pitte, P.¹; Ceballos, J.L.⁵; Barcaza,
4 G.⁶; Soruco, A.⁷; Bown, F.³

5

6 ¹ Instituto Argentino de Nivología, Glaciología y Ciencias Ambientales (IANIGLA), CCT
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8 ² Univ. Grenoble Alpes, CNRS, IRD, Grenoble-INP, Institut des Géosciences de
9 l'Environnement (UMR5001), Grenoble, France

10 ³ Laboratorio de Glaciología, Centro de Estudios Científicos (CECs), Valdivia, Chile

11 ⁴ Departamento de Geografía, Universidad de Chile, Santiago, Chile

12 ⁵ Instituto de Hidrología, Meteorología y Estudios Ambientales (IDEAM), Bogotá, Colombia

13 ⁶ Dirección General de Aguas, Santiago, Chile

14 ⁷ Universidad de San Andrés, La Paz, Bolivia

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Research Topic

**Connecting Mountain
Hydroclimate Through the
American Cordilleras**





A REGIONAL HYDROCLIMATE INITIATIVE FOR THE ANDES

ANDEX White Book Chapters
(6/6) Papers submitted a special issue of Frontiers – Earth Sciences



Research Topic

Connecting Mountain Hydroclimate Through the American Cordilleras

Climatological and hydrological observations for the South American Andes: in-situ stations, satellite and reanalysis data sets

Thomas Condom⁴, Rodney Martínez¹, José Daniel Pabón², Felipe Costa¹, Luis Pineda³, Juan Jose Nieto¹, Freddy López¹, Marcos Villacis⁵

¹ Department of Climate Services, Centro Internacional para la Investigación del Fenómeno de El Niño, Guayaquil, Ecuador.

² Department of Geography, Universidad Nacional de Colombia, Bogota, Colombia.

³ Escuela de Ciencias de la Tierra, Energía y Ambiente, Universidad Yachay Tech, Urcuquí, Ecuador

⁴ Université Grenoble Alpes, CNRS, IRD, Institut des Geosciences de l'Environnement (IGE)-UMR 5001, Grenoble, France.

⁵ Escuela Politécnica Nacional, Departamento de Ingeniería Civil y Ambiental, Quito, Ecuador

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A REGIONAL HYDROCLIMATE INITIATIVE FOR THE ANDES

ANDEX Web Page: Already up and running
Thanks to Fernande Vervoort and her team
Great to increase ANDEX visibility

The screenshot shows the ANDEX website homepage. The browser address bar displays gewex.org/project/andex/home/background/. The website features a dark blue header with navigation links: ABOUT, PANELS, ACTIVITIES, and EVENTS. Below the header is a large banner area with the ANDEX logo and the text "A REGIONAL HYDROCLIMATE INITIATIVE FOR THE ANDES". A secondary navigation bar includes ABOUT, CONTACT, HOME (with a dropdown arrow), and SCIENCE (with a dropdown arrow). The main content area is divided into two columns. The left column contains a "Background" section with text describing the Andes cordillera and its climate conditions. The right column features a "HOME" section with a list of links: BACKGROUND, ANDEX RATIONALE, TIMELINE, and PEOPLE. Below this is an "UPCOMING EVENTS" section listing two events: "8 - 10 OCT. 2019 GHP CC WORKSHOP: DETERMINING EVAPOTRANSPIRATION" and "11 - 12 OCT. 2019 2019 GHP MEETING (BY INVITATION ONLY)". A vertical image of a mountain landscape with a glacier is visible on the right side of the page.

← → ↻ gewex.org/project/andex/home/background/

ABOUT PANELS ACTIVITIES EVENTS

 **ANDEX**
A REGIONAL HYDROCLIMATE INITIATIVE FOR THE ANDES

ABOUT CONTACT HOME ▼ SCIENCE ▼

Background

The Andes cordillera runs near the west coast of South America from Venezuela (~10°N) to the southern tip of the continent (~53°S), thus encompassing a rich variety of mountain climates and ecosystems, from very humid conditions near the equator and over western Patagonia to the hyper arid conditions in the subtropics. Consistent with its continuity and height, the Andes also produces strong contrasting climate conditions along the eastern and western slopes and adjacent lowlands.

The Andes is a narrow, nearly two-dimensional mountain range, with the exception of a portion between 15°-22°S where it splits into two mountain ranges holding the South American Altiplano, a closed, high level (4000 m ASL) plateau. Likewise, the Andes splits in three branches to the north of the equator, with major rivers draining into the Caribbean Sea.

The Andes provides ecosystem services, starting with the provision of fresh water to nearly 80 million people in seven countries (Venezuela, Colombia, Ecuador, Peru, Bolivia, Chile and Argentina), and at the

gewex

HOME RESOURCES

HOME

BACKGROUND
ANDEX RATIONALE
TIMELINE
PEOPLE

UPCOMING EVENTS

8 - 10 OCT. 2019
GHP CC WORKSHOP:
DETERMINING
EVAPOTRANSPIRATION

11 - 12 OCT. 2019
2019 GHP MEETING (BY
INVITATION ONLY)



A REGIONAL HYDROCLIMATE INITIATIVE FOR THE ANDES

Science Meetings

- ANDEX oral and a poster session at the 2019 AGU Fall Meeting in San Francisco “*The Hydro-climate of the Andes: Current Understanding and Future Challenges*: 25 Abstracts submitted. Conveners: R. Garreaud, G. Poveda, M. Vuille, A. Barros.
- ANDEX will have a session at EGU General Assembly 2020, Vienna, Austria, 3-8 May 2020. “Recent progress in understanding the hydro-climate system of the Andes: Physical processes and resources for Andean populations.” Conveners: J.C. Espinoza, G. Poveda, W. Buytaert and K. Trachte. 32 Abstracts submitted.
- Meeting of the ANDEX SSC in October 2020 in Cusco, Peru.
- Open Scientific Conference (300+ participants), October 2021: White Book and Implementation Plan.