

## IMPACTOS DEL CAMBIO CLIMÁTICO EN LA BIODIVERSIDAD DE LOS ANDES TROPICALES

Riesgo climático, vulnerabilidad y herramientas de toma de decisiones para la planificación de la conservación

### Eventos de Difusión y Capacitación

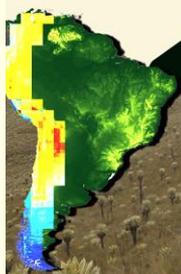
Bolivia-La Paz, 19-21 de enero

Ecuador-Quito 23 & 26-27 de enero

Colombia-Bogotá 2-4 de febrero

Perú-Lima 5-7 de febrero

2015



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International Research Institute for Climate and Society  
Lamont-Doherty Earth Observatory, USA

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Analysis Area	Time Period	Map Options	Measurement	Resources
<input type="radio"/> United States <input checked="" type="radio"/> Global Global	<input type="radio"/> Past 50 Years <input checked="" type="radio"/> Mid Century (2050s) <input type="radio"/> End Century (2080s)	<input type="radio"/> Map of Average <input checked="" type="radio"/> Map of Change <a href="#">Compare &amp; Animate Models</a>	<input checked="" type="radio"/> Average Temperature <input type="radio"/> Precipitation Annual	<a href="#">Case Studies</a> <a href="#">Documentation</a>   <a href="#">Developer</a> <a href="#">Data and Map Image</a> Download <a href="#">ClimateWizard Custom Analysis</a> <a href="#">Printer Friendly Version</a>

**Future Climate Model**  
 IPCC Fourth Assessment  
 Emission Scenario: Medium A1B  
 General Circulation Model: Ensemble Average

### Change in Annual Temperature by the 2050s

Model: Ensemble Average, SRES emission scenario: A1B

50%: This map shows the temperature change projected by the middle model. That is, half of the models project a greater amount of change, and half of the models project less change as compared to the 1961-1990 baseline average.

Map data Sources: Esri, HERE, DeLorme, TomTom, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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# GCM

## DOWNSCALED GCM DATA PORTAL

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RESEARCH PROGRAM ON  
**Climate Change,  
Agriculture and  
Food Security**

**CCAFS**

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Data Provided by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

The data distributed here are in ARC GRID, and ARC ASCII format, in decimal degrees and datum WGS84. CCAFS and its partners have processed this data to provide seamless continuous future climate surfaces. Users are prohibited from any commercial, non-free resale, or redistribution without explicit written permission from CCAFS or the data-developing institutions. Users should acknowledge CCAFS as the source used in the creation of any reports, publications, new data sets, derived products, or services resulting from the use of this data set. For commercial access to the data, send requests to **Andy Jarvis** at the International Center for Tropical Agriculture (CIAT).

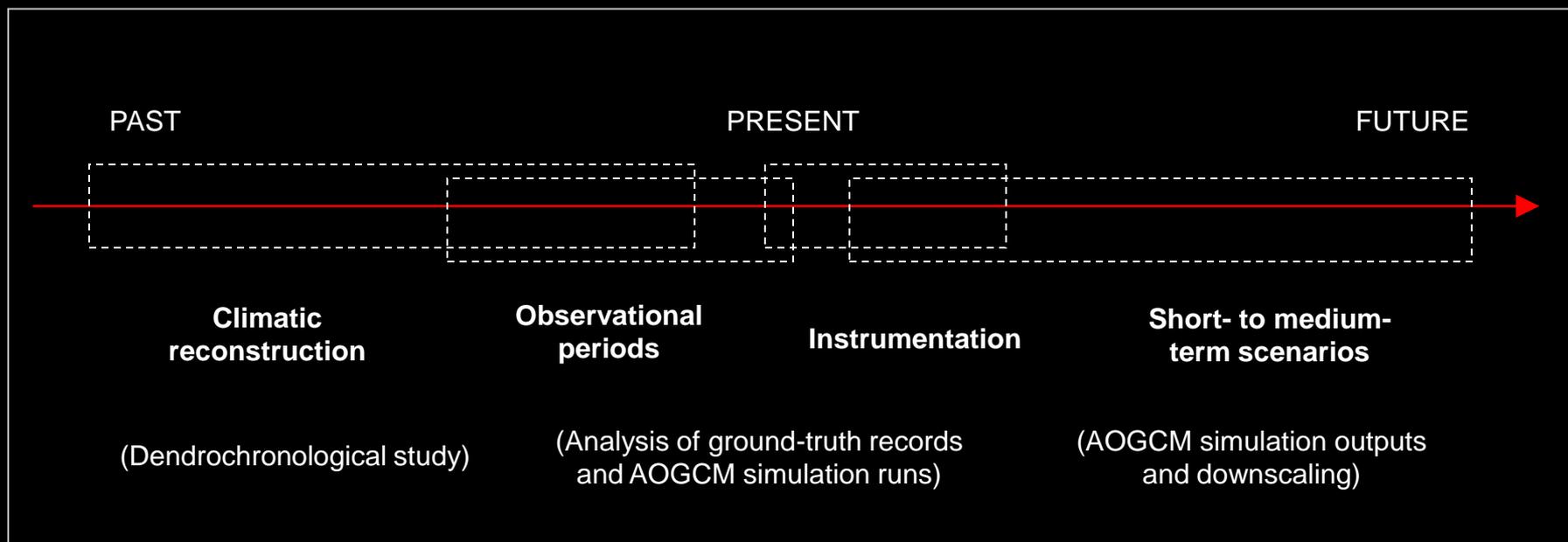
These open-access datasets are hosted by **Amazon Web Services**.

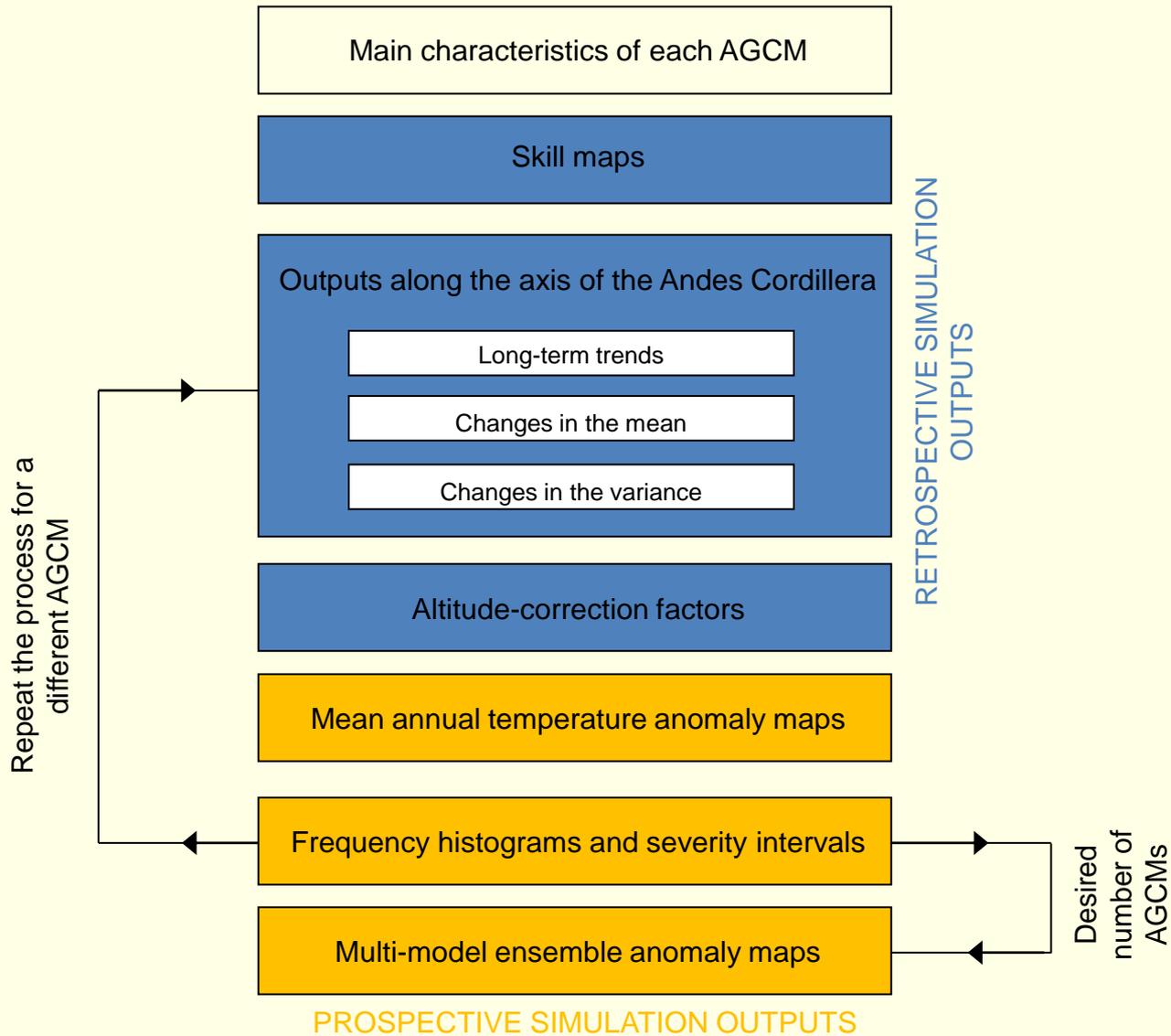
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CCAFS GCM DATA PORTAL  
2014

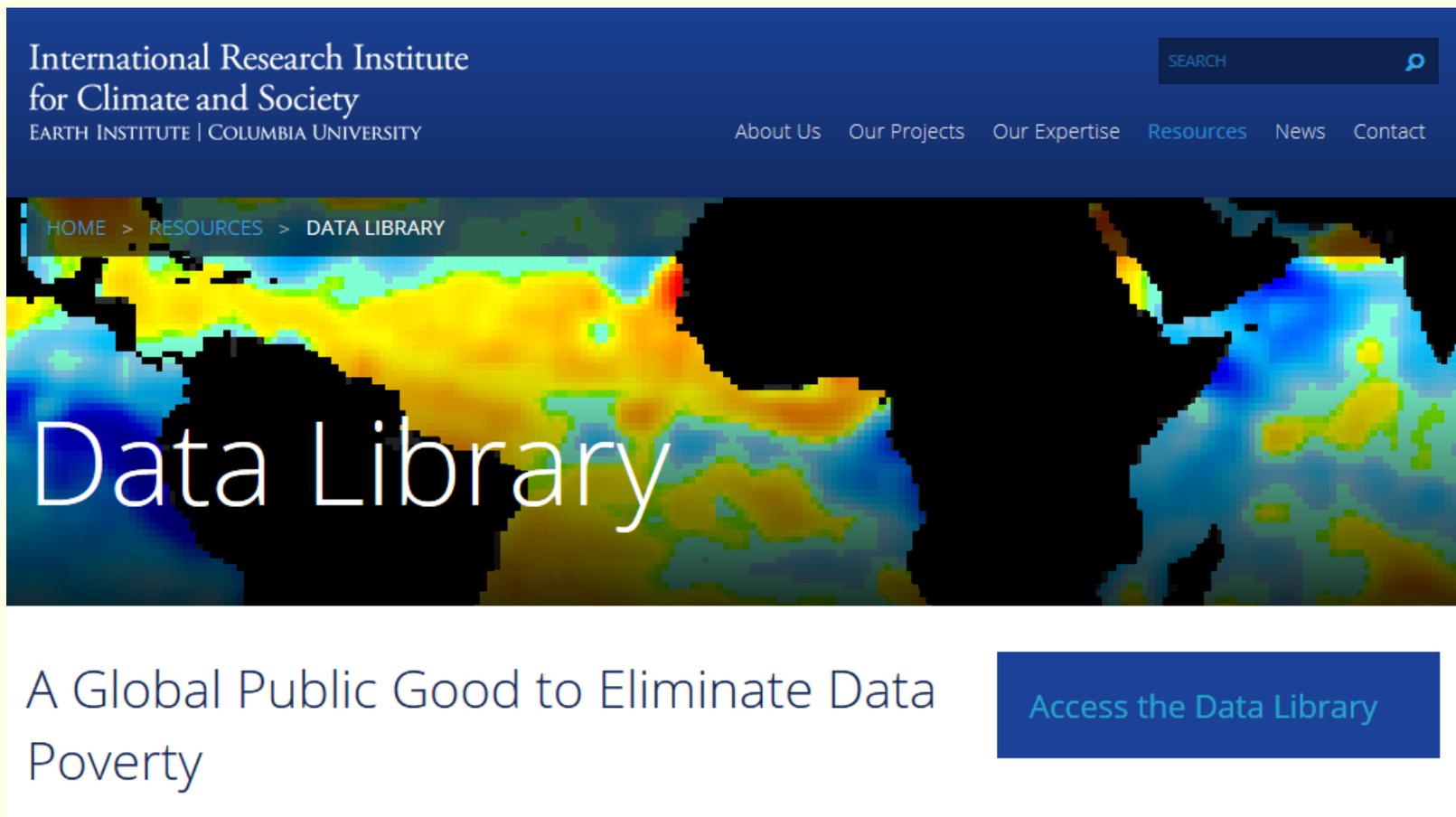
<http://www.ccafs-climate.org/>

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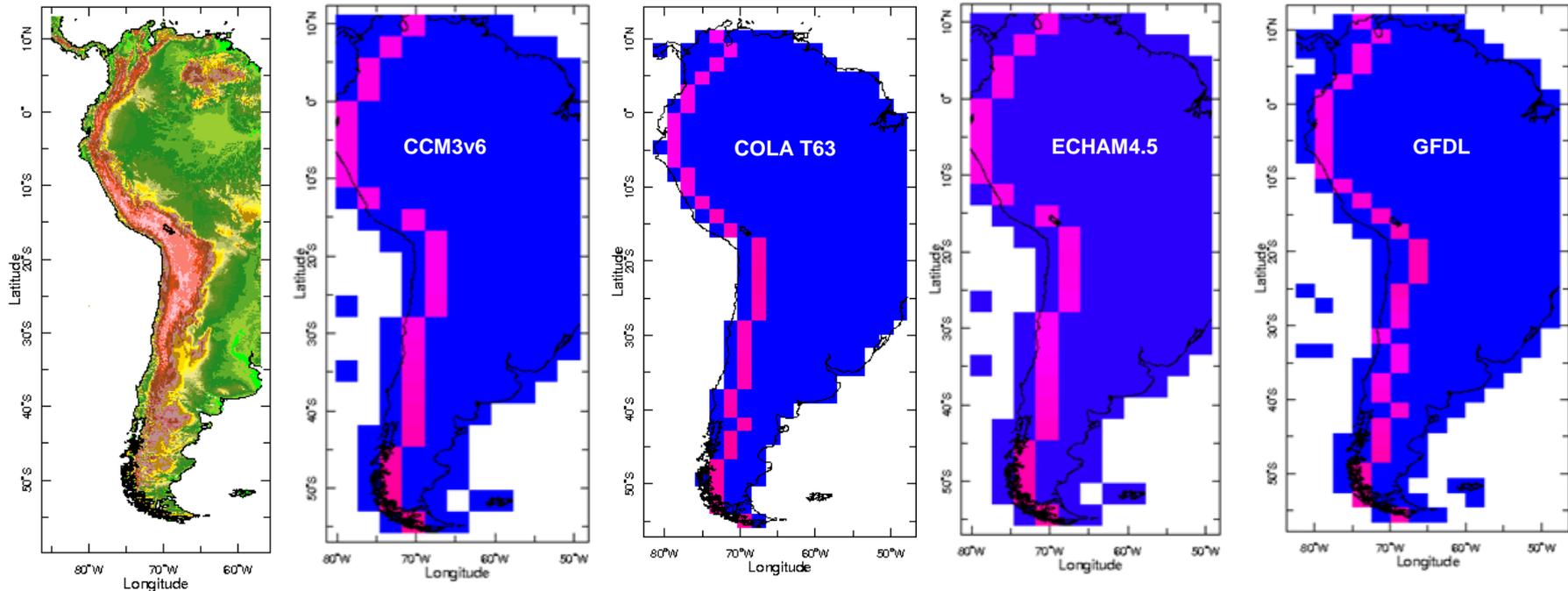
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## AXIS OF THE ANDES CORDILLERA

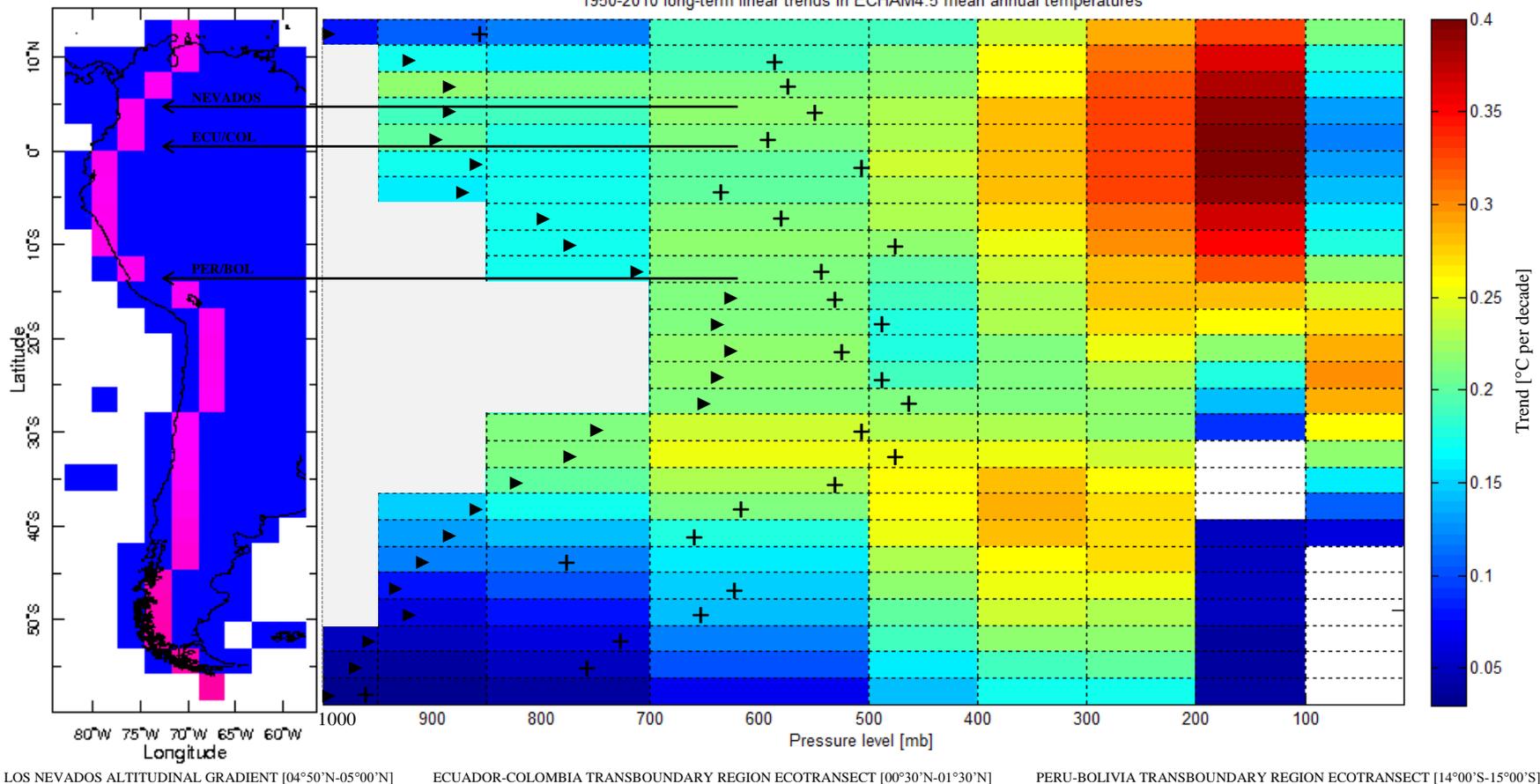


Source: González, Gutiérrez and Ruiz. (2014)

(Left panel) NOAA NGDC GLOBE gridded 1-km, quality-controlled digital elevation model

(Right panels) Grid points for the analysis of CCM3v6, COLA T63, ECHAM4.5, and GFDL ensemble simulation outputs

1950-2010 long-term linear trends in ECHAM4.5 mean annual temperatures

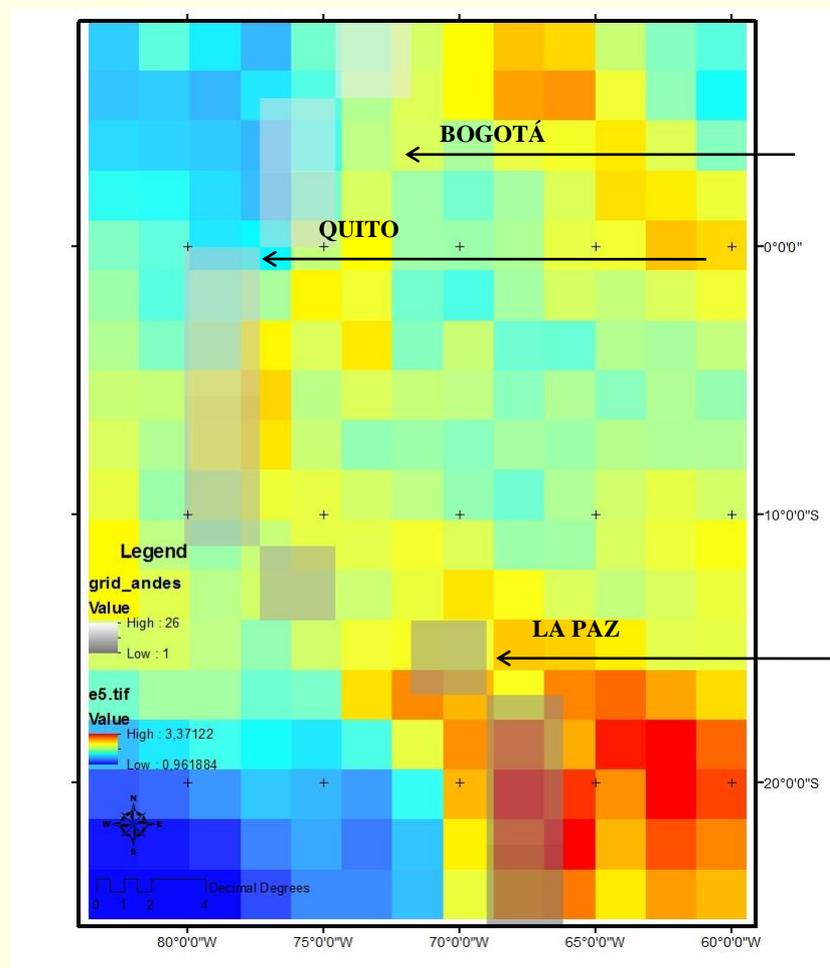


Source: Ruiz et al. (2012)

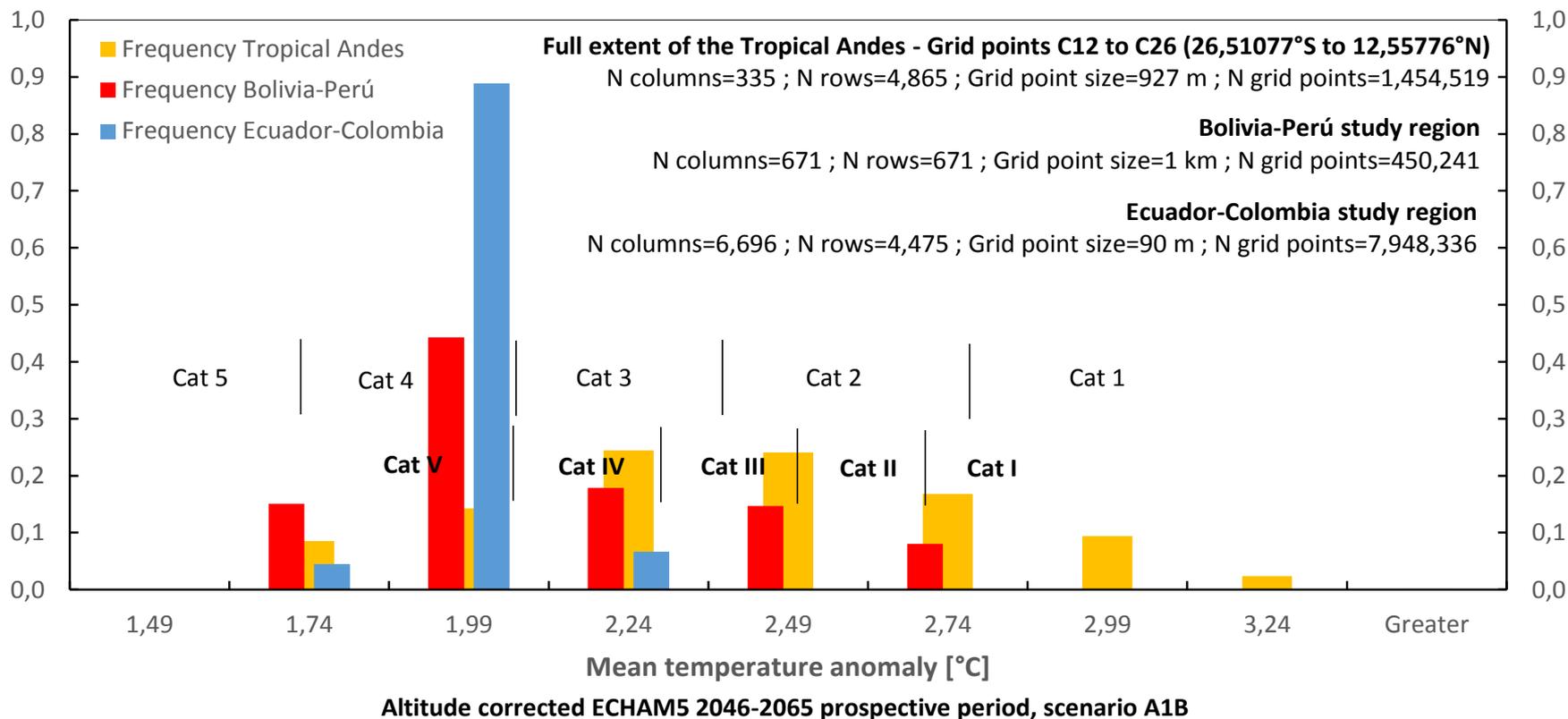
Black solid triangles and crosses depict, respectively, the average and maximum altitudes of the NOAA NGDC GLOBE gridded 1-km, quality controlled global DEM in the ECHAM4.5 model grid points

## CLIMATE CHANGE PROJECTIONS

Mean annual near-surface temperature anomalies, with respect to the historical period 1961-1991, according to ECHAM5 multi-member ensemble simulation outputs, for the prospective period 2046-2065 and for the A1B representative pathway



## MEAN TEMPERATURE ANOMALY PROJECTIONS FOR THE TROPICAL ANDES



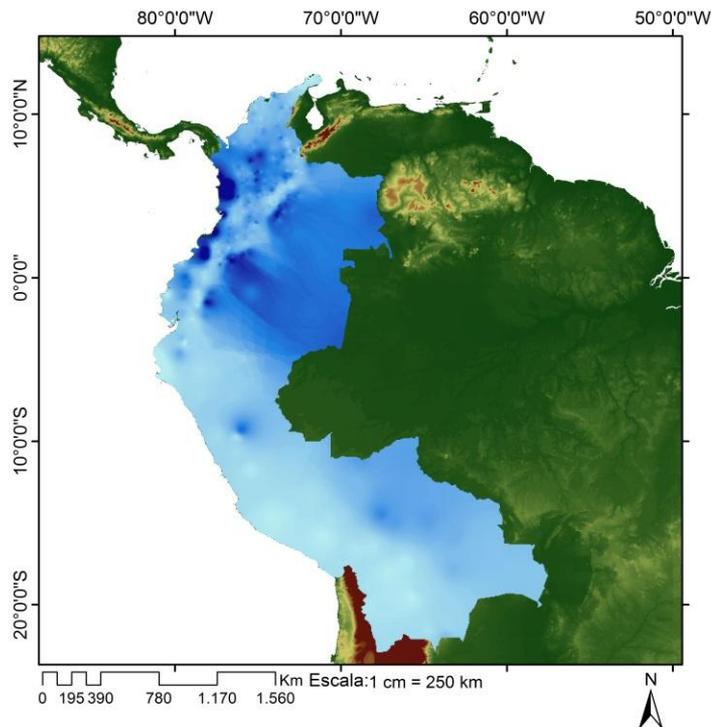
## HUMIDITY

$$AET = \frac{P}{\sqrt{0,9 + \left(\frac{P^2}{L^2}\right)}} \text{ if } \frac{P}{L} > 0,316$$

$$AET = P \text{ if } \frac{P}{L} < 0,316$$

$$PET = 16 \left( 10 \frac{T}{I} \right)^a$$

Precipitación Media



### Convenciones

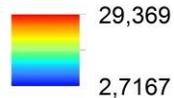
#### Precipitación media

##### Valor

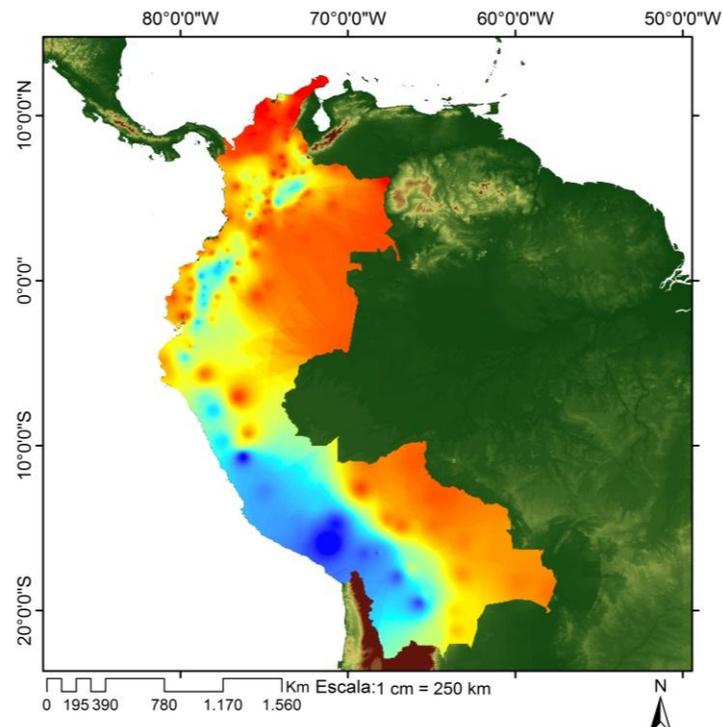


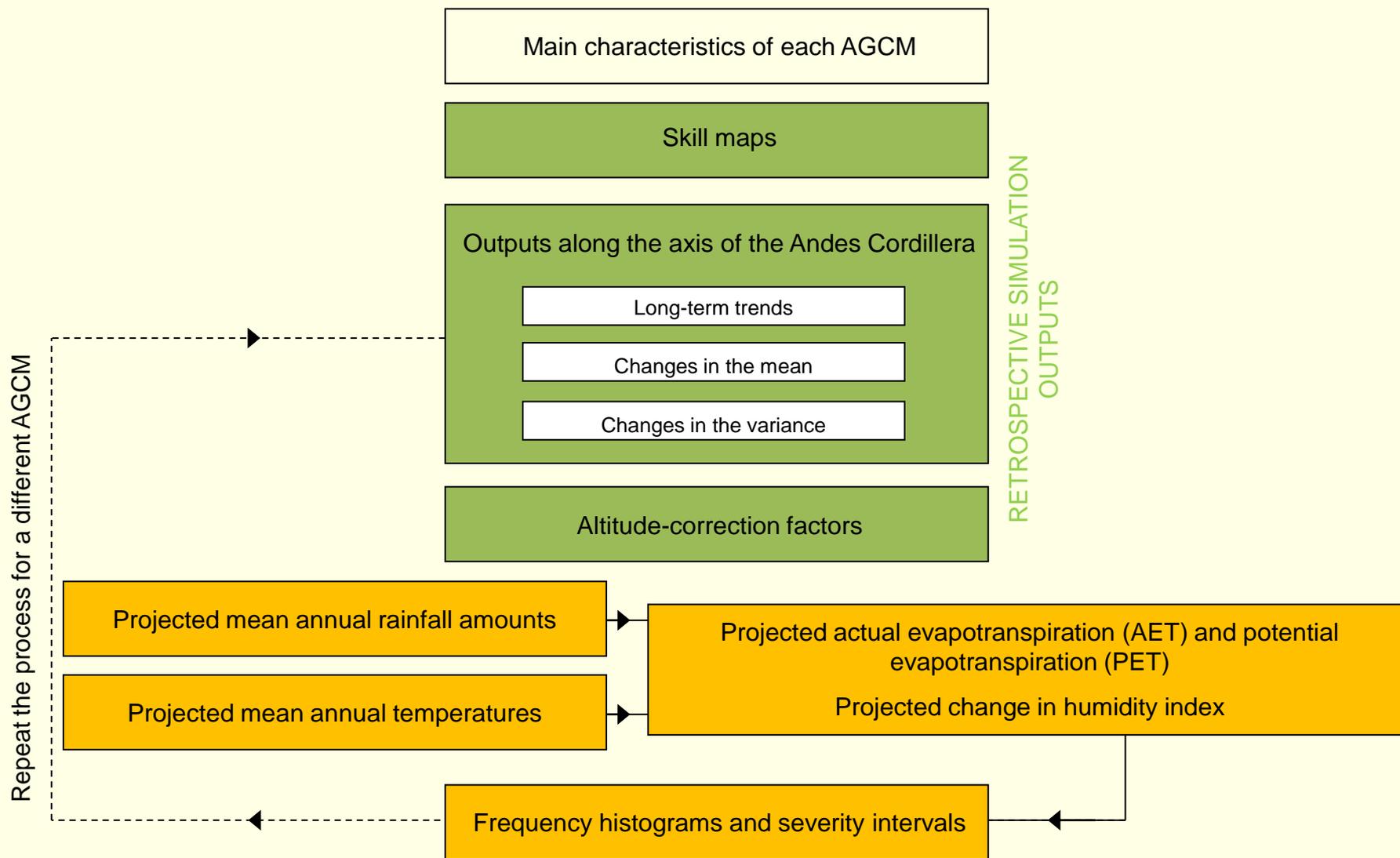
#### Tempertatura media

##### Valor

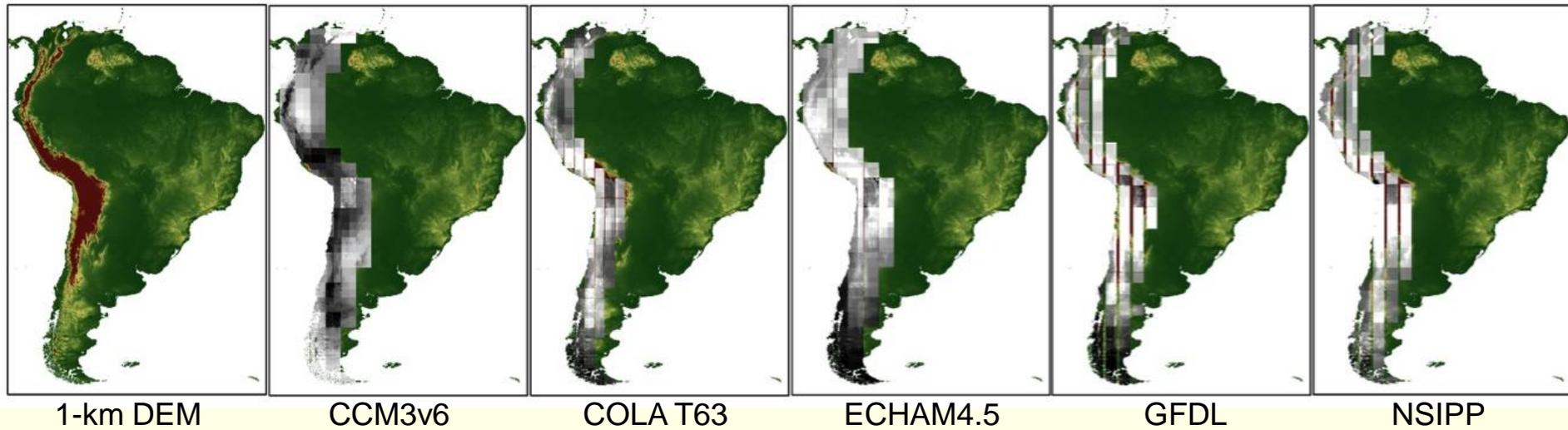


Temperatura Media

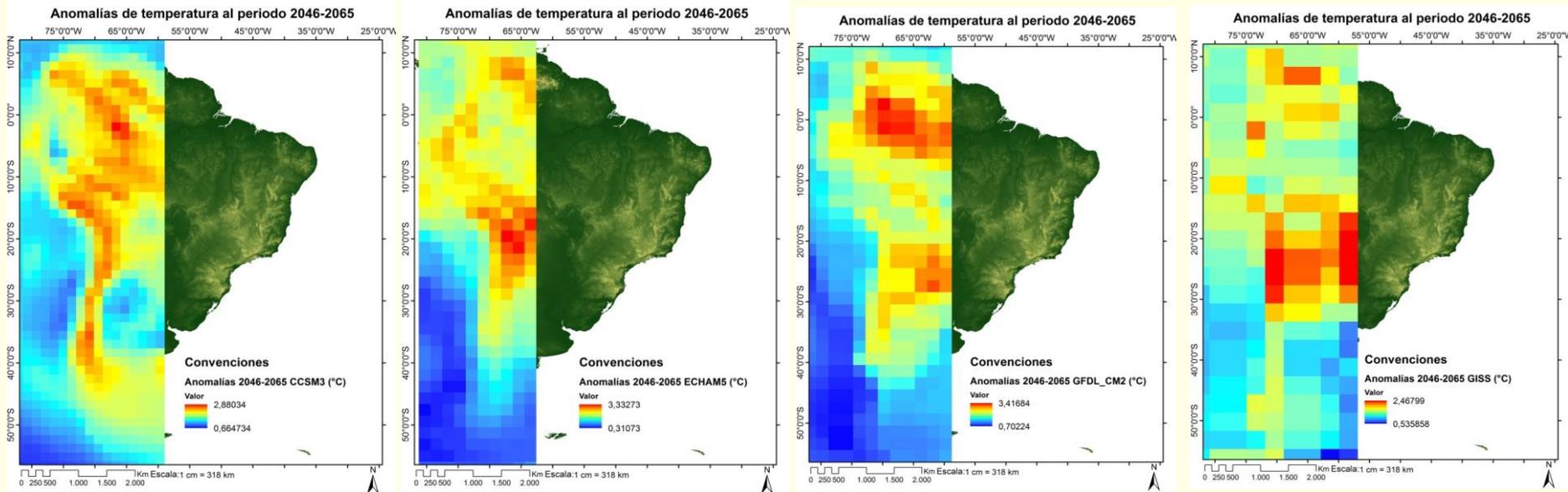




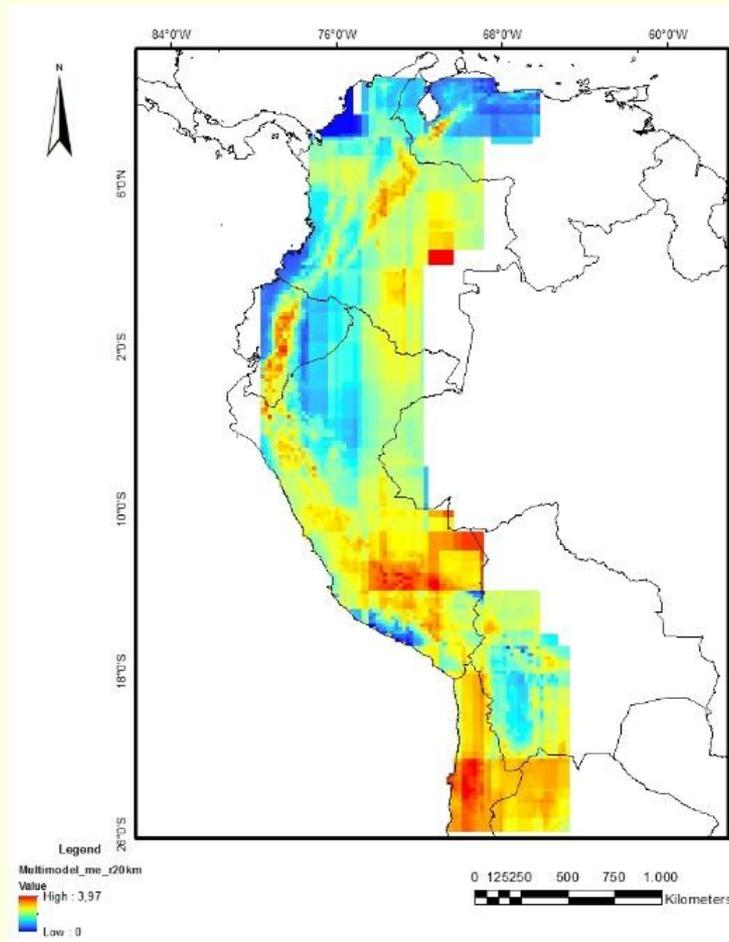
## SYSTEMIC REPRESENTATION OF THE ANDES CORDILLERA (considering both flanks)



## MULTI-MODEL CLIMATE CHANGE PROJECTIONS

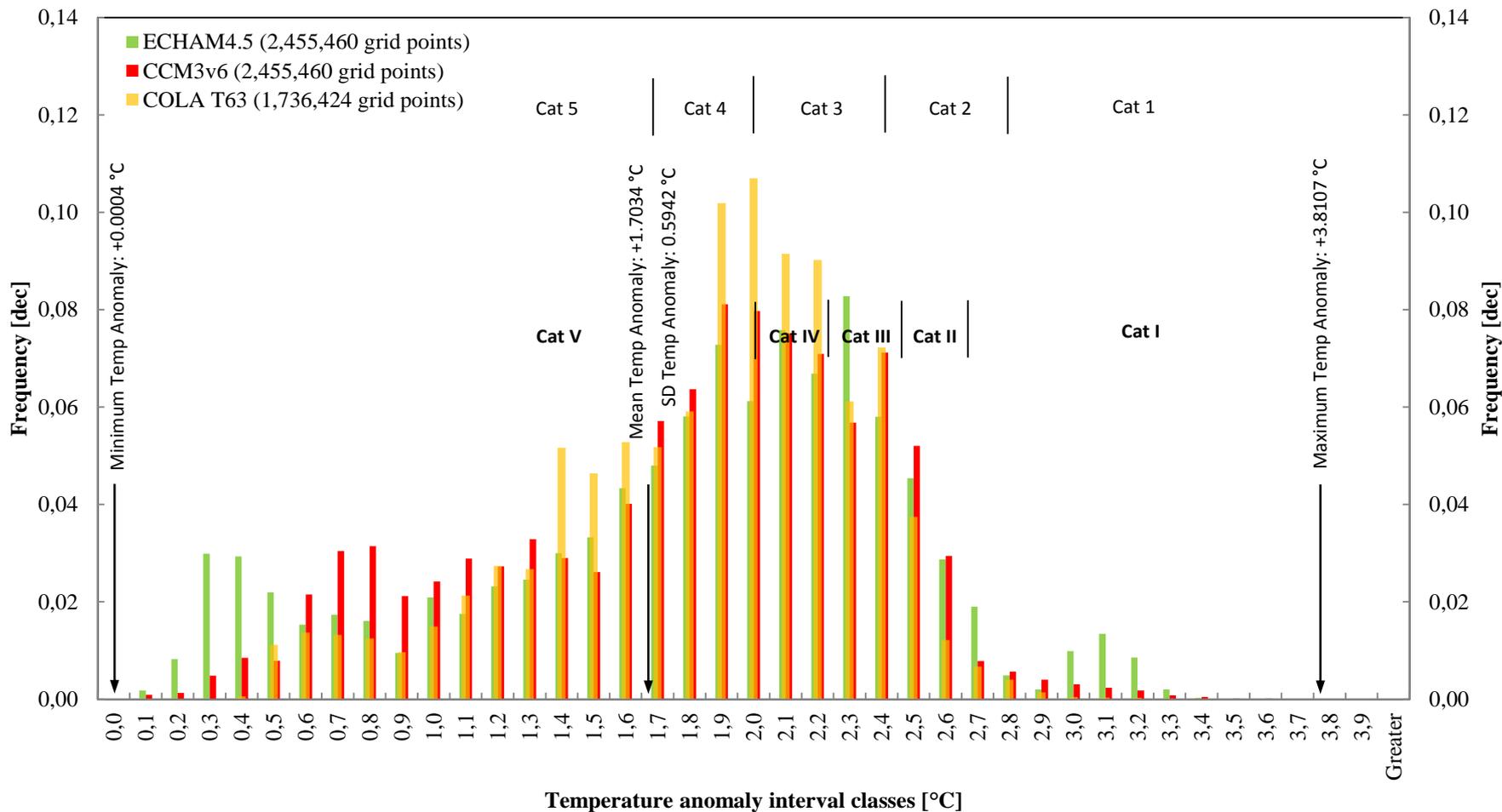


Mean annual near-surface temperature anomalies, with respect to the historical period 1961-1991, according to CCSM3 (left), ECHAM5 (middle left), GFDL\_CM2 (middle right), and GISS (right) multi-member ensemble simulation outputs, for the prospective period 2046-2065 and for the A1B representative pathway

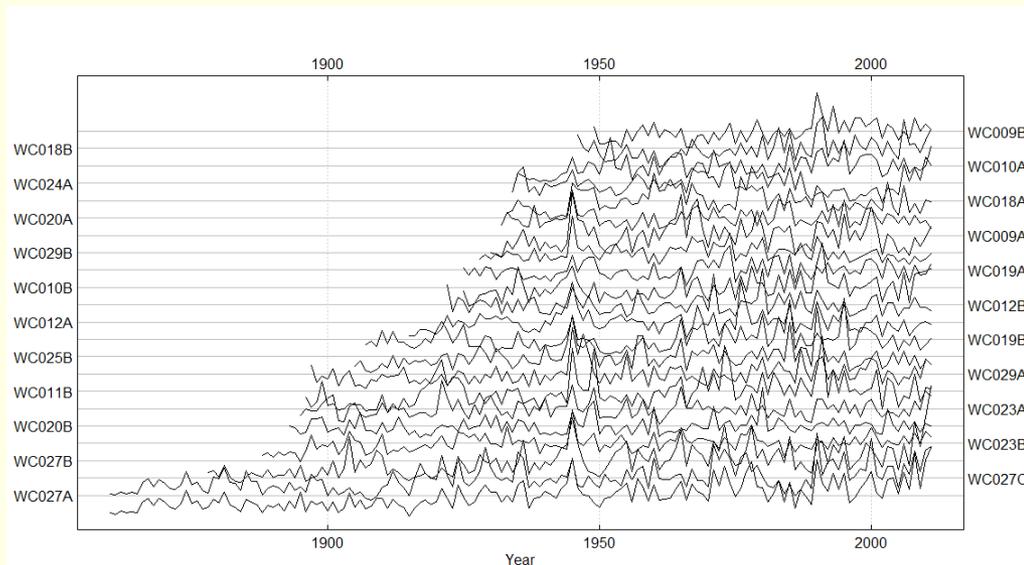
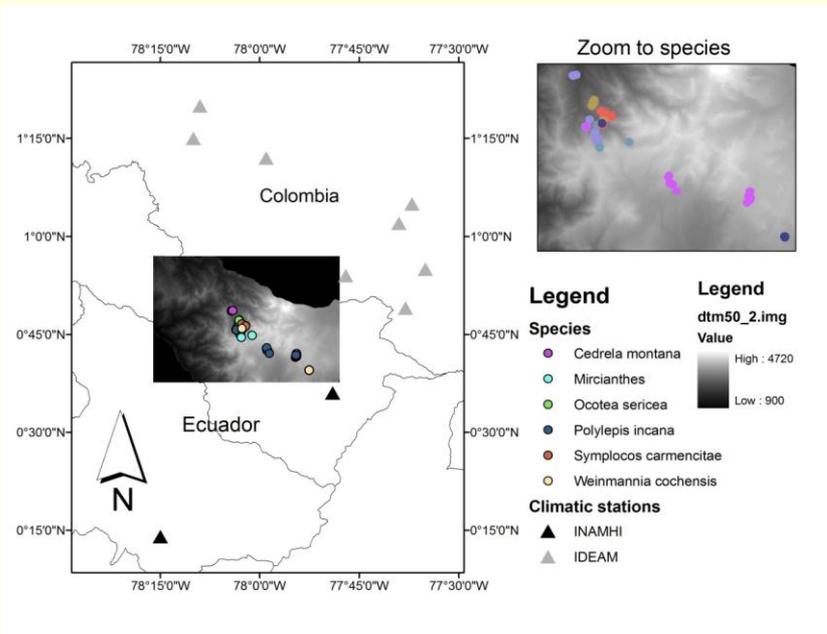


Mean annual near-surface temperature anomalies suggested by a 20-km altitude-corrected, equally-weighted, multi-model ensemble – MME, with respect to the historical period 1961-1991, for the prospective period 2046-2065 and for the A1B representative pathway

# UNCERTAINTY IN CLIMATE CHANGE PROJECTIONS



# DENDROCHRONOLOGICAL STUDY



Raw tree ring-width series from *Weinmannia cochensis*

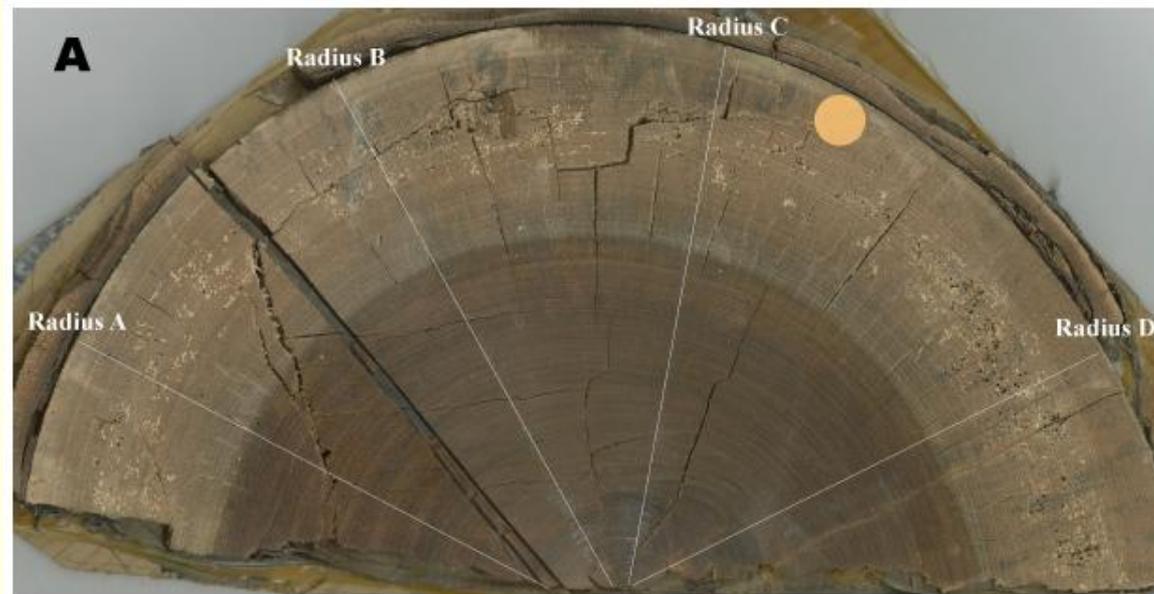
Radiocarbon, Vol 57, Nr 1, 2015, p 1–13

DOI: 10.2458/azu\_rc.57.18192

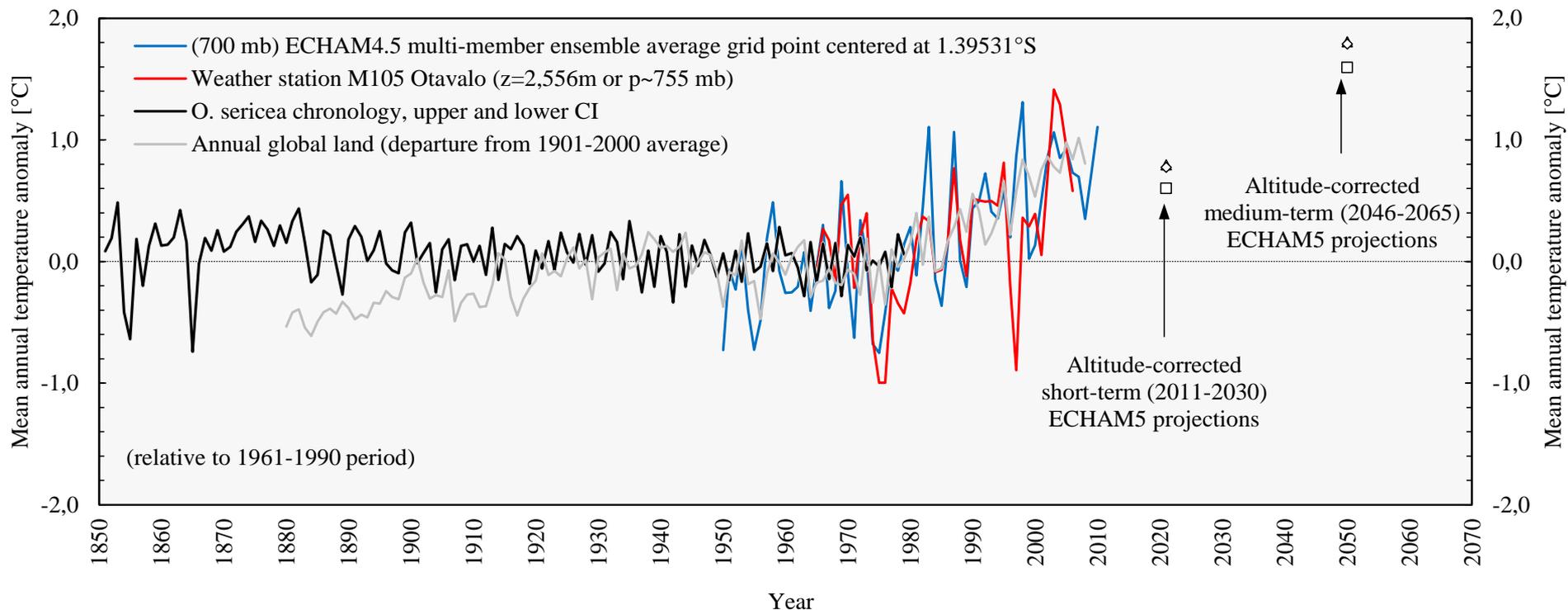
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**ANNUAL TREE RINGS IN *PSEUDOLMEDIA RIGIDA* FROM BOLIVIA CONFIRMED BY MATCHING DENDROCHRONOLOGICAL DATES WITH THE SOUTHERN HEMISPHERE <sup>14</sup>C CURVES**

Laila Andreu-Hayles<sup>1,2,†</sup> • Guaciara M Santos<sup>3,†</sup> • David A Herrera-Ramírez<sup>4</sup> • Javier Martin-Fernández<sup>1</sup> • Daniel Ruiz-Carrascal<sup>5,6</sup> • Tatiana E Boza-Espinoza<sup>7</sup> • Alfredo F Fuentes<sup>8,9</sup> • Peter M Jørgensen<sup>9</sup>



## LONG-TERM CONTEXT



## TEMPERATURE ANOMALIES SEVERITY INTERVALS

NatureServe

**Cat 1** [ $> +2.71^{\circ}\text{C}$ ]

Cat 2 [ $+2.50$  to  $+2.71^{\circ}\text{C}$ ]

Cat 3 [ $+2.29$  to  $+2.49^{\circ}\text{C}$ ]

Cat 4 [ $+2.06$  to  $+2.28^{\circ}\text{C}$ ]

**Cat 5** [ $< +2.06^{\circ}\text{C}$ ]

1-km  
MPIM:ECHAM5  
individual,  
altitude-corrected,  
multi-member  
simulation outputs

[ $> +2.83^{\circ}\text{C}$ ]

[ $+2.47$  to  $+2.83^{\circ}\text{C}$ ]

[ $+2.09$  to  $+2.46^{\circ}\text{C}$ ]

[ $+1.73$  to  $+2.08^{\circ}\text{C}$ ]

[ $< +1.72^{\circ}\text{C}$ ]

20-km  
equally-weighted,  
altitude-corrected,  
multi-model  
ensemble

[ $> +2.42^{\circ}\text{C}$ ]

[ $+2.05$  to  $+2.42^{\circ}\text{C}$ ]

[ $+1.68$  to  $+2.04^{\circ}\text{C}$ ]

[ $+1.32$  to  $+1.67^{\circ}\text{C}$ ]

[ $< +1.31^{\circ}\text{C}$ ]

Long-term  
context

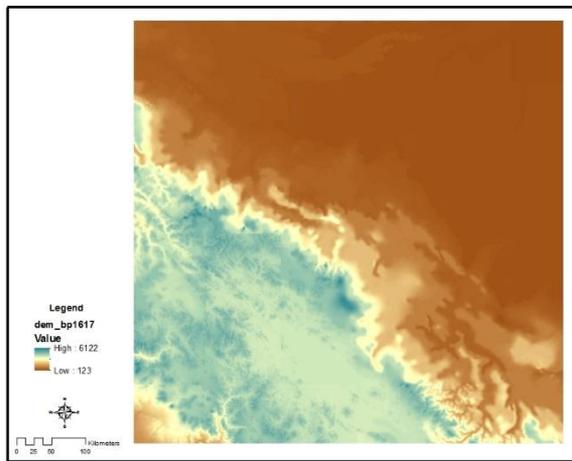
[ $> +2.58^{\circ}\text{C}$ ]

[ $+2.32$  to  $+2.58^{\circ}\text{C}$ ]

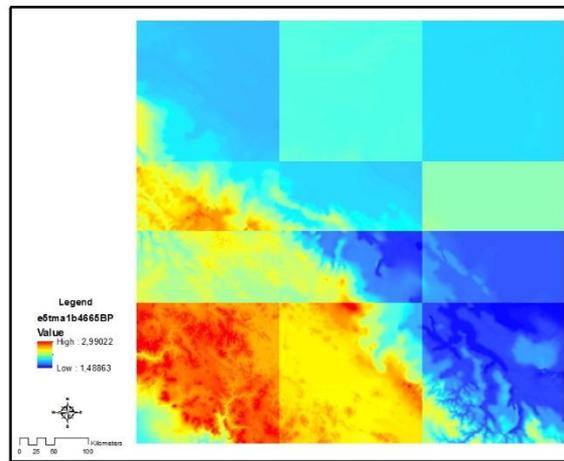
[ $+2.06$  to  $+2.31^{\circ}\text{C}$ ]

[ $+1.79$  to  $+2.05^{\circ}\text{C}$ ]

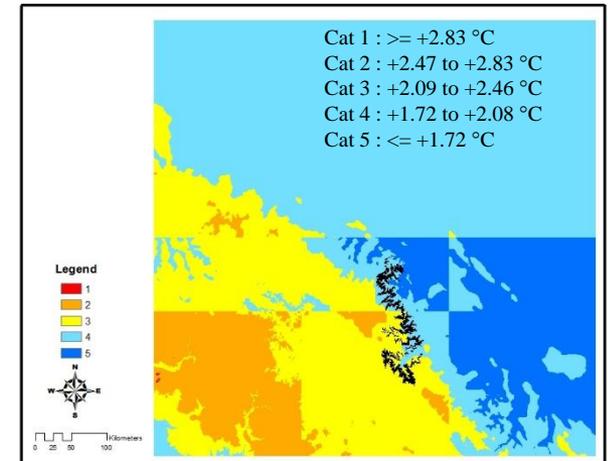
[ $< +1.78^{\circ}\text{C}$ ]



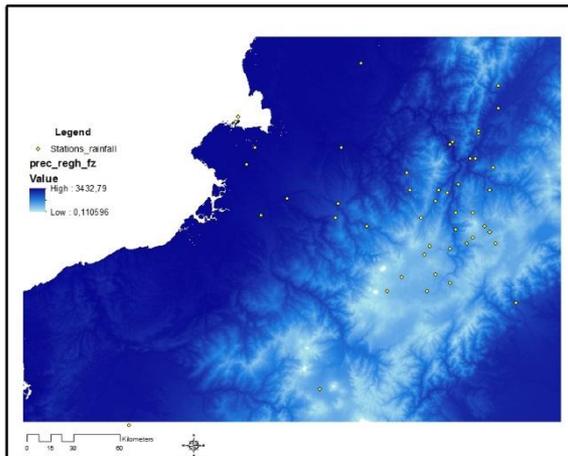
DTM, Bolivia - Perú study region (123 to 6,122 masl)



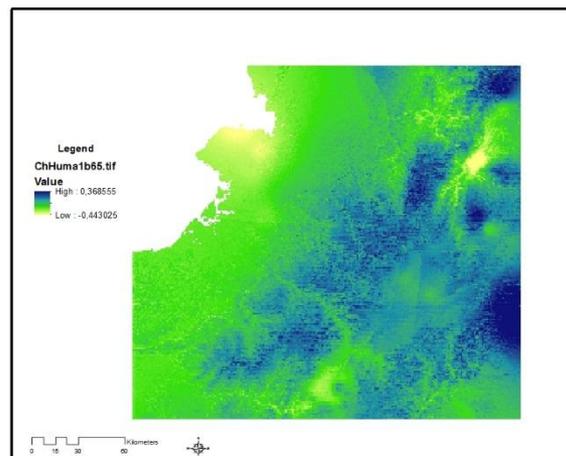
Altitude-corrected mean temperature anomaly, 2046-2065 prospective period, A1B representative pathway (+1.49°C to +3.00°C)



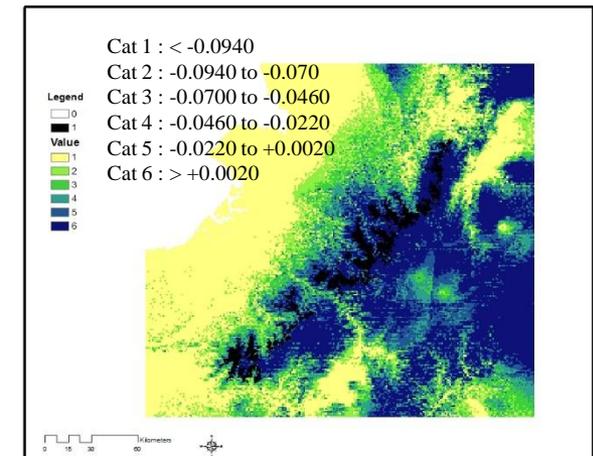
Classified temperature anomaly severity intervals  
*Ontherus bridgesi* Dung Beetle species distribution



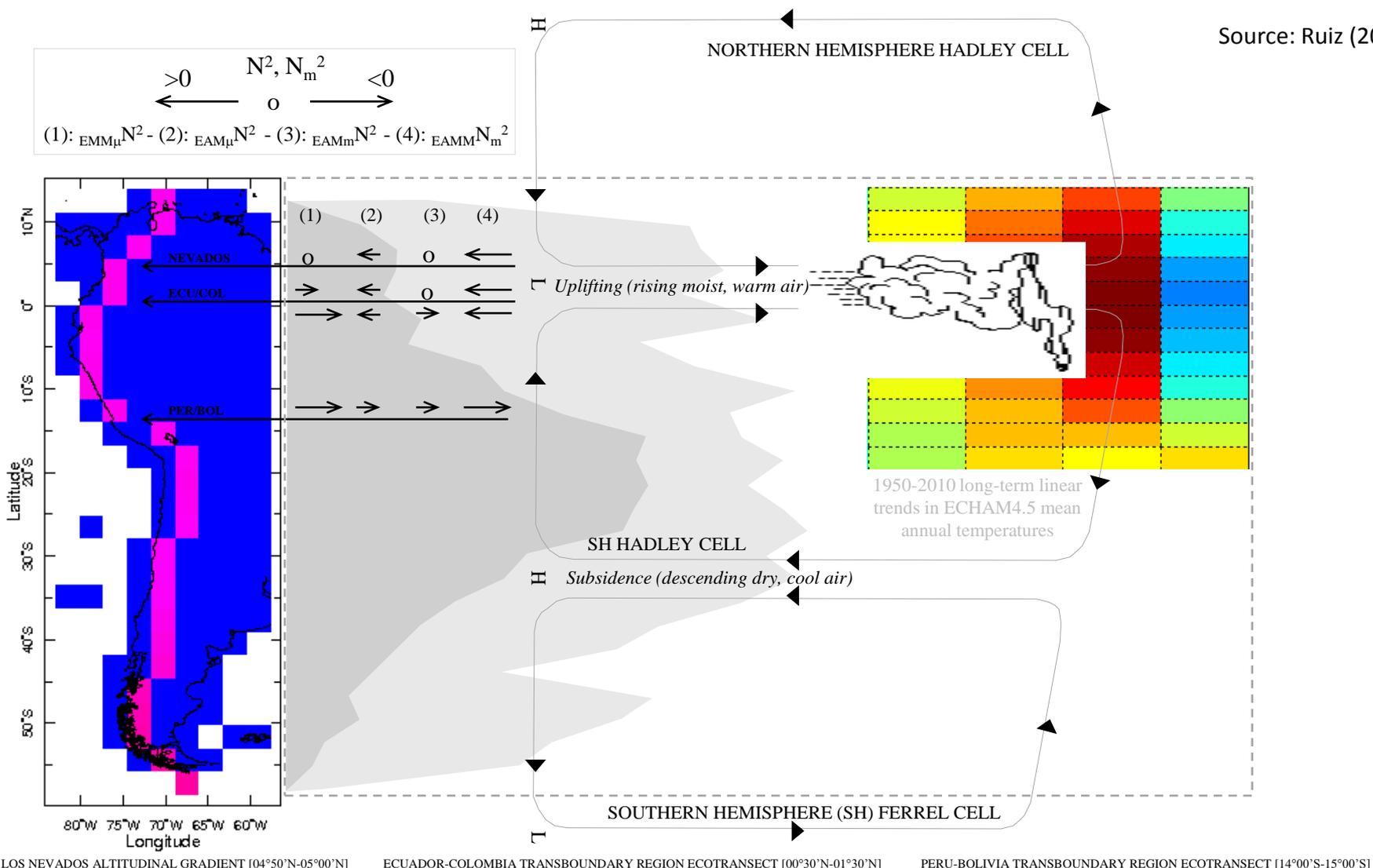
Total annual rainfall (0.11 to 3,432.8 mm)



Change in humidity, 2046-2065 prospective period, A1B representative pathway (-0.44 to +0.37)



Classified humidity anomaly severity intervals  
*Aberrans* Dung Beetle species distribution



LOS NEVADOS ALTITUDINAL GRADIENT [04°50'N-05°00'N]    ECUADOR-COLOMBIA TRANSBOUNDARY REGION ECOTRANSECT [00°30'N-01°30'N]    PERU-BOLIVIA TRANSBOUNDARY REGION ECOTRANSECT [14°00'S-15°00'S]

Idealized representation of the large-scale atmospheric circulation over the axis of the Andes Cordillera, along with the 1950-2010 long-term linear trends in ECHAM4.5 mean annual temperatures. The thermal equator is assumed to be static at around 0-5°N, approximately

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