PERÚ Ministerio del Ambiente

Senamhi

"TRENDS AND CLIMATE CHANGE SCENARIOS IN PERU"

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National Weather and Hydrology Service of Perú

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Objectives

- To detect evidence of climate change in Peru.
- To generate regional climate scenarios to 2030.

In Peru…

Increase of GHG emissions → **INCREASE OF GLOBAL TEMPERATURE (IPCC, 2007)**

↓ ?

REGIONAL AND LOCAL CLIMATE IMPACTS IN PERU

HIGH VULNERABILITY

SOCIO-ECONOMICAL ASPECTS: POVERTY, ACCESS TO EDUCATION, etc

NATURAL ASPECTS: COMPLEX TOPOGRAPHY, DIVERSITY OF CLIMATES, RECURRENCE OF EXTREME EVENTS

SECTORS

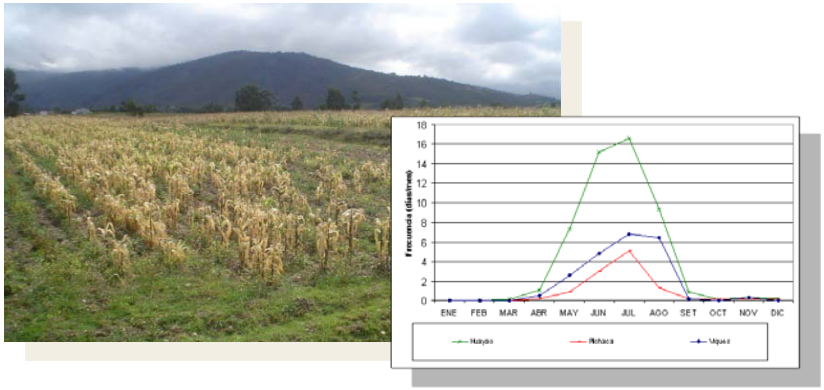
Evidences:

GLACIER RETREAT : YANAMAREY
(Cordillera Blanca- Height 4786 m above Sea Level)

Extreme events:

Ica – downtown
Floods February 1998

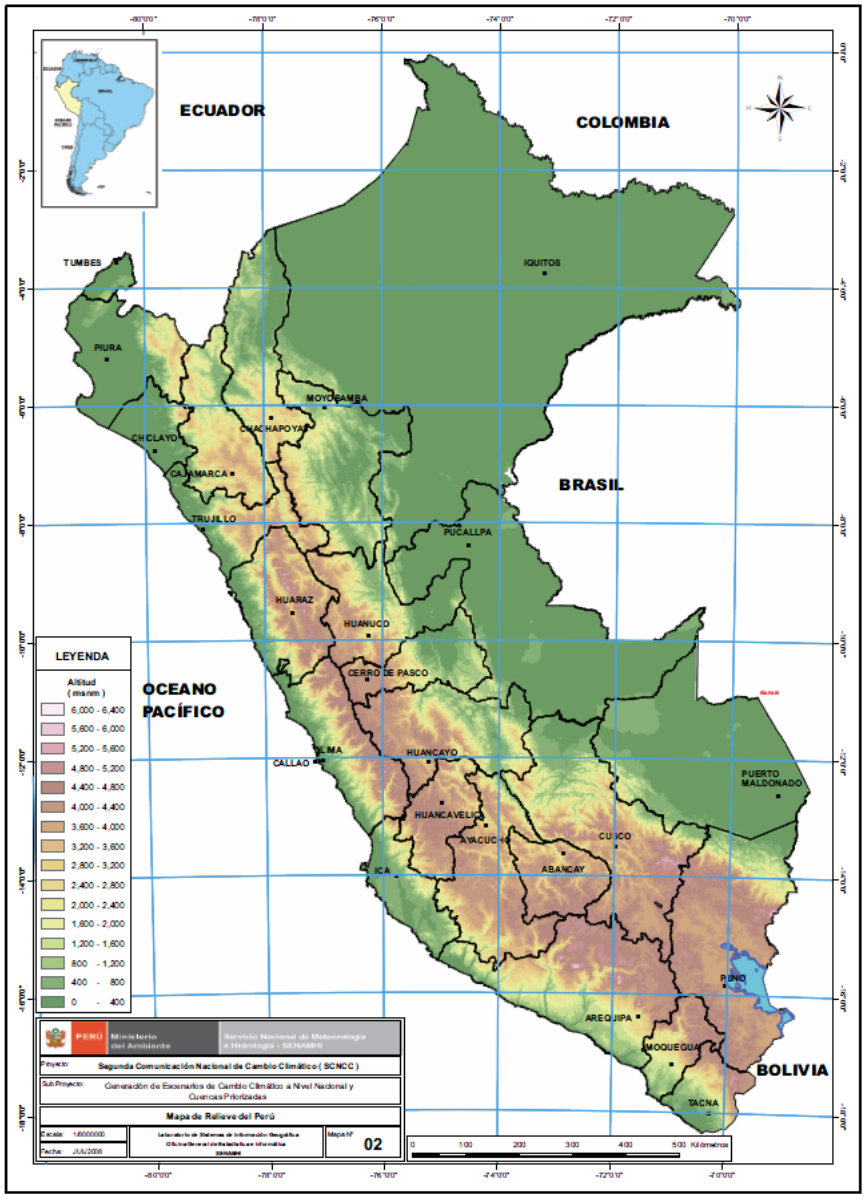
Puno – Snow July 2004



Huancayo – Frost
February 2007

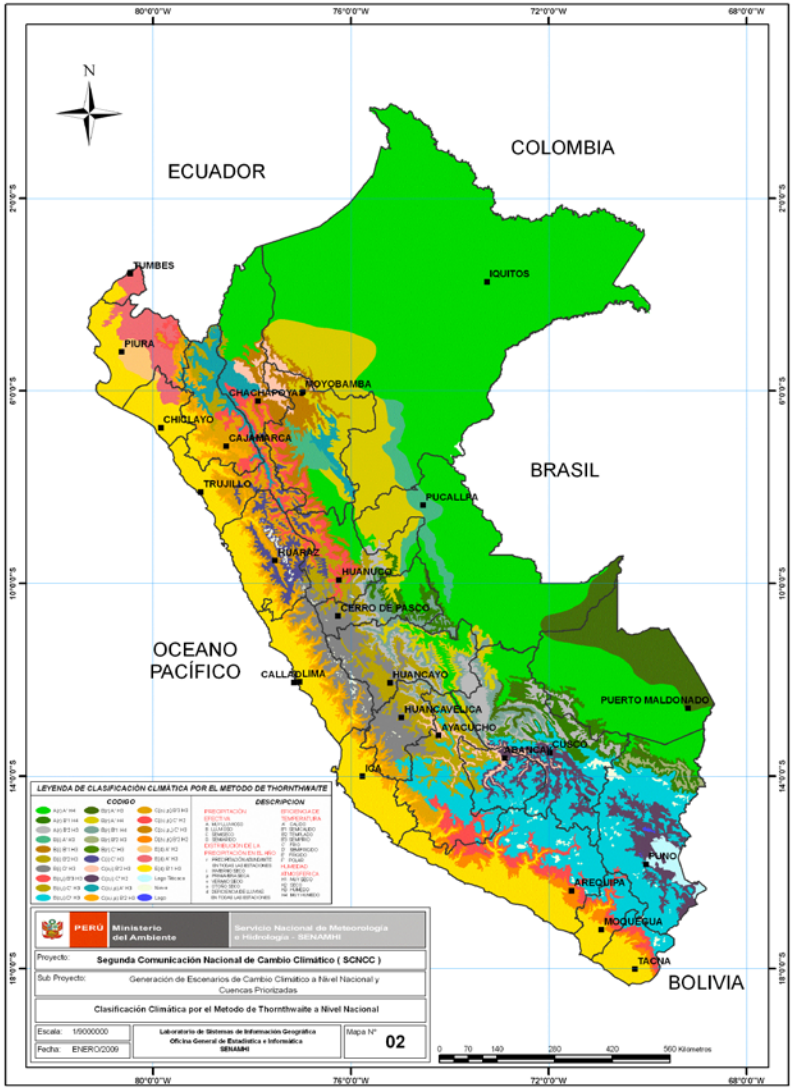
San Martín – Floods
December 2006

Are these extreme events in Perú linked to climate change?



Factors that modulate the climate in Peru

There are 27 different types of climates



Climate classification by Thornwaite

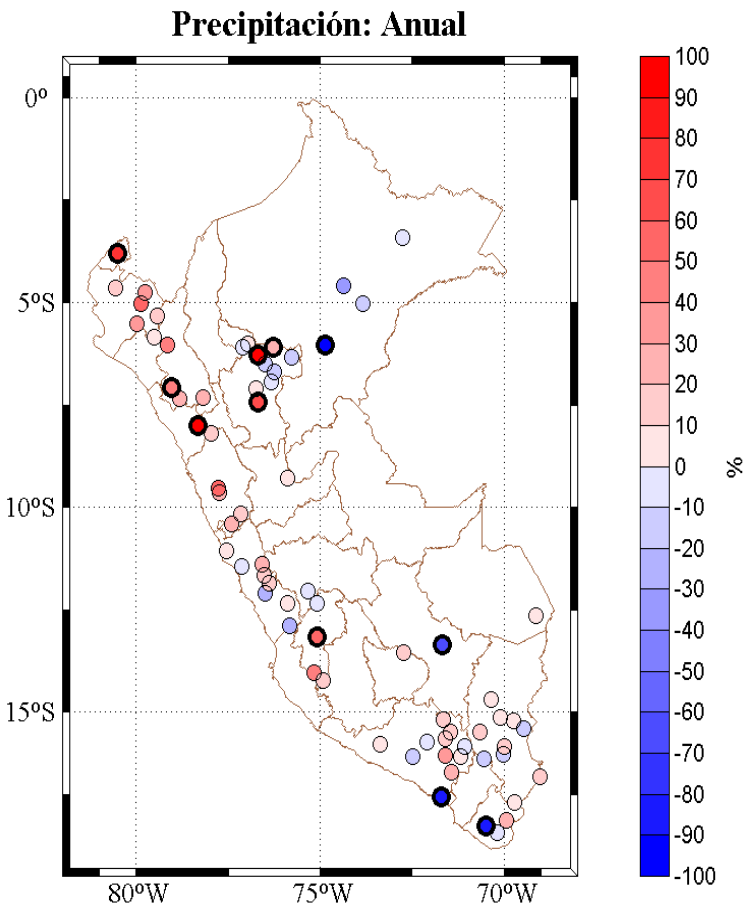
Looking at the trends:

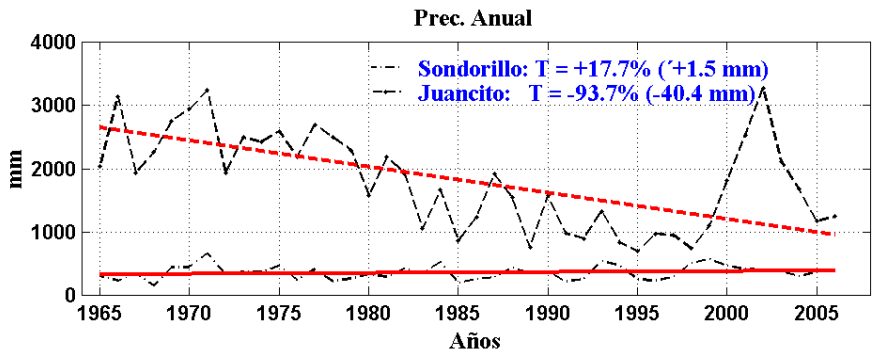
- What is observed data indicating?

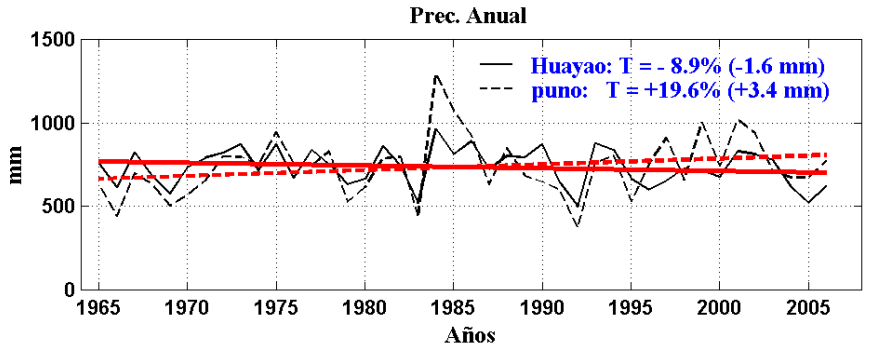
METHODOLOGIES

Climate change detection	**Climate Trends** • Mann –Kendall Method (non parametric test) • Trend PP mm/year • Trend TT °C/year **Extreme Climate Indexes** • Frisch et al. (2002), used in AR4 IPCC. **Droughts** • SPI: Standarized Precipitation Index

Rainfall trends (1965 – 2006)

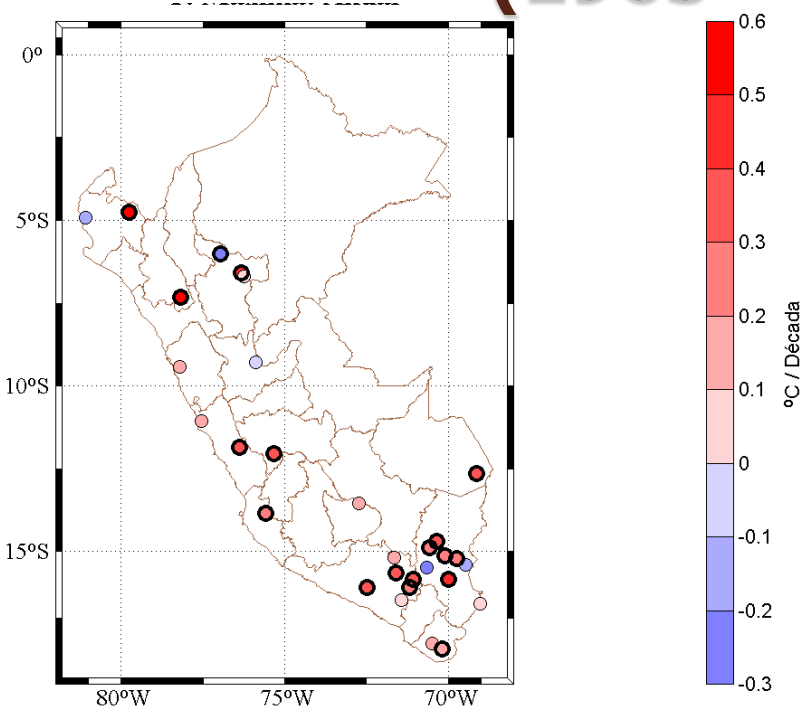




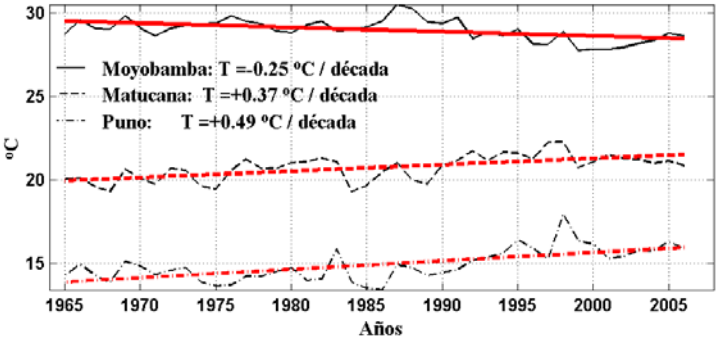


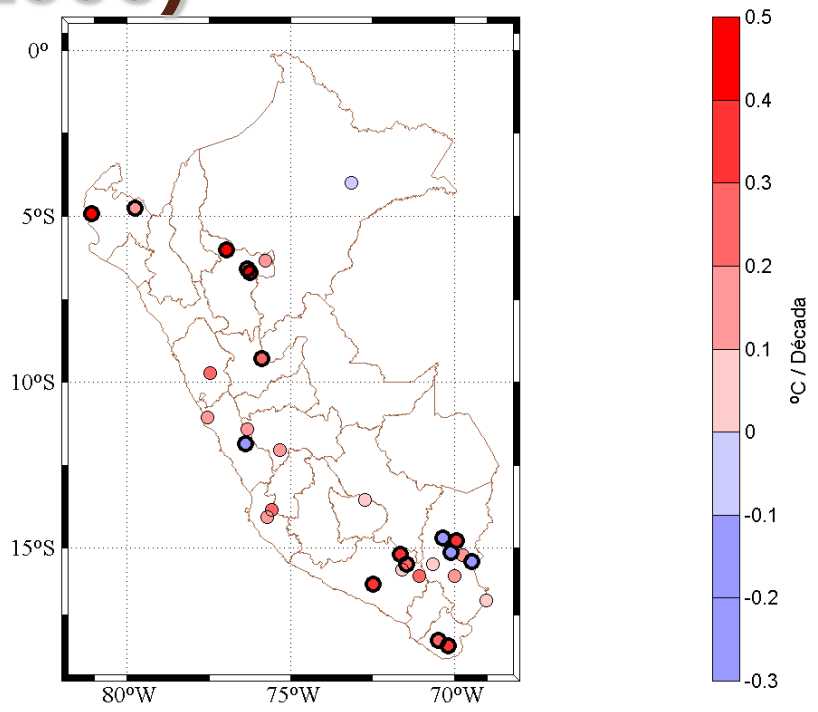
(Sen (1968), Hirsch et al. (1982): Slope: SEN Method ; Test: Mann-Kendall

Temperature trends (1965 – 2006)

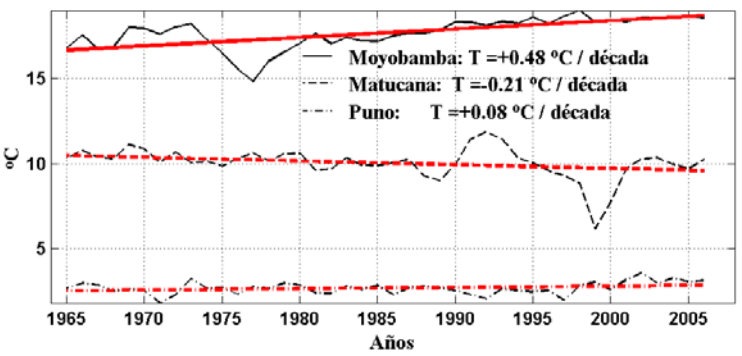


T. Máxima Anual

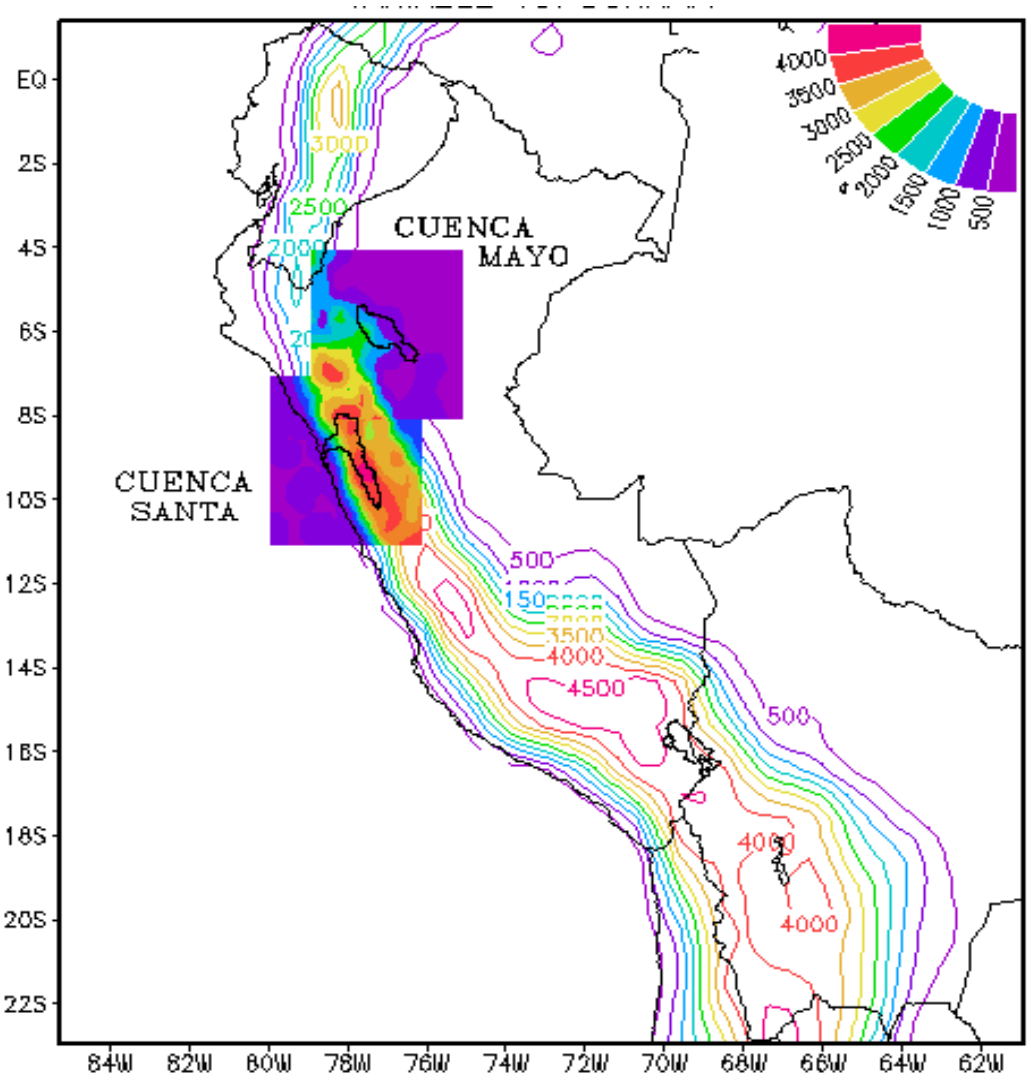




T. Mínima Anual

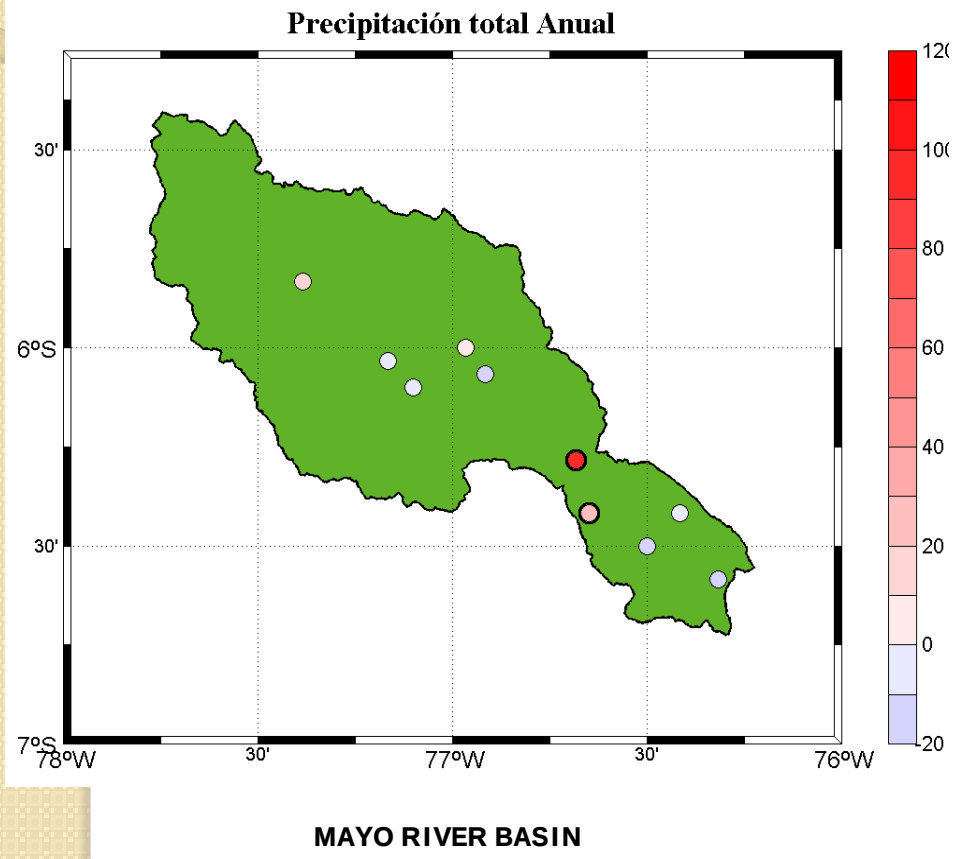


- Basin Level

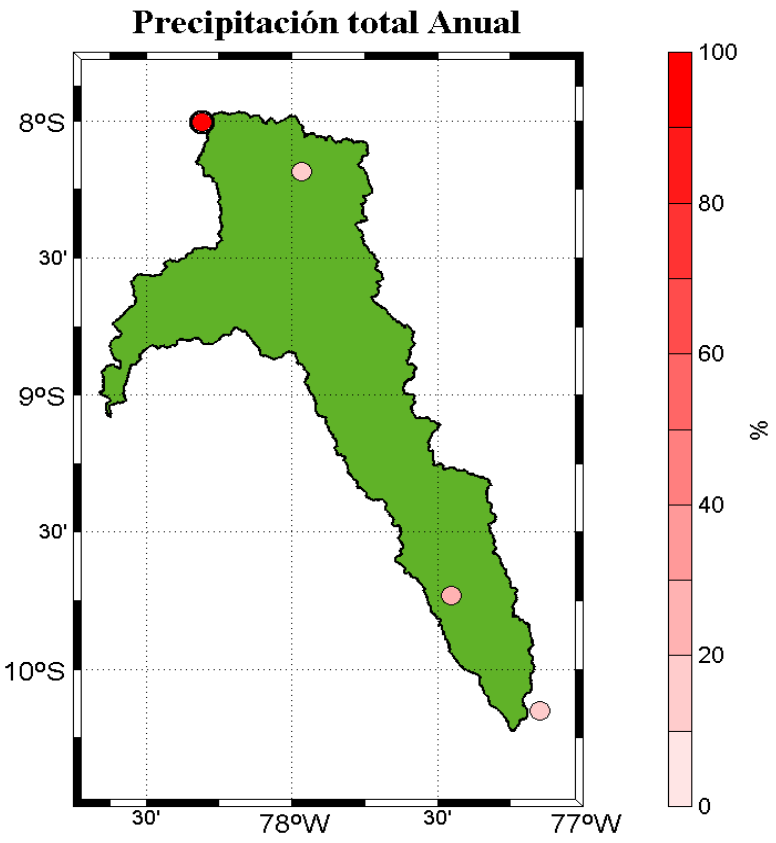


Representación de los dominios de simulación en la variable topografía (metros).
Área Perú a 60 km y área de las cuencas de los ríos Santa y Mayo a 20 km.

Yearly Rainfall Trends



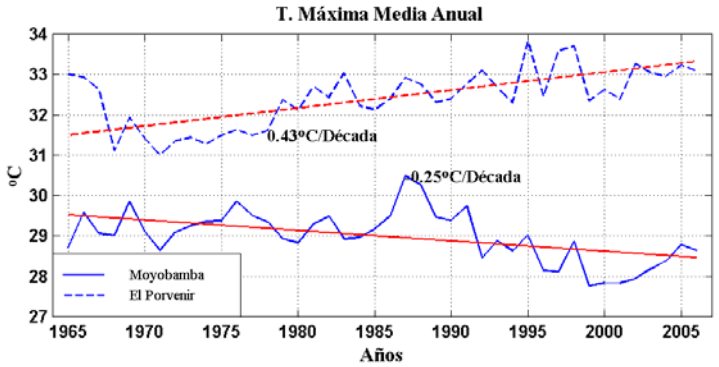
MAYO RIVER BASIN

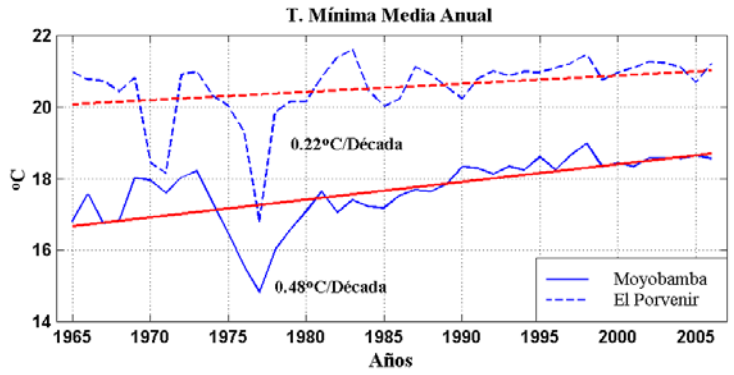


SANTA RIVER BASIN

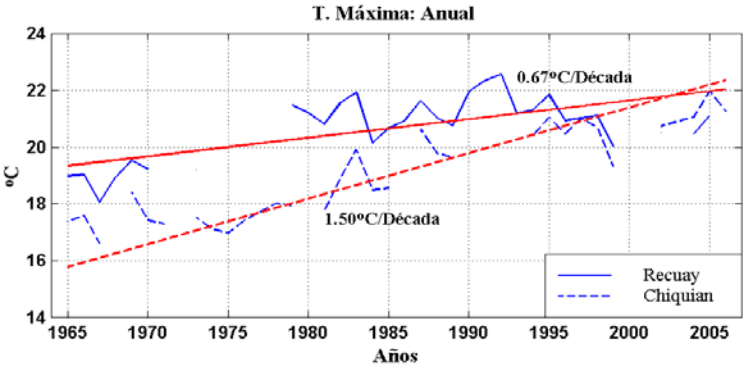
Temperature Trends

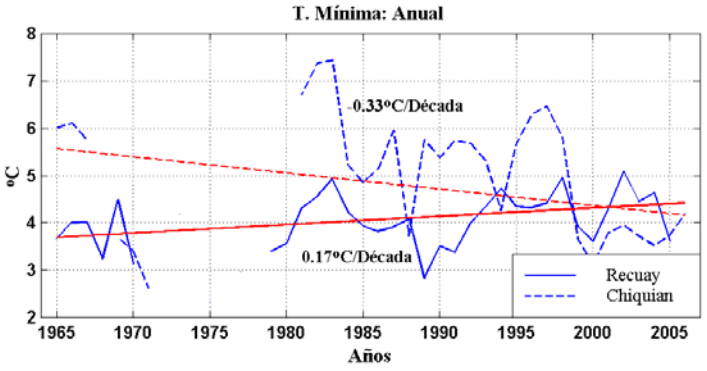
MAYO RIVER BASIN





SANTA RIVER BASIN

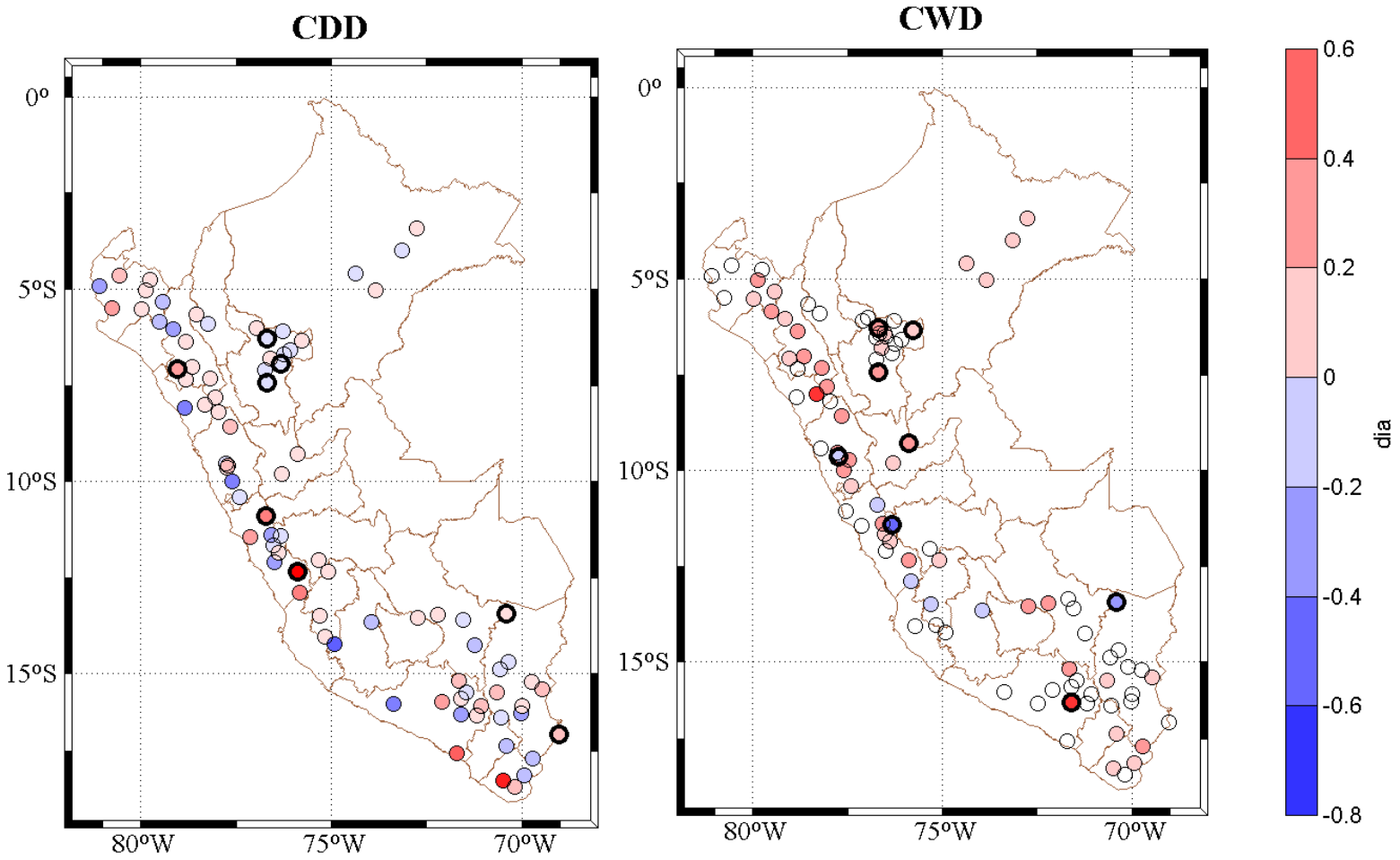




DETECTION OF CLIMATE CHANGE:

EXTREME INDEXES

Extreme climate index

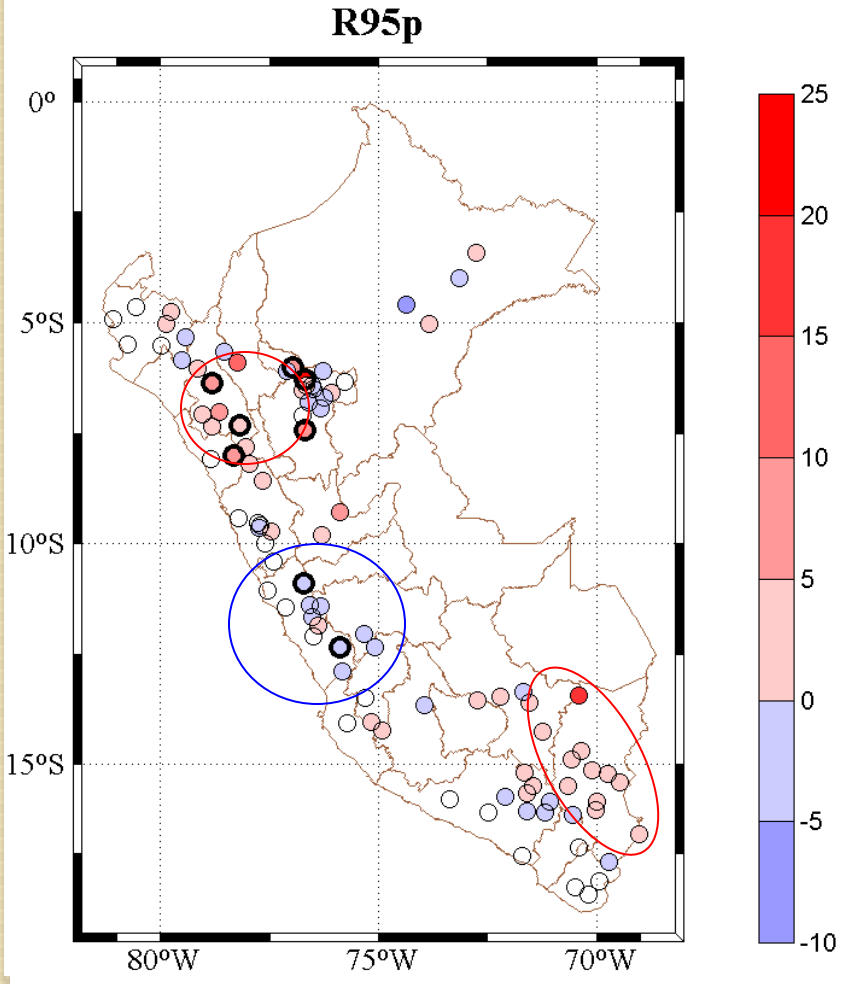


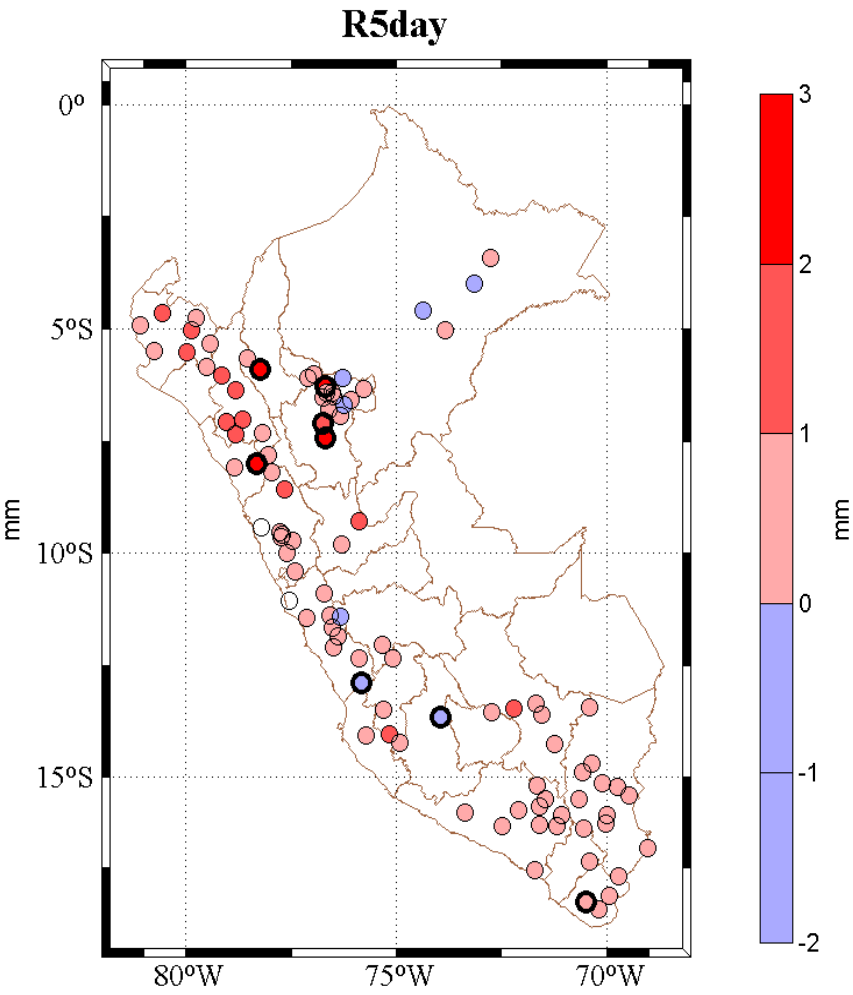
CDD: Consecutive dry days

CWD: Consecutive wet days

Extreme climate index : Frisch (2002); FClimdex

Extreme climate index

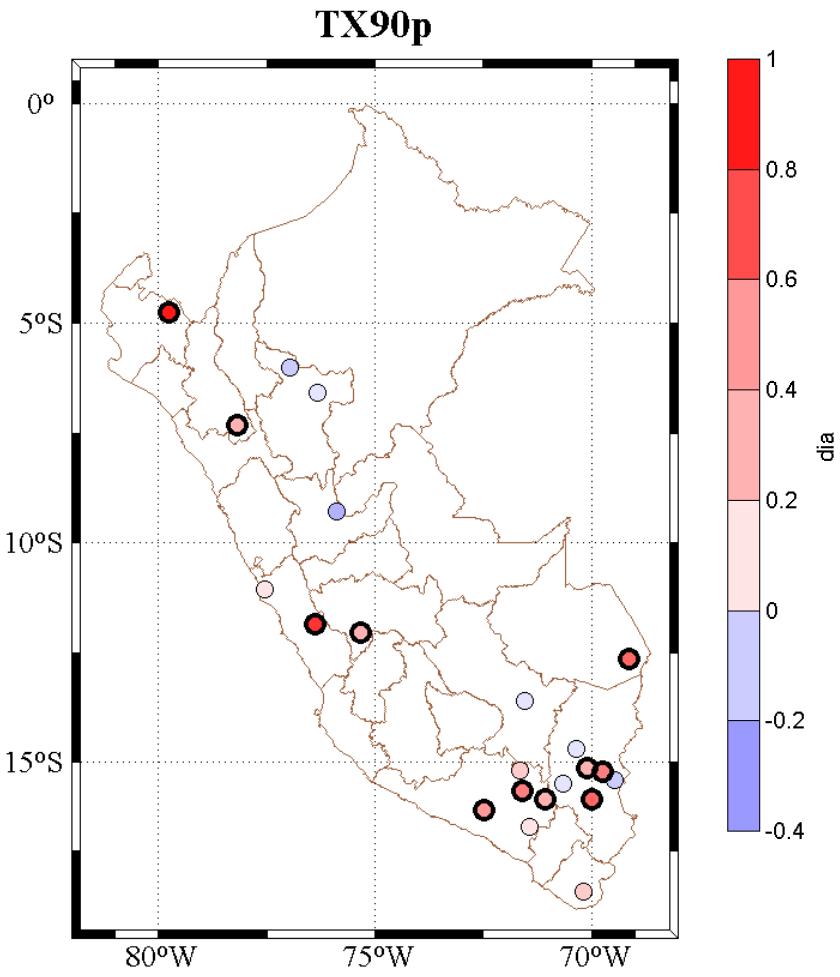




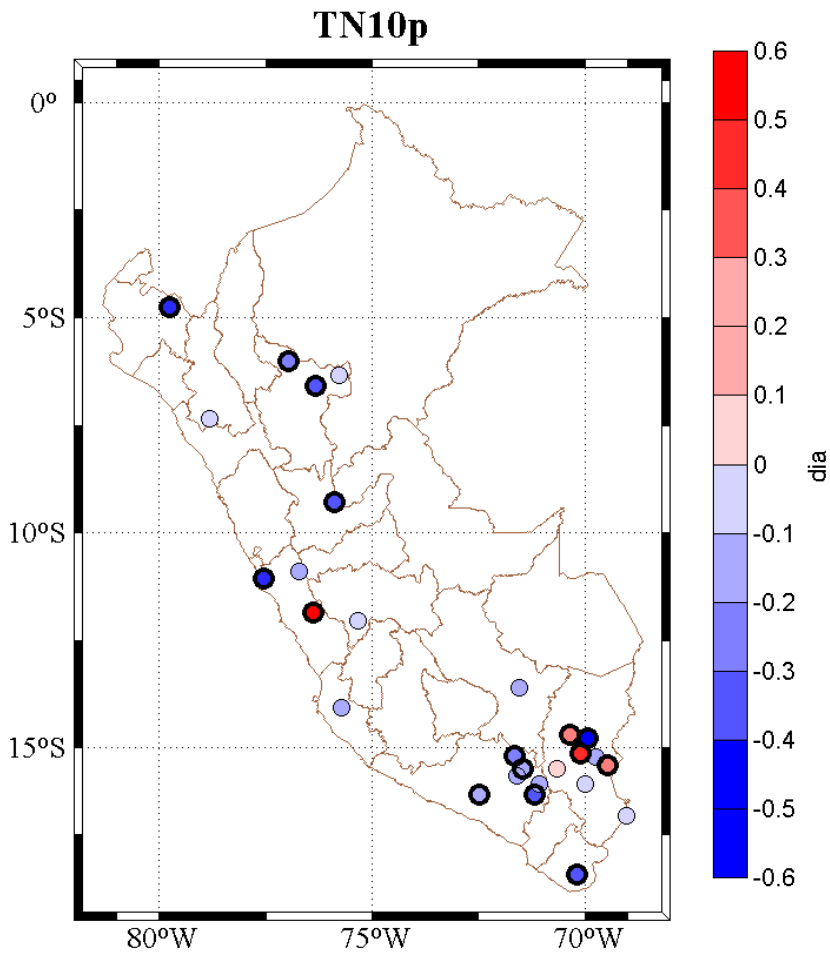
R95p: very wet days

R5day: Max. 5-day Amount

Extreme climate index



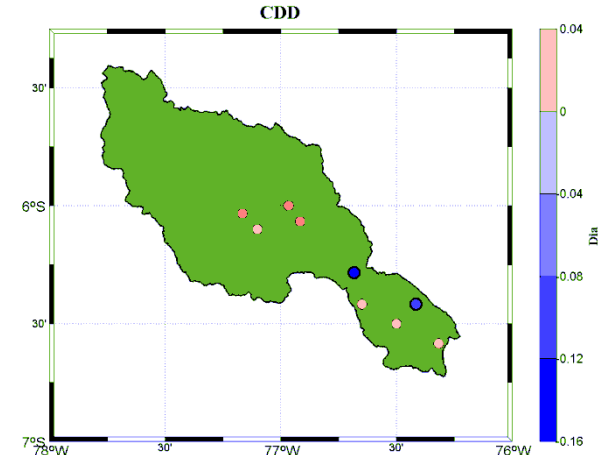
TX90p: Warm days

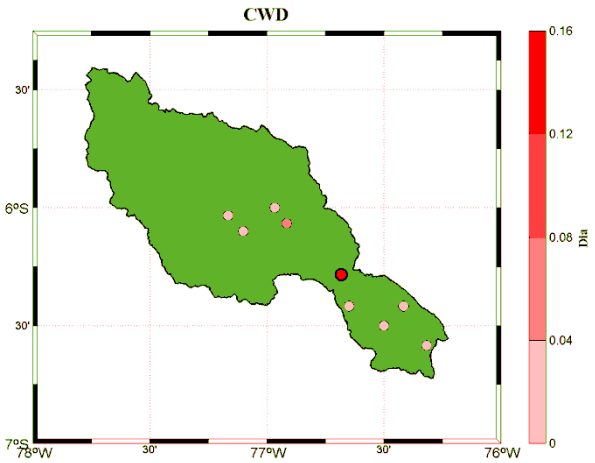


TN10p: Cool nights

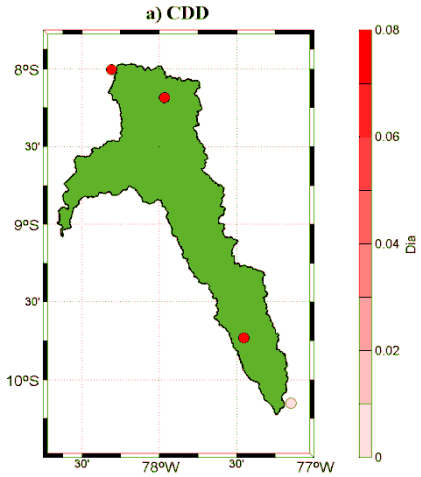
- Basin Level extreme indexes

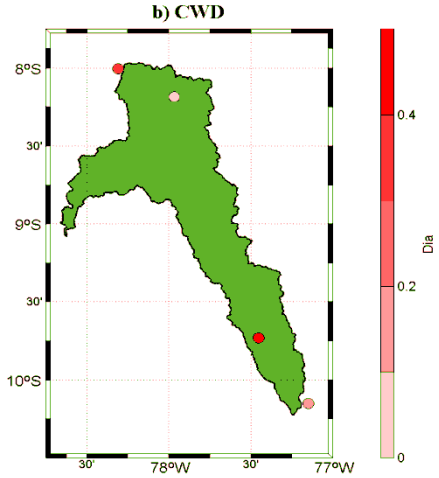
Extreme climate index





MAYO RIVER BASIN



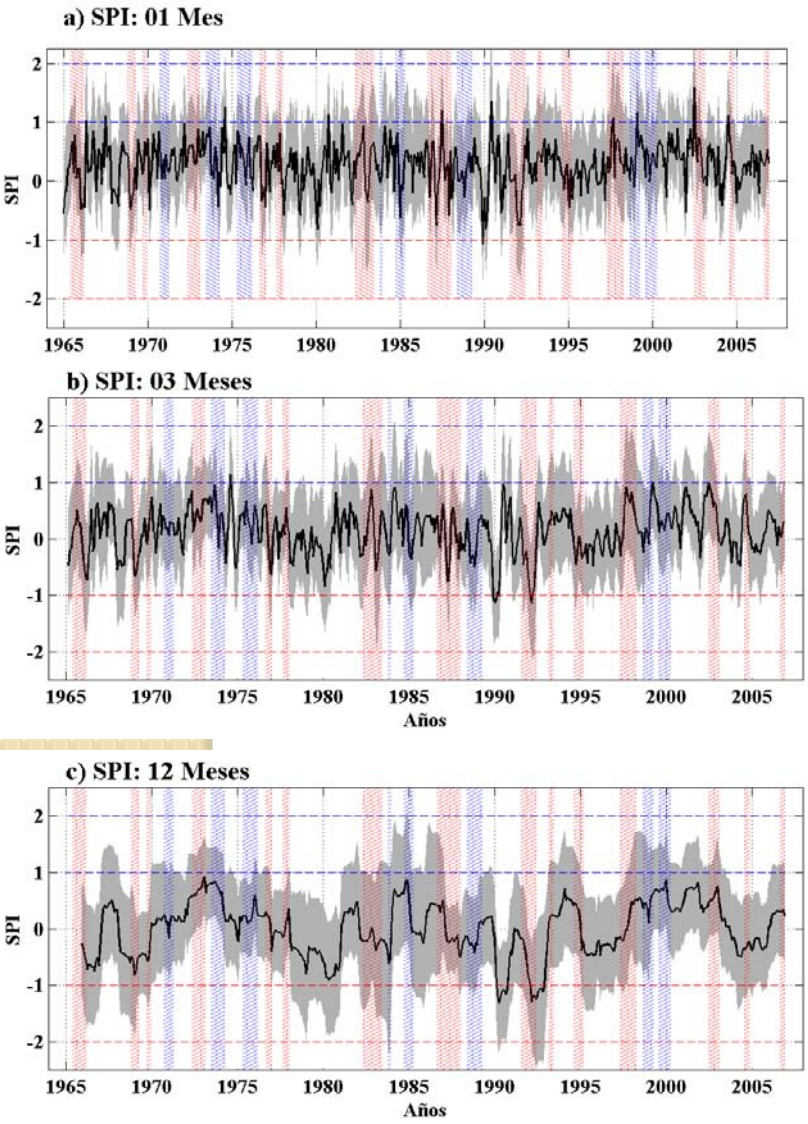


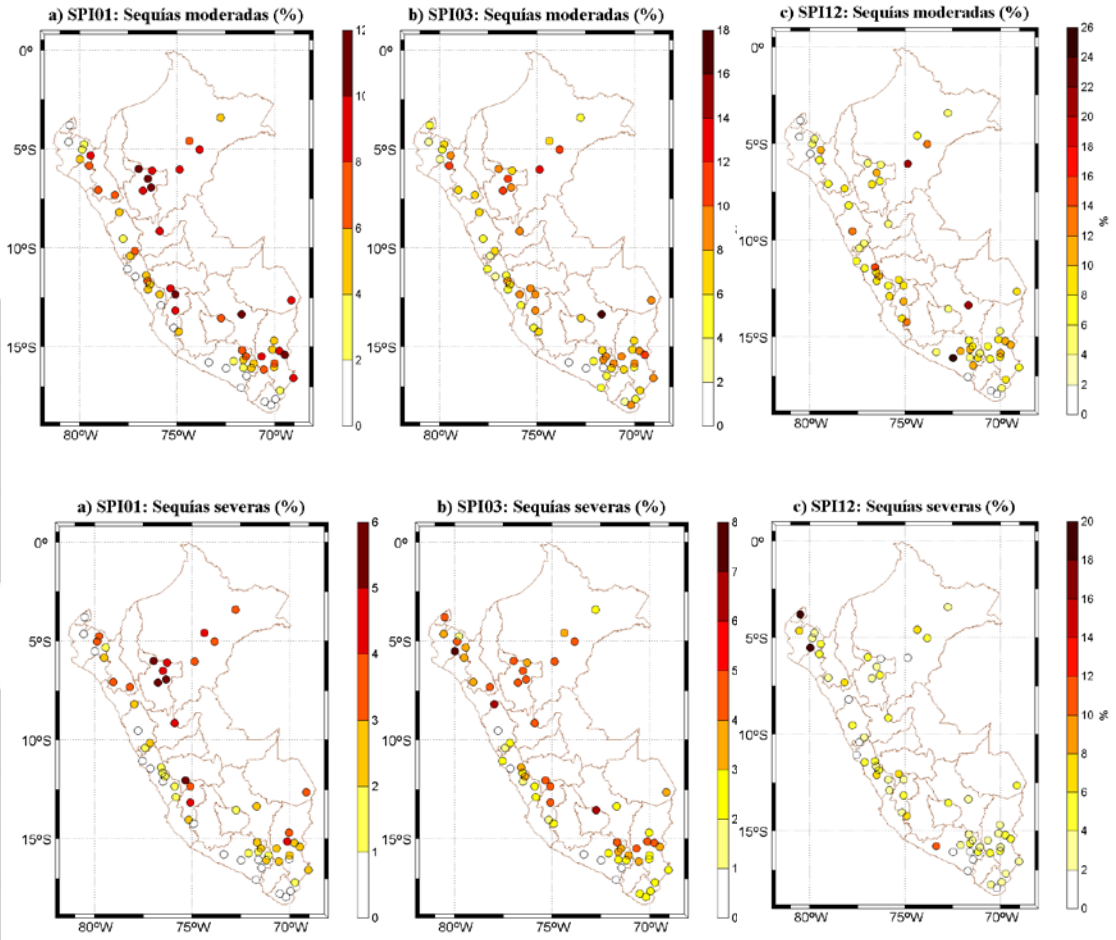
SANTA RIVER BASIN

CDD: Consecutive dry days
CWD: Consecutive wet days

Standarized Precipitation Index (SPI)

DROUGHTS



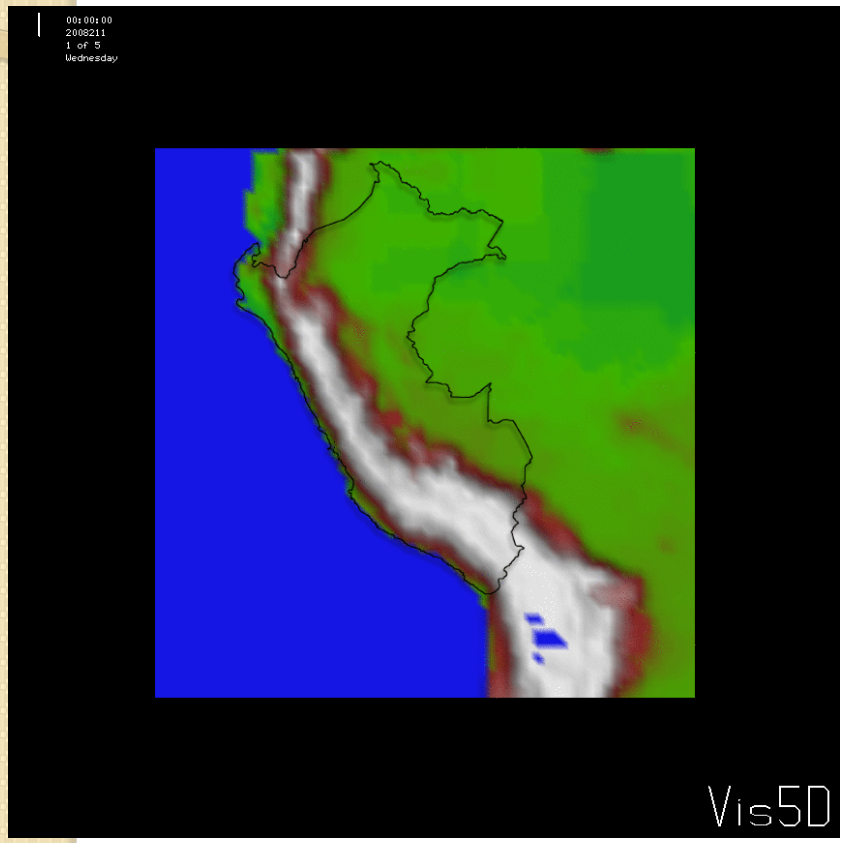


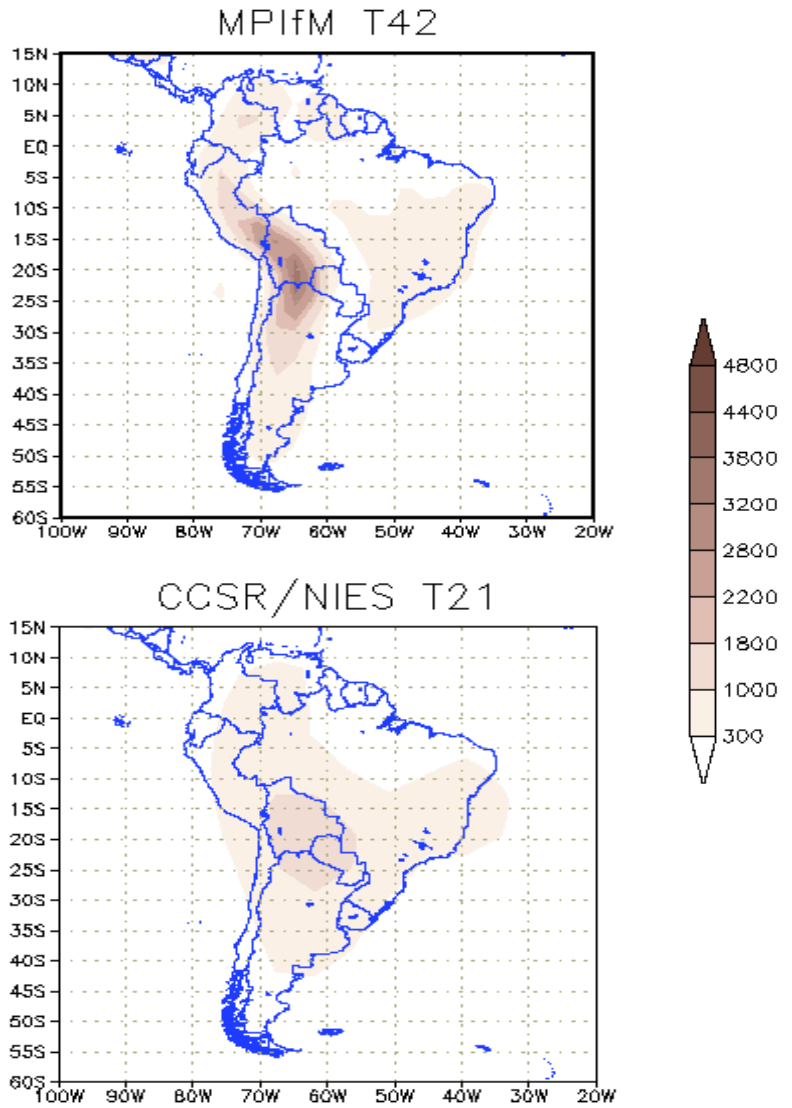
Temporal distribution

CLIMATE CHANGE

What will we expect for the future?

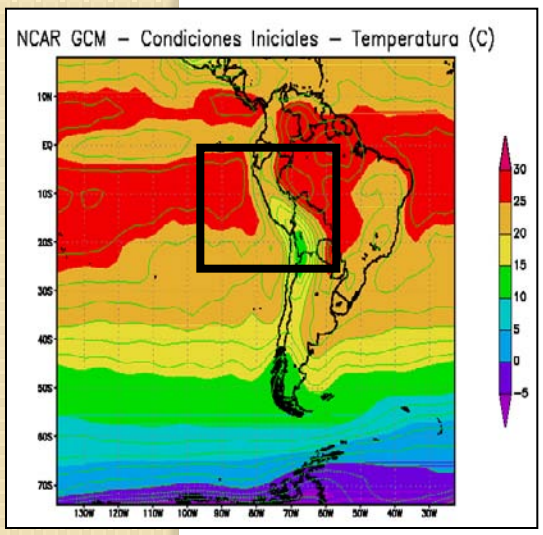
… How do global models "see" the South American topography?





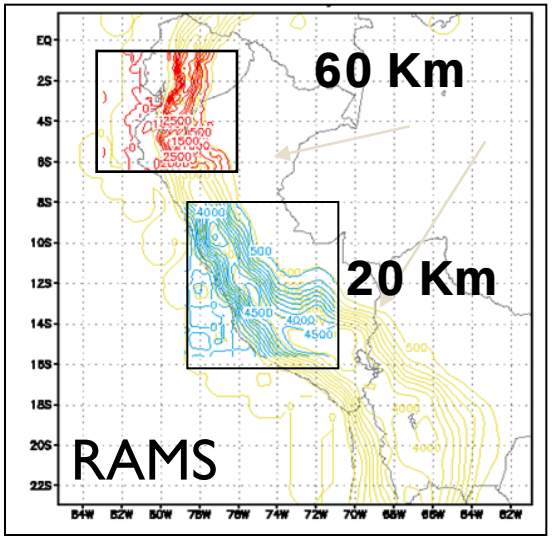
Methodology to generate scenarios

GLOBAL MODEL : ~ 300 Km

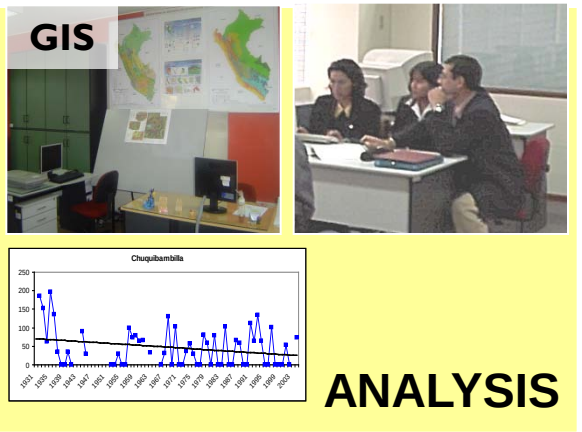


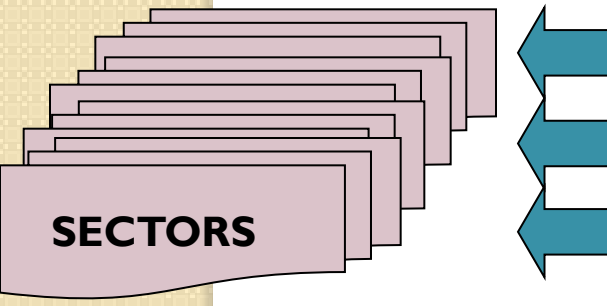
Dynamical downscaling

REGIONAL MODEL



Scenario Maps



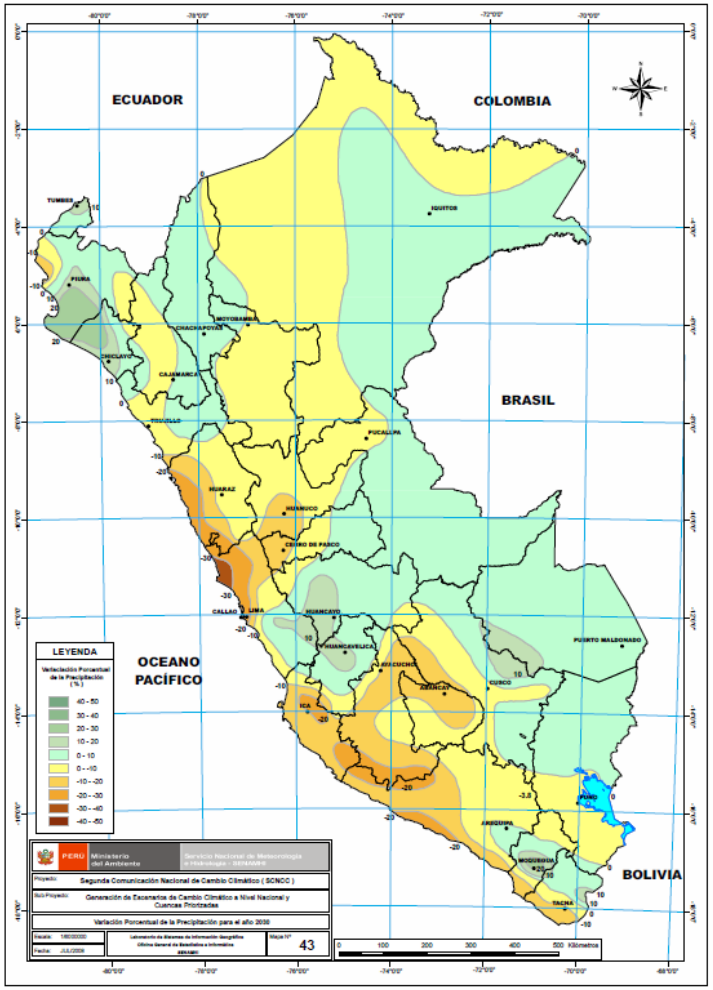


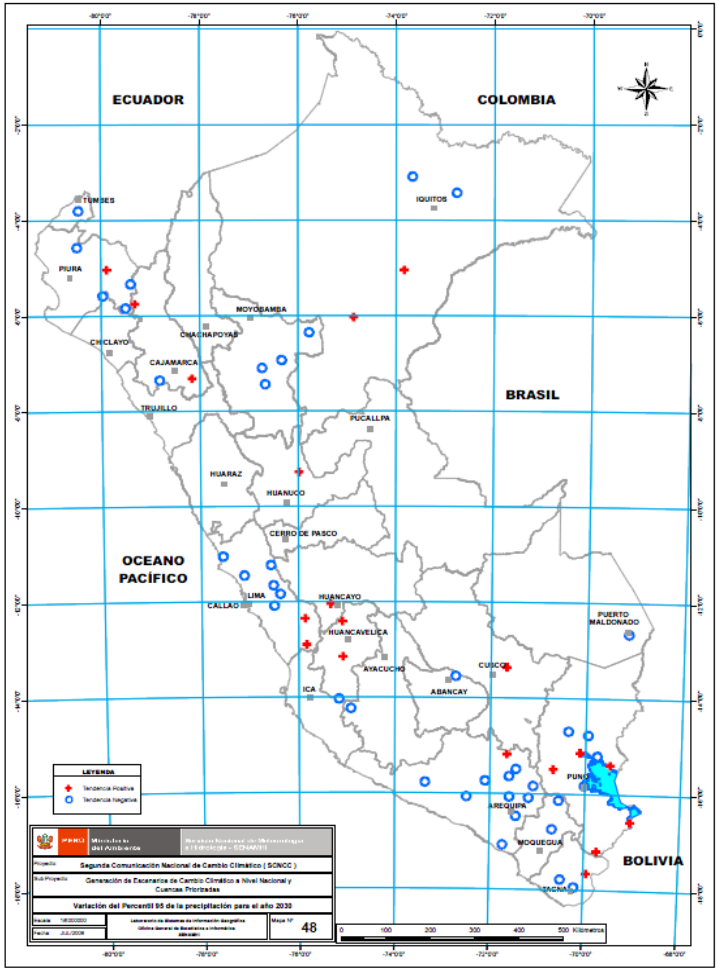
Downscaling setup

- SRES A2 CCSM NCAR(characteristics)
  - Baseline: 1983-2003 per 6 hours
  - Future period: 2004-2035 per 6 hours
- RAMS 4.4 Model:
  - Horizontal resolution 60 km (national)
  - Nesting 20 km (basins)
  - Vertical levels: 30
  - Simulation period: 1983 - 2035
  - Time steps: 50 seconds
- Products:
  - Time slice scenarios to 2020, centered in11 years (2015-2025)
  - Time slice scenarios to 2030, centered in11 years(2025-2035)

Reference: Hulme & Lu, 2000

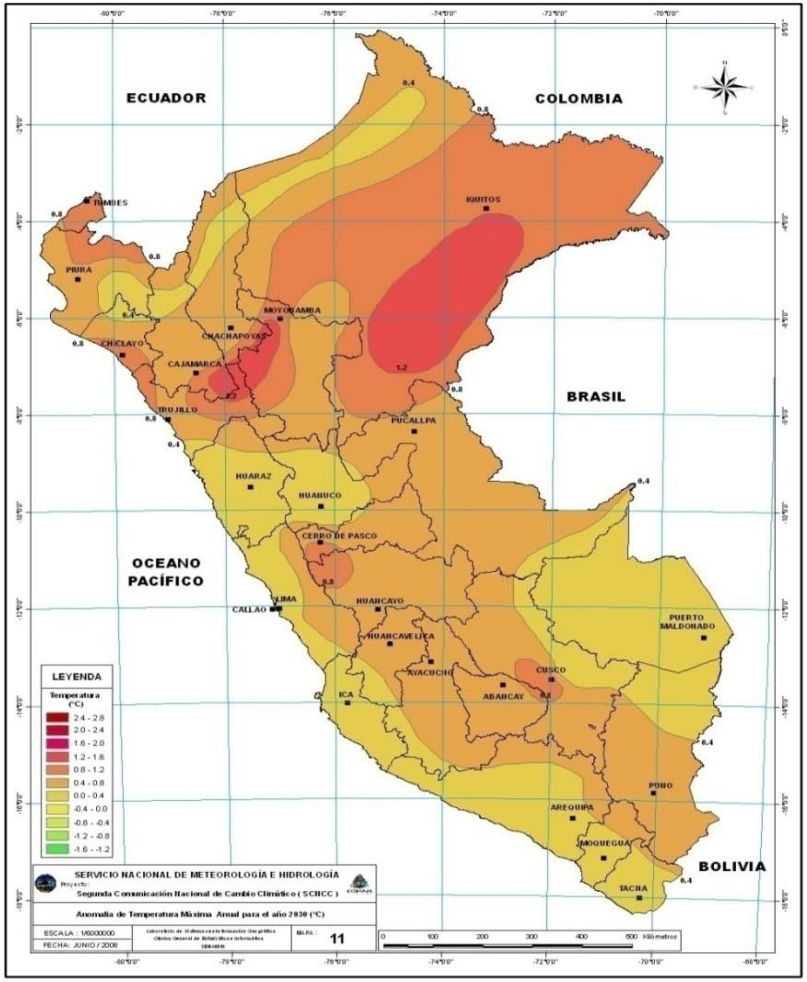
The future climate…

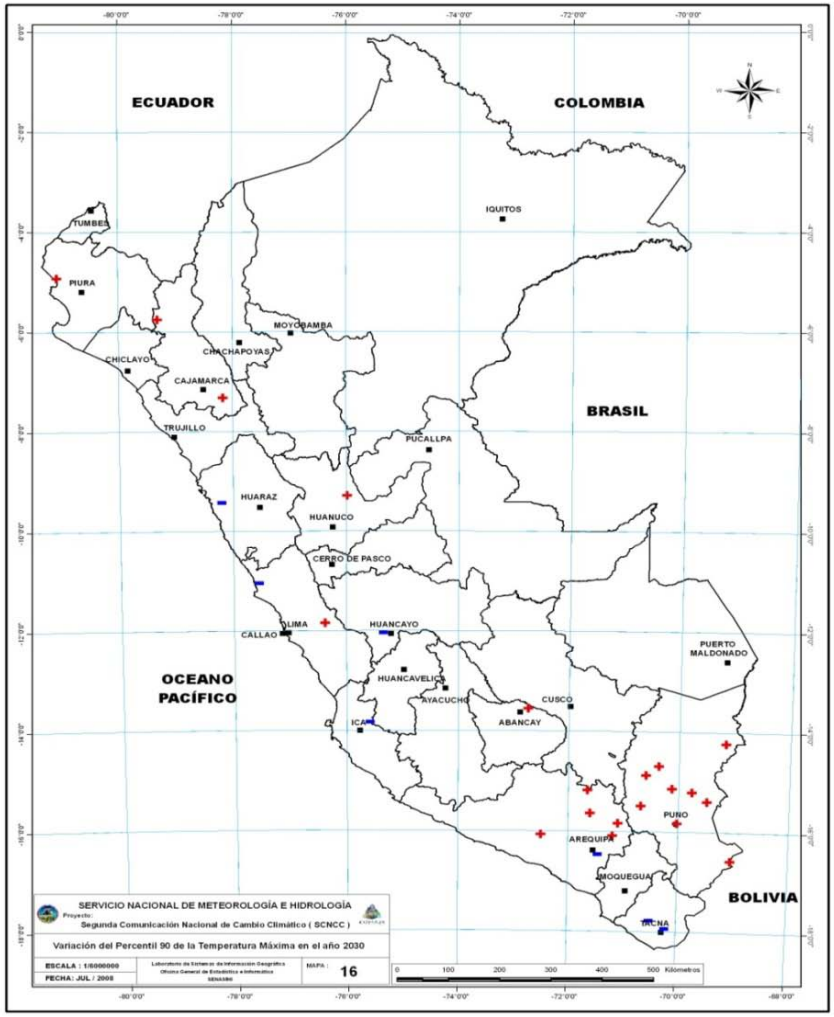




Spatial distribution of rainfall change (%) and the extreme yearly prec. percentile 95 for year 2030 - *CCSM/RAMS-SENAMHI*

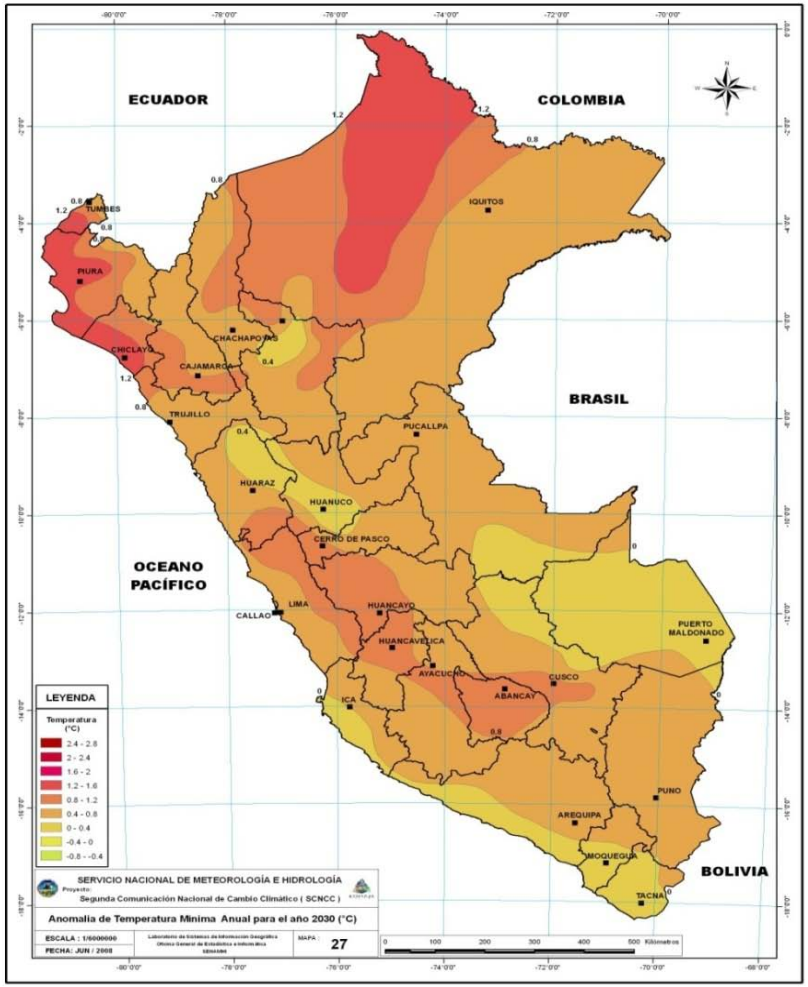
The future climate…

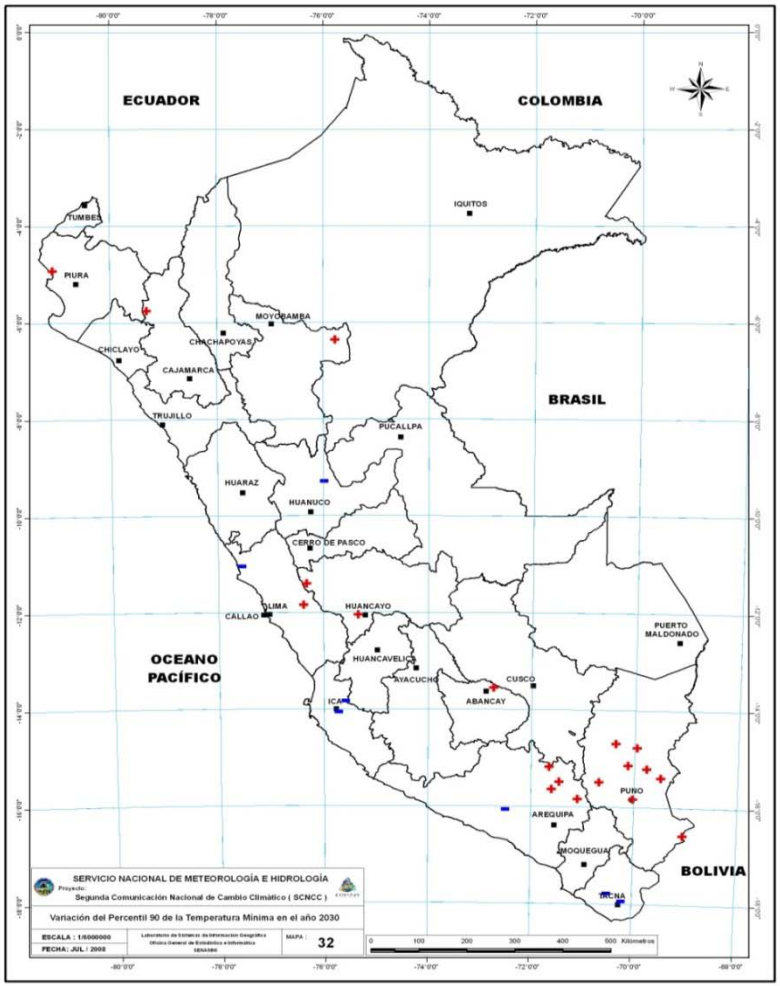




Spatial distribution of the yearly max. Temp. change (°C) and its 90 percentile for year 2030 - CCSM/RAMS-SENAMHI

The future climate…





Spatial distribution of min. Temp. change (°C) and its 90 percentile for year 2030 - CCSM/RAMS-SENAMHI

Conclusions...

•In the northern coast and highlands we expect up to 20 % rainfall increment.

•In the northern jungle, we expect up to 20% rainfall decrease.

•The estimated rainfall index shows us a probable decrease in the next 30 years in a great portion of the peruvian territory.

... Conclusions

In general the models show an increment in the max temperature up to 1,6 °C in average (0.53°C/10 years), and up to 1.4°C for the min temp. (0.47°C/10 years).

Some identified obstacles …

- There are large gaps in the climate information for some important areas in Perú.
- It is needed to identify with better accuracy the role of local, regional and global factors that condition the climate tendencies in the national analysis, in order to better understand the climate change process.

What next?…

- Develop strategies to improve climate observation systems and data retrieval from different sources.
- Give an impulse to research in climate change and its impacts in the society, the economy and the ecosystems.
- Increase and strenghten international cooperation and exchange in data, information, technologies and knowledge.
- Update the climate scenarios.

Thank you...

…and greetings from PERU