Dynamic regionalization over Peru: HadGEM2-ES / WRF

Alan Llacza Rodríguez, Gerardo Jacome Vergaray

National Service of Meteorology and Hydrology of Peru

Abstract

The present work has as objective the elaboration of a new gridded data base to 16 km, for the analysis of the changes of the future climate on Peru, mainly in the variables of precipitation, maximum and minimum temperature.
The methodology used is the dynamic regionalization technique, using the regional climate model Weather Research and Forecasting (WRF), using the initial conditions of the HadGEM2-ES global model, for the period of 1981-2065, with the RCP 8.5 emission scenario.
The analysis of the results for the observed period indicates a better representation of the precipitation in the central and southern part of the Peruvian Andes and overestimation mainly in the summer period (December, January and February). With regard to temperatures, there is a better representation of the minimum temperature compared to the maximum.
While the results of the changes to 2030 indicate non-uniform values over Peru, with an increase in precipitation over the coast and jungle, and decreases over part of the Andes and southern coast of Peru. Regarding the temperatures, there are increases over the whole country, mainly over the Andes.

Keywords: Dynamic regionalization, Peru, Climate change.

Study area

The domains of the dynamical regionalization was South America at 48 km and Peru to 16 km. It was considered first that the boundaries of the selected domain do not contain an area with a high altitude. The second observation considers that within the selected area contain the circulation patterns or systems meteorological conditions that directly or indirectly affect the behavior of surface variables such as precipitation and temperature of Peru. Finally, the domains did not exceed the edges of the model data global being the model HadGEM2-ES considered as forcing of the regional climate modeling.

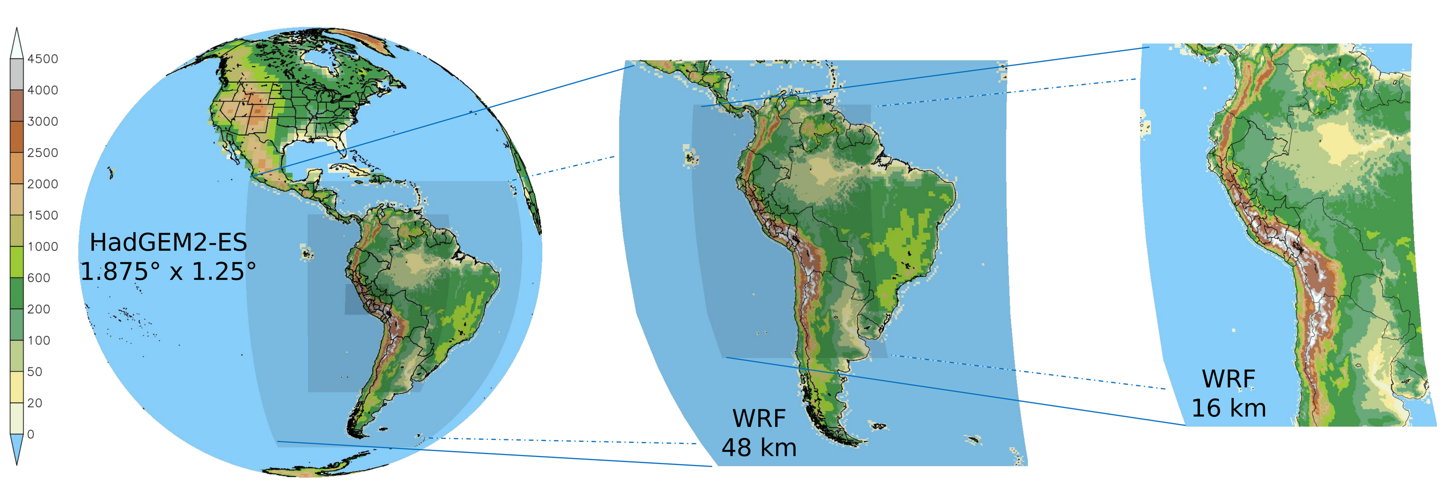


Figure 1: Domains of the dynamical regionalization

Metodology

Preprocessing: Data was downloaded and prepared global circulation model HadGEM2-ES (Vertical interpolation of Hybrid height to Pressure levels), which was transformed from NetCDF to Grib format for the period of 1981-2065, with the RCP 8.5 emission scenario..
Processing: The regional climate model Weather Research and Forecasting (WRF 3.4 - ARW core) was used. The first domain at 48 km with a nesting at 16 km. Simulations with a re-initialization every 6 years (Garcia 2012, Chun-Fung 2008) in which the first simulation year was considered as the Spinup period and this year's data was not considered within the results.

Characteristics	
Domains	2
Horizontal resolution	48 y 16 km.
Vertical levels	28
Top height of the atmosphere	50 hPa
Proyection	Mercator
Dynamical core	Non-hydrostatic
Periodo de simulación	1981 – 2065
Initial conditions	HadGEM2-ES
Sea temperatura update	Yes
Parametrizations	
Radiation	RRTM (longwave) y Dudhia (shortwave)
Land surface	Unified Noah land-surface model
Surface layer	MM5 Monin-Obukhov
Planetary boundary layer	YSU (Yonsei University Scheme)
Cumulos	Betts-Miller-Janjic
Microphysics	WSM Single-Moment 6-class scheme

Table 1: Characteristics of the Dynamical regionalization

Results

The wind analysis **in levels** indicates a similar behavior between the current lines of the WRF and ERA-Interim for the 850 hPa to **1981-2005**, WRF show lower speeds than the ERA-Interim. At the 200 hPa for the summer and autumn seasons, tend to be very similar to ERA INTERIM, they present the configuration of the Alta de Bolivia (for summer), however WRF does not configure this pattern for the winter season.

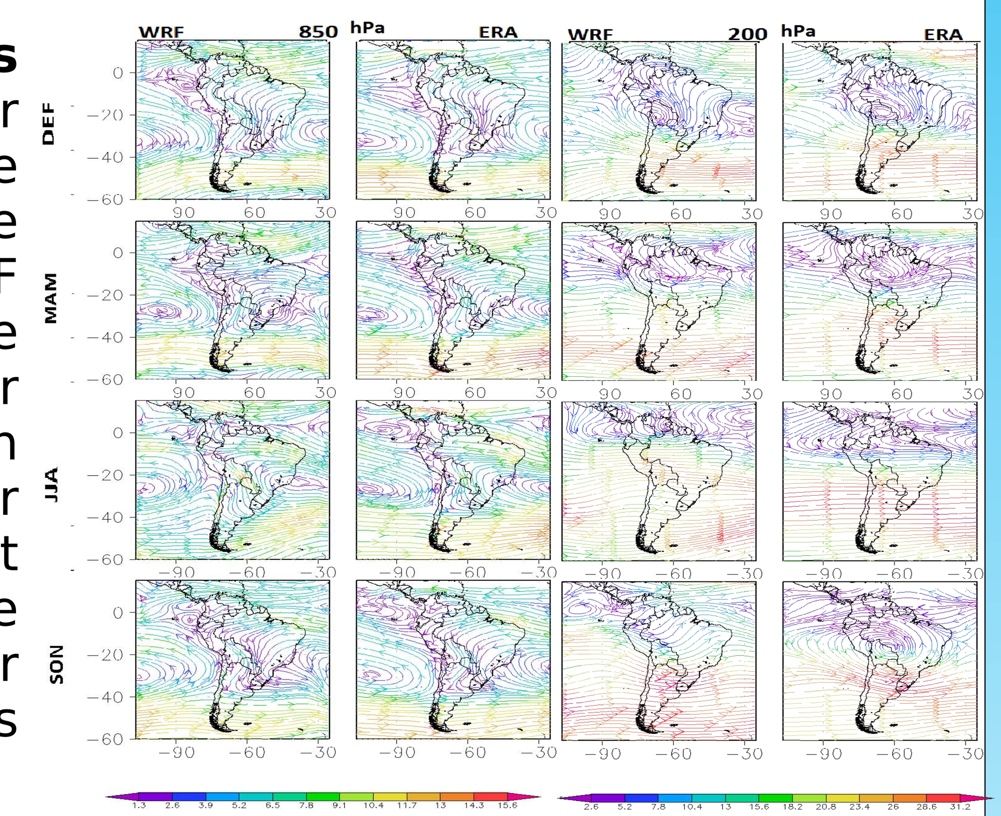
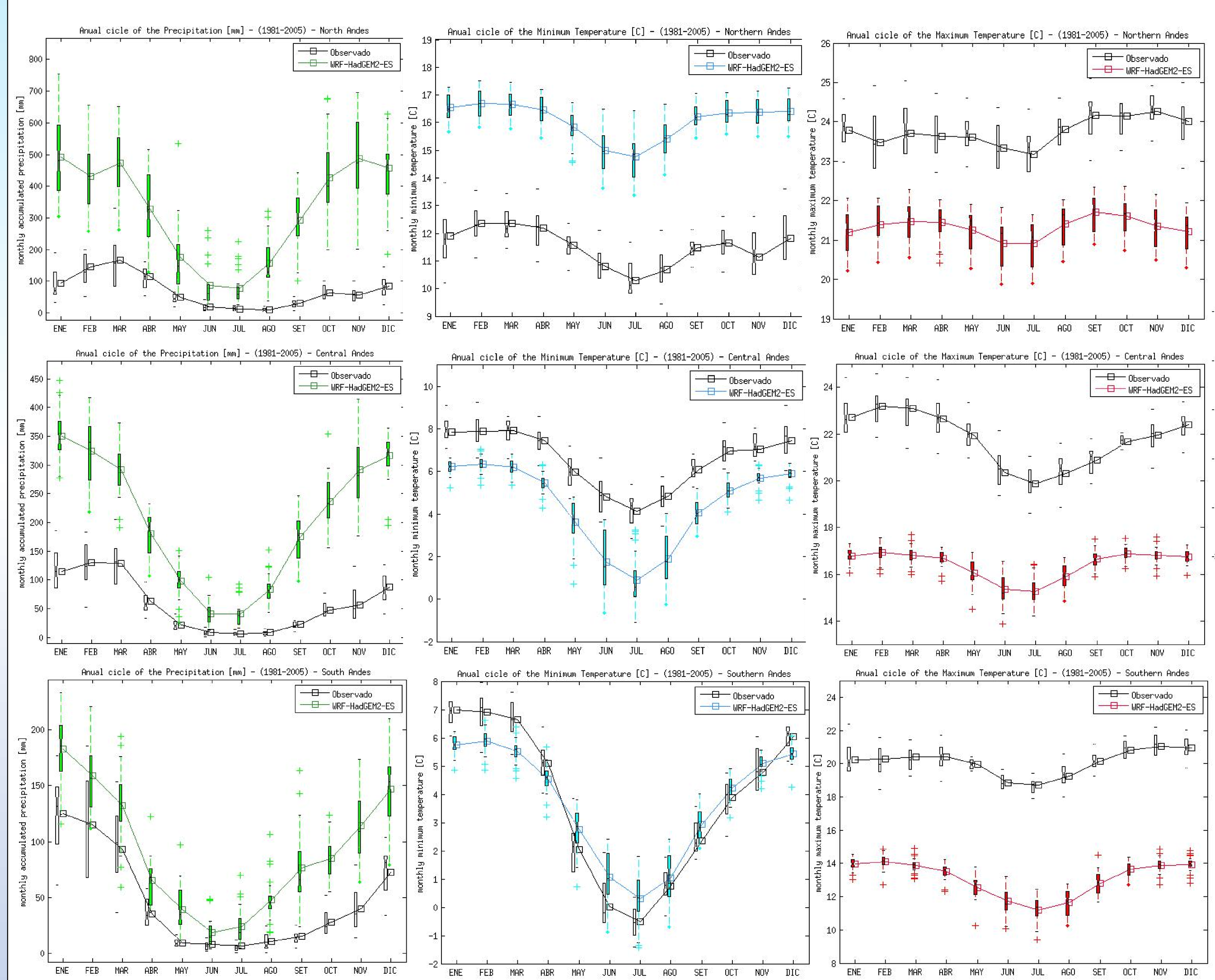


Figure 2: Wind (WRF 48 km)

The analysis **in the surface**, indicate that precipitation is overestimation in the summer period to **1981-2005** and a better representation over the Andes. The minimum temperature is better represented than the maximum except for north and south coast (not show).



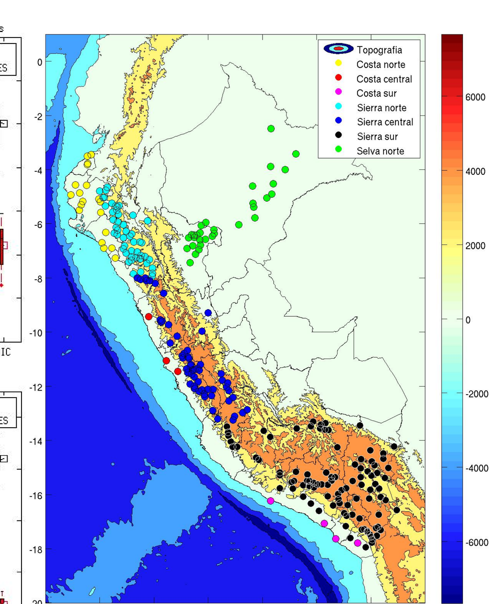


Figure 3: Annual cycle of the monthly precipitation, maximum and minimum temperature (Observed and WRF 48 km), over the Andes.

The **change** of the precipitation to **2030s** in austral summer indicates a overestimation in the northern coast and and a warming greater than 1 degree for most of Peru for the maximum and minimum temperature mainly on the Andes.

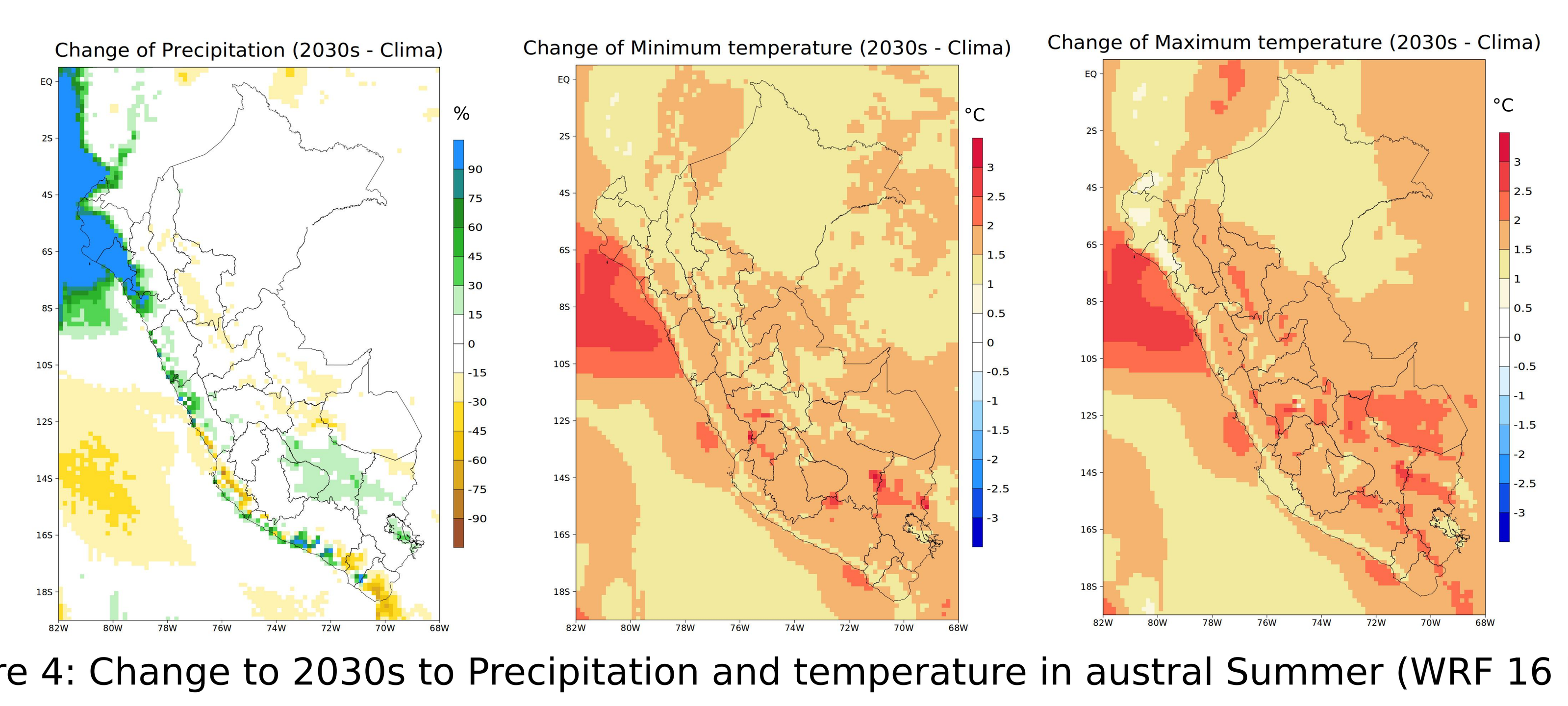


Figure 4: Change to 2030s to Precipitation and temperature in austral Summer (WRF 16 km)

Conclusions

The new griddes data to 16 km over Peru has a better representation in the Andes than in the jungle and coast. , with the RCP 8.5 emission scenario. This is a very useful tool for post-adaptation studies and vulnerability to changes in rainfall and temperatures

Bibliography

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