EVALUATION OF THE MODEL PRECIS FOR THE REGION OF BOLIVIA

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Abstract

The purpose of this study is to evaluate the accuracy and skill of the Regional Climate Model PRECIS (Providing Regional Climates for Impacts Studies) which is used for the simulation of regional scale climatology at high resolution (i.e.25-Km horizontal resolution). It was evaluated seasonally (summer and winter) and monthly with temperature and precipitation variables over Bolivia in long-term simulations (30 years, 1961-1990) with the scenario A1B and lateral boundary condition (Echam5) in 4 representative places of Bolivia like: Altiplano Sur (adobe 3500 masl), Pando (below 500 masl), Chaco (between 500 and 3500 masl) and Santa Cruz (below 500 masl).

Introduction

Duè to the resolution of the results of PRECIS (25 km) and the resolution of CRU (50 km), a linear interpolation was made to these data, in order to make the one-to-one comparison with the results of the model. The re-scaling or interpolation was done using a built-in function in the OpenGRADS analysis software version 2.0.a9, that is, a decrease was made only in spatial resolution.

The reason for choosing a distant future from PRECIS 2071-2100 is related to climate variability and the way climate models represent the future. That is, it is possible to obtain model outputs for short future periods (a period centered in 2030 for example), but the increase of greenhouse gases projected for these concentrations are not very large (60ppmv more than the current one), there would be no relevant outputs of part of the model

Results

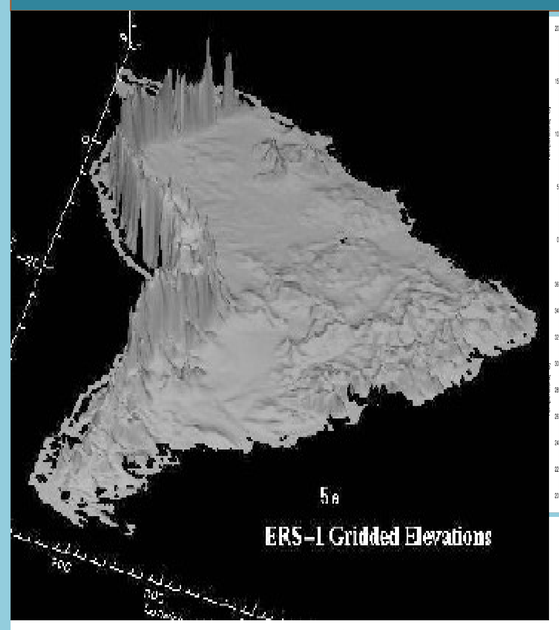

Figure 1:Surface elevation of South America. Vertical exaggerated scale (Source: Brenner Etal., 2003, http://earth.esa.int/workshops/ers97/papers/frey/FIG5)

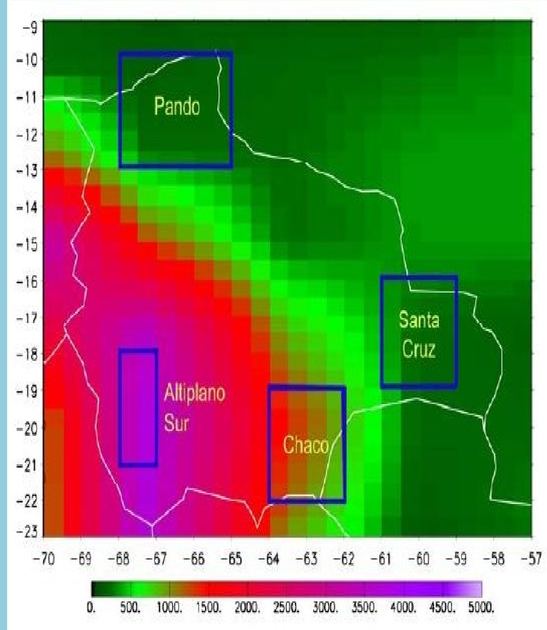

Figure 2: Map of Bolivia according to its surface height above sea level (in meters). The rectangular regions indicate the four regions used for analysis of the changes of average temperature and accumulated precipitation. (Source: Marcos Andrade)

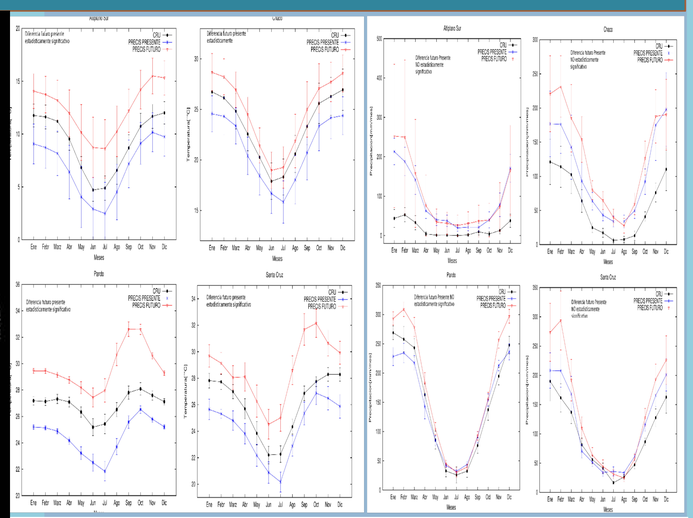

Figure 2: Current climate calculated from observational data of CRU (black line), present climate obtained by PRECIS (blue line) and future climate obtained by PRECIS (red), (a) represents the southern highlands area, (b) represents the Chaco region, (c) represents the Pando region, and (d) represents the Santa Cruz region . The bars indicate the monthly variability represented by a standard desviation (sigma)

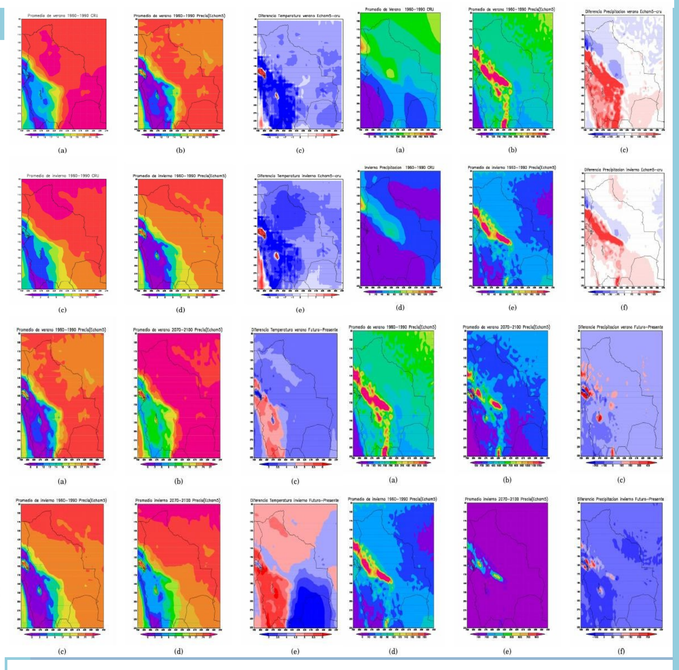

Figure 3:Average temperature (in ° C) for summer (upper panel) and winter (lower panel) and average monthly cumulative precipitation (mm / month). (a) and (c) are outputs from PRECIS present (1961-1990), (b) and (d) are future PRECIS outputs (2071-2100) and (c) and (f) are the differences between these future models and present model observations.

Conclusions

The comparison of temperature and precipitation of model outputs was with the Climate Research Unit (CRU) data, used for understanding the performance of the model. The period 1961-1990 shows that the model has a good performance for both parameters at the Bolivian lowlands (locations with an altitude below 500 m asl) while overestimates precipitation at regions situated at intermediate heights (between 500 and 3500 m asl) as well as at the Andean region (above 3500 m asl). Once the model was evaluated, the future climate projection was estimated in long-term simulations (30 years, 20701-2100), calculating ΔT (differences between future and present temperature of the model) and ΔPcp% (percentage variation of precipitation model respect to the present). The differences between future-present is statistically significant for the temperature and not statistically significant for precipitation using T-student distribution. However, in the regional model, there are still systematic errors which might be related to the physics of the model (convective schemes, topography, and land surface-processes).

Bolivia	$[\Delta T]$	$[\Delta Pcp_{Cambio}]\%$
verano	4	23,14
invierno	4,5	18,33
Altiplano Sur		
verano	5	17,39
invierno	5,6	-3,27
Chaco		
verano	3,8	19,16
invierno	2,8	34,47
Pando		
verano	4	28,40
invierno	5	14,84
Santa Cruz		
verano	3,7	29,29
invierno	3,8	16,36

Statistically significant

It is necessary to do more studies and comparisons with the CRU data and surface data in the Bolivian territory to obtain the greater reliability in the interpolation that CRU performs in regions where there are not many surface stations of surface.

[1] Andrade, 2008,Mitos y verdades acerca del cambio climático en Bolivia, Revista Boliviana de Física.
[2] Andrade, & Blacutt, L 2010, Evaluación del modelo Climático PRECIS para el área de Bolivia, Revista Boliviana de Física,12, 16.
[3] Marengo, Assessmentes of moisture fluxes east of the abdes in south America in a global warming scenario, doi:10,1002/joc,1800. 2008.
[4] Marengo & Alves, Assessment of regional seasonal predictability using the PRECIS regional climate modeling system ver South America,,doi:10.1007/s00704-009-0165-2,2009,
[5] Nazrul Islam,2007, Future chabge in the frecuency of warm and cold spellsd durations over pakistan simulated by the PRECIS regional climate model.
[6] Francou,B.,M,Vuille,2003,Tropical climate change recorded by a glacier in the central Andes during the last decades of the twentieth century,doi:10.1029/2002jd002959.
[7] Vuille. M,1999,International Journal of Climatology.
[8] IPCC,2007,Emissions Scenarios.
[9] Peixoto J.P. / A. H. Oort.,Physics of Climate, Springer Verlag,1992.