

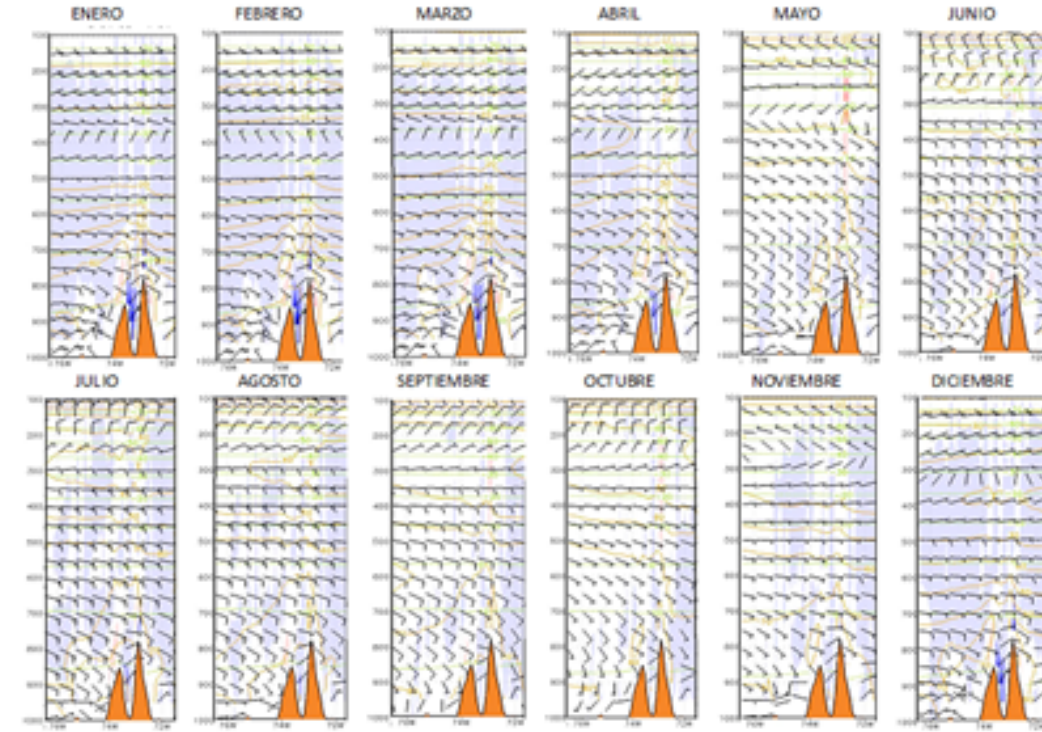
Chapter 3

Climate and Environmental Change

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Knowledge gaps and relevance (1)

The immense variety of mesoclimates of the Andes, generated by the interaction of large-scale circulation with regional complex topography and by the own regional circulations systems, requires a more detailed representation in hydroclimate studies. Generalized views of large sub-regions in terms of climate trends and future scenarios are not sufficient to represent the real processes of this environmental diversity. Therefore, for the Andes a more detailed spatial view is needed in terms of trends and scenarios of climate change. This request put on any regional research agenda the challenge for producing more detailed data and information and for developing very high spatial resolution modelling.



Vertical profile of the winds and vertical velocity over the Valley of Cesar river at 10°N, as simulated by WRF in 10x10 kilometers resolution (Armenta-Porras y Pabón-Caicedo, 2016). The valley of Cesar river is located at 73°W approximately, between Serranía de Perija (mountain at the right side) and Sierra Nevada de Santa Marta (mountain at left side) (Pabón-Caicedo, Bulla-Portuguez, Armenta-Porras, 2018)

Knowledge gaps and relevance (2)

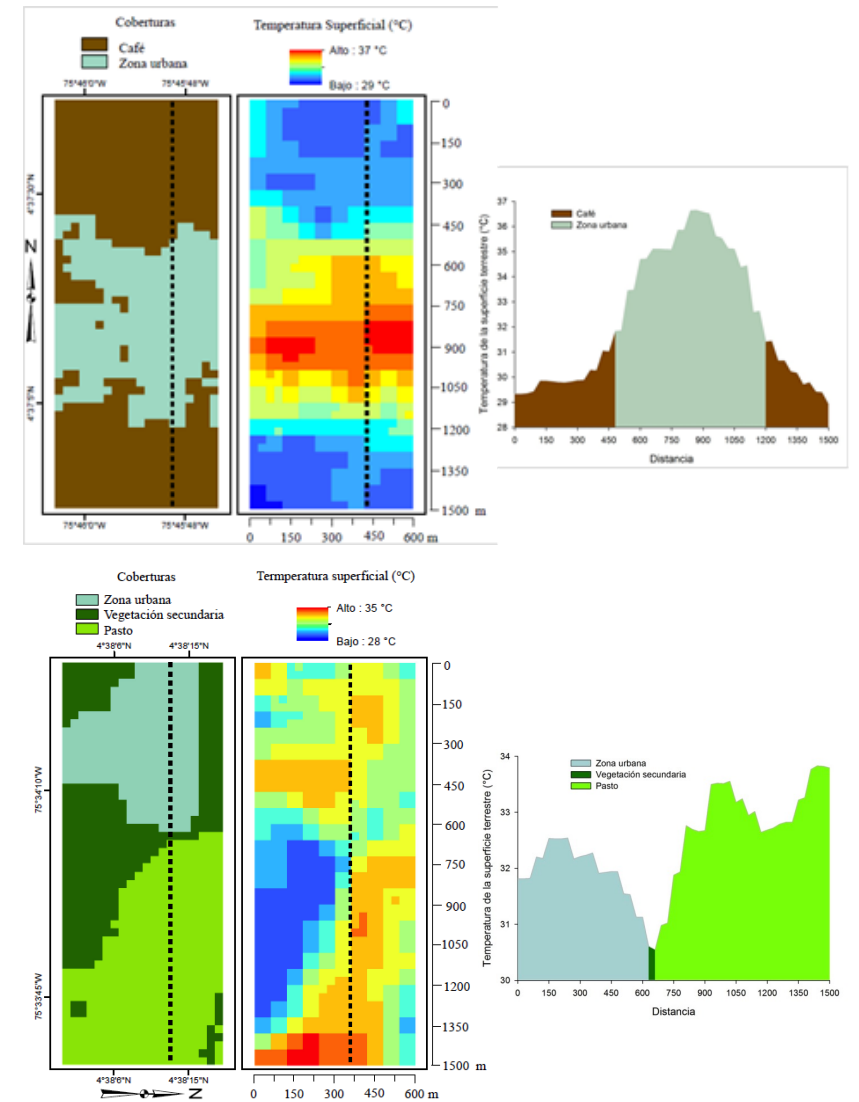
For better understanding of processes related to the water cycle and energy fluxes in the Andes, knowledge about the effect of climate change on vertical position of condensation level and cloud basis is necessary. The condensation level and cloudiness is relevant for the cloud forest and páramo ecosystems, and their associated environmental services This specific demand of knowledge requires more fine vertical monitoring and very high spatial resolution in vertical coordinate in modeling.



<https://www.biodiversidad.gob.mx/Biodiversitas/Articulos/biodiv83art1.pdf>

Knowledge gaps and relevance (3)

- As mentioned in paragraph 3.1.2 particular sub-regional situations of LULC changes have particular effect on local and regional climate and there are not a regional pattern of this effect. Efforts are necessary to spend for producing more detailed knowledge on this specific issue for a variety of sub-regions. To achieve this objective several oriented case studies have to be promoted.



Distribución espacial de las coberturas y TST con perfiles de TST ilustrando los cambios de temperatura entre transiciones de coberturas. Top) Café-urbana, Bottom) Urbana-pasto. La línea negra punteada muestra el transecto trazado para elaborar el perfil de temperatura. (Carvajal-Vanegas & Pabón-Caicedo, 2014)

Potential activities

- To produce data and information of hydroclimate variables in very high spatial (horizontal and vertical) resolution. Building of a special reanalysis for ANDEX is recommended
- To carry out several case studies for concrete regions where a dense network of measurements is emplaced
- To advance in modeling at gamma-mesoscale (2-20 kms) level in order to have a better representation of diversity of climate of the Andes
- To promote studies on the specific regional climate effects of land use and land cover changes in concrete basin or sub-region of the Andes.

Expected outcomes

- Specific reanalysis for ANDEX program
- More detailed knowledge about the hydroclimate processes in small areas of the Andes
- More detailed estimates of climate change trends for the Andes hydroclimate diversity
- More detailed (spatially) climate change scenarios for the Andes