

The necessity for tailoring seasonal climate forecast in Central America for urban and coastal areas, including physics and human dimensions.

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Recent assessment analyses in Central America showed that trends in the annual number of impacts and disasters related with hydro-meteorology causes cannot be explained by climate trends only. That means that other variables such as those related with socioeconomic aspects should be included in those analyses to explain these variabilities and their associated impacts (e.g. Alfaro et al. 2010).

For example, results of the projected climate in the 2050–2099 period showed median significant reductions in precipitation (as much as 5–10%) and runoff (as much as 10–30%) in northern Central America. Therefore in this sub-region the prevalence of severe drought may increase significantly in the future under a moderate emissions scenario (Hidalgo et al. 2013). But the most consistent result is that the current north–south socio-economic contrast between the countries (in which the southern countries of Panama and Costa Rica present better living conditions than the rest of the Central American countries), is not diminished in the future; and in fact for some climate and social-condition scenarios this contrast is exacerbated in the future. Moreover, Panama and Costa Rica are the only countries that present improved living conditions at the end of the century when considering the positive effect of the increases in gross domestic product (GDP) and the negative effects of climate change. It is worrisome that the north–south differences in the living standards will keep growing in the region, and attention should be given to socio-economic and physical aspects that may play a role in increasing these differences (Hidalgo and Alfaro 2012).

Under the scenarios mentioned above, the role of seasonal prediction for urban and coastal areas become to play a crucial role, especially for management and planning. These predictions should covert not only outlooks of the mean, but also aspects of variability and extreme events. Another aspect that should be considered when studying extreme climatic events in urban areas, is the role of land-use related factors such as urbanization along with human related factors such as the degree of maintenance and condition of hydraulic structures, all compared to the influence of climatic factors that lead to severe floods and landslides. In coastal cities the problems related to erosion, changes in sea level and saline intrusion, add to the problems of urbanization and climate change. These extra challenges have to be considered when designing a particular forecast systems for these cities.

Since 1997, Regional Climate Outlook Forums (RCOFs) have taken place in various Latin American countries, in an effort to produce seasonal prediction products (IRI 2001). They have been funded by several international agencies with the assistance of local and regional entities such as the Regional Committee of Hydraulic Resources (CRRH) in Central America (Donoso and Ramirez 2001; Garcia-Solera and Ramirez 2012).

Alfaro et al. (2003) adds that generally, these forums gather representatives of the Meteorological and Hydrological services, as well as members of the scientific and academic community, who work on the elaboration of regional and local climate forecasts for the next 1-2 seasons. The objective of these forums is to use national climatic experience to elaborate a regional consensus for the climate outlook. In Central America, precipitation is the variable generally forecast for the months following the forum. The forecast is presented in a format that is useful for the agencies involved. The recommended methodology for the forecast is quite simple and this forecast is later integrated geographically with the coordinated inputs from the countries of the region, and is used as a tool for the meteorological services and as a basis for expected impact scenarios for stakeholders and decision-makers.

Alfaro et al. (2003) mentioned also that scientific and academic communities have discussed certain problems that arise during the development of the forums and how the research results can be better used to improve the forums' products. One of the problems identified during the RCOFs is that because there is not an standardized methodology for producing the forecast, the contributions from different countries can result in a disjointed regional forecast that is sometimes physically inconsistent across political borders. Moreover, it appears that the statistics behind the tools used are not familiar to some of the participants, such that the national climate forecasts are sometimes based only on subjective evaluations. Some of the roots of these problems have been identified: i) the resources of some institutions are limited to the routine tasks and only a small portion of their budget is allocated for research and capacity building; and ii) there have been very few opportunities for training on the concepts required for the RCOFs.

Additionally, Maldonado et al. (2013) explain that in Central America recent meetings after RCOF with different socioeconomic stakeholders, including those of urban and coastal areas, took place to translate the probable climate impacts from predictions. These meetings are tending to reduce the fact that sometimes the climate outlooks information is not necessary used by the decision makers. From the feedback processes of these meetings has emerged that extreme event and rainy days seasonal predictions are necessary for different sectors. These predictions can be tailored using different tools for rain aspects, including different downscaling approaches (Amador and Alfaro, 2009). However, analyzing the seasonal geographical distribution of the disaster reports, it is noticed that they did not necessarily agree with the geographical extreme precipitation event distribution, reinforcing the above ideas that social variables, like population vulnerability, should be included in the extreme events impact analysis, and enhanced the necessity of include the extreme events and variability aspects of rain in Central America seasonal forecast in those key areas.

References.

- Alfaro, E., A. Quesada and F. Solano, 2010. Análisis del impacto en Costa Rica de los ciclones tropicales ocurridos en el Mar Caribe desde 1968 al 2007 (Analysis of Caribbean Sea tropical cyclones occurrences from 1968 to 2007 and their impact in Costa Rica), *Revista Diálogos*, <http://historia.fcs.ucr.ac.cr/>. *Revista Dialogos*, **11**(2), 22-38. *In Spanish*.
- Alfaro, E., J. Soley and D. Enfield, 2003. *Uso de una Tabla de Contingencia para Aplicaciones Climáticas (Use of a Contingency Table for Climatic Applications)*, ISBN 9978-310-00-2. Edited by ESPOL and FUNDESPOL, Guayaquil, Ecuador. 51pp. *In Spanish and English*.

- Amador, J. and E. Alfaro, 2009. Métodos de reducción de escala: Aplicaciones al clima, variabilidad y cambio climático. *Revista REVIBEC*, **11**, 39-52. *In Spanish*.
- Donoso, M. and P. Ramirez, 2001. Latin America and the Caribbean: Report on the Climate Outlook Forums for Mesoamerica. In: *Coping with the climate: A step Forward*. Workshop Report “A multi-stakeholder review of Regional Climate Outlook Forums”, October 16-20 (2000), Pretoria, South Africa. Publication IRI-CW/01/1, pp. 11-18.
- García-Solera, I. and P. Ramirez, 2012. Central America’s Seasonal Climate Outlook Forum. The Climate Services Partnership, 8 pp. http://www.climate-services.org/sites/default/files/CRRH_Case_Study.pdf (visited 16/01/2014).
- Hidalgo, H.G. and E.J. Alfaro, 2012. Some Physical and Socio-economical Aspects of Climate Change in Central America. *Progress in Physical Geography*. **36**(3), 380 – 399.
- Hidalgo, H.G., J.A. Amador, E.J. Alfaro, and B. Quesada. 2013. Hydrological Climate Change Projections for Central America. *Journal of Hydrology*, **495**, 94-112.
- IRI, 2001. Latin America Regional Report . In: *Coping with the climate: A step Forward*. Workshop Report “A multi-stakeholder review of Regional Climate Outlook Forums”, October 16-20 (2000), Pretoria, South Africa. Publication IRI-CW/01/1, pp. 136-138.
- Maldonado, T., E. Alfaro, B. Fallas and L. Alvarado, 2013. Seasonal prediction of extreme precipitation events and frequency of rainy days over Costa Rica, Central America, using Canonical Correlation Analysis. *Advances in Geosciences*, **33**, 41-52.