



Preface: Third ENSO Conference: findings and key messages

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The anomalous warming (cooling) of the surface waters of the tropical Pacific known as El Niño (La Niña) phenomena, with the atmospheric response called Southern Oscillation (ENSO), induces a prominent signal in the inter-annual climate variability in different regions of planet. Therefore, a great attention is paid to the understanding of the processes involved in the genesis and development of these phenomena, as well to the monitoring for supporting climate forecasting and warning systems of the countries. The International Center for Research on El Niño (CIIFEN, acronym broadly used by its name in Spanish language) socializes the scientific knowledge related to ENSO and disseminates information on monitoring and forecasting of tropical Pacific processes, particularly in the Eastern Pacific, in order to support climate prediction in the tropical America. For disseminating the knowledge on ENSO, CIIFEN promotes various initiatives; one of them is the ENSO Conference that has as objective to synthesize the progress of the knowledge on the ENSO, and to socialize it for benefit of the society. In this context, CIIFEN organized the Third International ENSO Conference in November 2014 in Guayaquil (Ecuador).

The Third International ENSO Conference was devoted to the main theme “*Bridging the gaps between global ENSO science and regional processes: extremes and impacts*” and was supported by the World Meteorological Organization (WMO), the World Climate Research Program (WCRP), the Secretariat of Risk Management of Ecuador and the National Institute of Meteorology and Hydrology (INAMHI) of Ecuador. The conference was attended by leading scientists in the study of the dynamics of the tropical Pacific Ocean associated with El Niño and La Niña and the effects and impacts that these phenomena have in different regions of the planet. During the three days of the Third Conference, six sessions (dynamics, climate variability, modeling, regional processes, impacts, and information services),

12 central conferences, 30 oral presentations and 50 posters were presented, with the participation of 20 world-renowned scientists and experts on ENSO, more than 150 attendees, most of them women young scientists, of 20 countries.

The progress of specialized knowledge on ENSO was exposed during this Conference and several novel findings were presented. The different presented themes confirmed the complexity and diversity of expressions of oceanic-atmospheric processes associated with ENSO. It was showed, for example, that the zone where El Niño is generated (the sector where the impulse mechanism appears), longitudinally oscillates through the Pacific in an inter-decadal cycle. Using data for the 1950–2010 period, the differences in the evolution and impacts of the “canonical” and “modoki” types of El Niño events were showed, pointing out the difficulties for distinguishing different La Niña types. Mention was made about the fact that the Central Pacific (modoki El Niño) events have occurred frequently over the last three decades, compared to the Eastern Pacific (canonical) events.

It was pointed out a relationship between the period of the year when the weakening of the winds happens in the tropical Pacific and the development (or not development) of a specific type of El Niño (modoki or canonical), with particular intensity and climate effects in regions. (As it is broadly known, in the relaxation of the easterlies, the intra-seasonal variability of the ocean-atmosphere system plays a crucial role, but the results presented in the Conference outstand the importance of the moment of the year when it occurs). Another advance presented was the role of the inter-decadal variability as a modulator of the more frequent oscillations (the intra-seasonal waves) involved in the genesis of El Niño and La Niña. The diversity of the processes in eastern Pacific woke special interest of participants. The findings about the effect of climate change on frequency and intensity of ENSO phases presented were subject of special attention as well.



Figure 1. Two moments during the III International Conference on ENSO “Bridging the gaps between global ENSO science and regional processes: extremes and impacts”, Guayaquil (Ecuador) 12–14 November 2014.

In the session on modeling of the processes related to ENSO it was pointed out that, despite the progress achieved in this matter, results of models still present substantial differences from the reality, because of the difficulties for including the non-linear dynamic involved. It was mentioned that a way to improve models skill, besides to incorporate a more realistic representation of the ocean-atmosphere dynamic, is to move from the practice of adjustment models by compensating bias detected in validation, with statistical metric, to adjustment based on dynamic metrics instead. Regarding this, Bjerknes stability index was pointed out as a very useful tool to evaluate the skill of the models, and also it was proposed to use the heat flux feedback, controlled by the convection parameterization used in the model, as a key parameter for validation and adjustment.

Sessions related to the climate effects of ENSO on remote regions and its socioeconomic impacts had a high number of presentations. It was exposed the effect of ENSO on climate of the Antarctic and Arctic, Amazon, several regions of Central and South America, as well as Southwestern Mediterranean, Eurasia and Southeastern Asia and Maritime continent. Regarding the impacts of ENSO extreme phases, results were presented about the consequences of El Niño in Peruvian mangroves environment, the influence of the sea surface temperature variability of Niño1+2 sector on Ecuadorian fisheries, the effect of ENSO phases on the glaciers of Ecuadorian Andes, on diarrhea diseases in Mexico, and on agriculture and natural disasters (by droughts or floods) on different countries.

During the Conference, scientists expressed their concern about the declination of the observation system in the tropical Pacific and the need for an international cooperation effort for its sustainability. In this regard, the initiative of a Tropical Pacific Observing System (TPOS), developed by ENSO researchers since early 2014, was exposed. Pointing out the special role of the Eastern Pacific in ENSO dynamics, researchers also expressed concerns about the gap in observa-

tional system and for the scarcity of research programs for this region.

At the date the Third ENSO Conference was ongoing, a new event El Niño had been developing. Since May–June 2014, after propagation of a Kelvin wave, the Eastern Pacific (El Niño 1+2 and El Niño 3 sectors) showed anomalies of the sea surface temperature greater than 0.5°C (see Fig. 2), and climate anomalies (the ITCZ was located southern than normal for the season, precipitation deficit and drought observed since June in northern South America, Central America and Caribbean region, above normal precipitation in Southern South America, a weak tropical cyclones season) had been observed since May, with strong socioeconomic impacts in South and Central America. With the diagnosis of this situation and recognizing the importance for the countries of the region, CIIFEN disseminated a warning and informed world and regional climate centers about the anomalies observed in the eastern Pacific. Despite the reports produced by CIIFEN based on regional observations, some international centers did not recognize this situation as an El Niño event. Here it is necessary to mention that the information on diagnosis of the processes in tropical Pacific, delivered by the global specialized centers during the second half of 2014, did not consider fully the regional particularities, and important features of sectors as the Eastern Pacific were excluded. Maybe this could have happened because most of the international centers are focused just in the Ocean El Niño Index (ONI), that only represent the evolution in the Central-Western sector of the Pacific, or because the existing “gaps between global ENSO science and regional processes” played an important role in this situation.

Regarding prediction, the CPC/IRI Consensus Probabilistic ENSO Forecast had in July 2014 a probability of 80% that an El Niño event could occur at the end of the year, but in October the probability fell to 65%. In November, there was uncertainty about the development of an El Niño event.

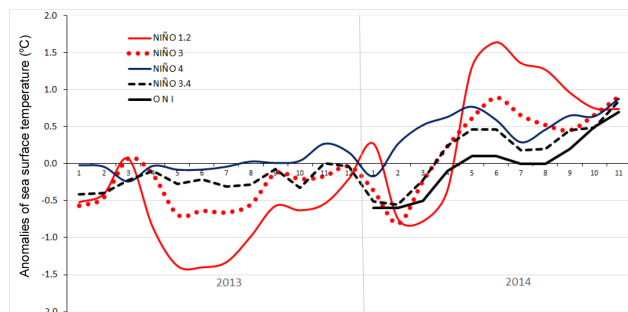


Figure 2. Evolution of the sea surface temperature anomalies in different areas of the tropical Pacific and ONI during 2013 until November 2014.

By the days of the conference, global media warned about the approaching of an event “El Niño”, even some speculated on a “Big-El Niño” and a “Godzilla”, while others stated that the observed conditions were not El Niño. In this situation, countries were confused by different sources of contradictory information and by different messages about what was happening in the climate system related to ENSO. This circumstance put on the table several themes for discussion and reflection, and it was a good opportunity for thinking and debate about not only issues related to ENSO science, but also with ethical, timely, responsible, and appropriate communicating of specialized information on ENSO and its use in the practice of planning and decision making in the society.

Some key messages have emerged from the Third ENSO Conference and from reflections on the particular situation experienced in the second half of 2014. These could be summarized as follows:

- Processes in the Eastern side of tropical Pacific play an important role in ENSO dynamic, as well for defining whether El Niño and La Niña conditions are present in the region. It is necessary to improve the knowledge about the processes in this sector of the Pacific.
- Besides the need for improving the understanding of ENSO dynamic, particularly its regional features, there is urgency for actions addressed to the maintenance and strengthening of the Tropical Pacific ocean observation system, and for its enhancement in poorly covered areas as the Eastern Pacific. This is a sine qua non condition for improving the knowledge and prediction tools, as well for strengthening warning systems on ENSO.

- The spatial distributions of the sea surface temperature anomalies along the tropical Pacific presents a diversity of configurations with maximum positive (during El Niño) or minimum negative (during La Niña) anomalies concentrated in a given sector, not always in Central Pacific or El Niño 3.4 sector, and each configuration produces its own particular effect on continental climate at regional scale. Because that, may exist El Niño or La Niña conditions, not detected in the Central Pacific sector, that are affecting the climate of several regions with severe impacts in different countries, as happened in the second half of 2014, with the warm anomalies in the Eastern Pacific and its effect in the climate on South and Central America.
- Regarding this, is strongly necessary to have a better understanding of the regional climate effect produced by different spatial configurations of the SST anomalies (El Niño or La Niña like), to provide decision makers with particular elements of judgment and prediction, and to support national authorities on the declaratory of El Niño or La Niña situation.
- Several challenges for communication of specialized information on ENSO appeared. Recommendations suggests to include information of the particular regional situations in the global reports of diagnosis and prediction issued by international specialized centers.

This issue of *Advances of Geosciences* includes the papers submitted by some presenters at the Third International Conference on ENSO.