

[Regional Climate Outlook Forum]

Status Report (Survey)

Annotated Outline

Specific Climate features of concerned region

The region of interest covers a large area in South America between 10°S and 55°S. It is characterized by diverse geographical features with the Andes Mountains in the west coast and the highlands and plateaus in the east. The region between 20°S and 40°S, east of 62°W is characterized by rainfall throughout the year. Bolivia, western Argentina and Paraguay exhibit a monsoonal precipitation regime with maxima during the austral summer and dry season in austral winter. At the opposite end, the regions of central Chile and part of the Patagonia in Argentina have a dry season during the austral summer.

The South Atlantic Convergence Zone (SACZ), the Indian Ocean Dipole, the Sea Surface Temperatures in the Atlantic, the Southern Annular Mode and the Madden-Julian Oscillation are sources of predictability, but El Niño Southern Oscillation (ENSO) is the main source. El Niño manifests over the region with above normal winter temperatures and increased precipitation, especially from April to September in central and south Chile and northwest Patagonia in Argentina, and from September to March in northeastern Argentina, Eastern Paraguay, southern Brazil and Uruguay. Conversely, La Niña event is associated with below normal winter temperatures and below normal precipitation from August to February in a similar region. During a La Niña event, the southeast of South America experienced severe droughts, which resulted in significant losses in a region where agriculture and farming are the main activities. The impact of droughts on one of the largest producer of soybean has significant economic consequences. The energy sector also suffers from the seasonal climate variations that directly affect the hydro-electric production. The irregular temporal and spatial distribution of water resources affects their availability and quality in different regions.

The RCOF background

The Southeast of South America Climate Outlook Forum (SSACOF) started in 1997 under the guidance of the World Meteorological Organization (WMO), with the co-sponsorship of the International Research Institute for Climate and Society (IRI) and the National Oceanic and Atmospheric Administration (NOAA). Since 1999, the forums have been organized by the National Meteorological and Hydrological Services (NMHSs), with the financial support of the WMO and, in recent years, also the State Agency for Meteorology of Spain (AEMET). Until 2014, the forum included the region comprised between 20°S and 40°S east of the Andes Mountains. However, with the establishment of the Regional Climate Center Network for Southern South America (RCCNetwork- SSA), the decision was made to extend the region. The countries currently participating in SSACOF are Argentina, Bolivia, Brazil, Chile, Paraguay and Uruguay. The forum is coordinated by the WMO RCC-Network SSA.

From the first forum held in December 1997 in Montevideo, Uruguay until the forum held in December 2016 in Asuncion, Paraguay, a total of 41 forums have been organized. Participating countries take turns hosting the forum. Prior to 2004, the SSACOF session was put in place around three times per year. Since 2004, the number of organized forums has been reduced to twice a year.

The forums usually extend for 3 days and are physical, changing the organizing country each time with the collaboration of RCC-Network SSA. During one day and a half, a technical

discussion for elaborate the consensus forecast is made. Since the creation of the RCC-SSA, part of the time of the forums is used to update activities of the RCC and new objectives are discussed and coordinated. During the rest of the forum, other activities are held, like discussions with specific users (for example with agricultural users like the forum of December 2015 held in Brazil) or training workshops (like the workshop on sub-seasonal prediction, held in December 2016 in Paraguay). Additionally, in some cases a press conference is made, depending on the hosting country.

The RCOF process

The methodology used in the SSACOF for preparing the seasonal forecast outlook has two main components:

- Diagnostics of the global and regional climate conditions of previous months, including the evaluation of the key drivers of the region's climate (ENSO status, Antarctic Oscillation, Indian Dipole and Madden-Julian Oscillation);
- Use of forecasting tools (both statistical and dynamical) for preparing the final forecast outlook. The final outlook is based on about 30% statistical models information and 70% dynamical models information. After presenting the content above, including diagnostic, forecasts and associated verification products, all participants contribute to the final discussion for elaborating the upcoming seasonal forecast by consensus agreement among climate experts attending the forum.

As for statistical models the following forecasts are considered in the discussion for preparing the outlook:

1. Circulation and sea surface temperature (SST) based forecasts produced with the Climate Predictability Tool (CPT -IRI) run at the RCC Network-SSA forecast.
2. Circulation and SST based CPT forecasts run at the Meteorological Services of Argentina, Bolivia, Brazil, Chile, Paraguay and Uruguay.
3. Circulation and SST based forecasts run at CIMA (Argentina) and as part of EUROBRISA (An Euro-Brazilian Initiative for improving South American seasonal forecasts)

As for dynamical models the following forecasts are considered in the discussion for preparing the outlook:

1. Global and regionally downscaled forecasts produced by the local Global Producing Centre for Long-Range Forecasts (GPC), CPTEC (Centre for Weather Forecasts and Climate Studies), Brazil
3. The multi-model ensemble forecast of the 12 WMO GPCs
4. The multi-model ensemble forecast produced by EUROSIP
5. The multi-model ensemble forecast produced by NMME
6. The multi-model ensemble forecast produced by the IRI
7. The hybrid (statistical-dynamical) multi-model ensemble forecast produced by EUROBRISA
8. The multi-model ensemble forecast produced by APEC Climate Center

SSACOF produces terciles probabilistic rainfall and temperature forecasts expected for the upcoming three months period for both mean temperature and precipitation. As a result, seasonal climate outlooks are distributed by the RCC-Network SSA and National Meteorological and Hydrological Services (NMHSs) to regional and national users.

Evaluation of the previous season's consensus outlook:

In every forum, a hit rate evaluation is made on the last consensus: temperature and precipitation consensus forecasts are compared with observational data from the RCC-network SSA. A hit is when the highest probability on the tercile scale of the forecast coincides with the

observed tercile A qualitative comparison is made and discussions are focused mainly on the regions where skill was poor. This discussion and its conclusions are for internal uses and are not communicated to the users. The categorical verification was not integrated through every year. This is mainly because not all the forums were able to be made for the same seasons.

Information updates between RCOF events

Since November 2016 RCC-network SSA coordinates a monthly virtual meeting for monitoring and elaborating a climatic perspective. Each month the organizing country changes and it's responsible of elaborating a presentation and leading the discussion (http://www.crc-sas.org/es/perspectivas_climaticas.php). The main goal of the meeting is to discuss about the climatic anomalies of the previous month, to analyze the different climatic models (global and regional) and to share results of each country.

Since XL RCOF climatology reference maps are included in the final report. Also, a link to get climatological information of the meteorological surface stations for every season is included (http://www.crc-sas.org/es/climatologia_faixa_normal.php). Maps for every season are available in the website: http://www.crc-sas.org/es/prevision_modelo_previsao_as.php

Capacity needs

Most users usually need these forecasts and more: we have met users that required us forecasts as long as 6 months or one year. Others told us they would be pleased to get monthly and weekly forecasts. For the latter issue we took the decision of incorporating sub-seasonal operational monitoring products in the RCC website. A discussion about the influence of patterns of this scale has already been incorporated in the forums and also weekly forecasts are analyzed but not published yet.

In addition, research projects have been made in order to work with the academic community, which main objectives are: contribution to the understanding of climate variability, how the combined influence of remote and regional sources of low-frequency variability drives anomalous conditions over SSA, develop regional prediction tools for elaborating sub-seasonal to seasonal forecasts and working with users in tailored products.

User involvement

SSACOF involves experts from NMHSs, universities, specialists in climate forecast, researchers in meteorology, hydrology and related environmental sciences, anthropologists, government organizations, international institutes and users from sectors such as agriculture, water resources, hydro-electric generation, civil defense and disaster awareness.

Users can contribute to the discussion through presentations on subjects such as the condition of rivers, hydro-electric dams, crops, soil moisture, and damages and losses due to recent weather conditions. These interactions allow climatologists to gain a better perception of how users interpret the forecast, what information is needed to make better decisions and whether the format of the information provided is adequate.

Agricultural and water sectors use the information provided by the forum and in some cases, integrate this information into crops models or hydrological models. The challenge is to adapt the forecast to the models. For instance, crop models need daily information, and translating seasonal information into daily time series is not a trivial task.

In the forums that were held during El Niño 2015-2016 several professionals from hydric institutions had an active participation in the forums due to the big concern about the possible impacts of this event. Every country had at least, one representative.

SWOT analysis

Strength

-Continuity, SSACOF has been conducted since 1997.

-To make new developments, new products and have new visions of the problems that society has when we talk about climate disasters and impacts there is a need of professionals from different disciplines. This is the reason why working with other disciplines is essential to cover these needs as much as possible. In this way, RCC and forums count with active participation of professionals from the hydrological sector and agricultural sector.

- Support of RCC-network SSA. Collaboration among met services and climate research centres.

Opportunity

Forums are an opportunity to discuss with colleagues from other countries the different climatic situations in each country. Also, it's way of knowing how other NMHSs work, or what users from other countries require most, finding points in common and new positions too. Users usually express that they need the results of the consensus forecast and, they actually use these results. In the case of National forums, it is an opportunity to interact with professionals from other disciplines and to know their work and their needs too.

Weaknesses

-One of the weaknesses we've been working on through the years is on the way of best communicating these forecasts to the users. As the final consensus is presented in terciles probabilities, each country has made an effort to explain these results as clear as possible to the users (through each NMHSs websites, or in press conferences, depending on the country). As users come from very different disciplines, their understanding is not always on the same level, so we realize that we still have to work harder on this issue to reach as much users as possible.

Threats

-Lack of funding from government

- There are few professional at the weather meteorological services

Sustainability of RCOF

With the advent of the RCC-Network-SSA, statistical seasonal climate forecasts for all the regions are provided each month on the RCC-Network-SSA website. These forecasts considerably facilitate the part of the forum dedicated to the forecast, allowing for more time to be devoted to interaction with users. Moreover, the role of the RCC-Network-SSA is to contribute significantly to improvements in the forecast methodology, diminishing its subjective content. In line with this, a new consolidated procedure for combining and calibrating statistical models and dynamical models from the Global Producing Centres for Long-Range Forecasts (GPCLRFs) to produce terciles probability seasonal forecasts will be developed and implemented in the RCC-Network.

Given the continuity and the trajectory of the forums, participants from different countries are usually the same people. This experience and continuity allows and facilitates discussing some issues like possible changes, searching for solutions and organizing the forums themselves. The implementation of the RCC has strengthened coordination through the focal points and has

facilitated interaction between workgroups inside the RCC and other workgroups from ARIII and CCI.

In terms of sustainability, forums are possible thanks to the financial support of WMO. Some other options to get financial support are being studied but none of them seems to be possible yet.

Way forward

The main efforts for the near future should be focused in: calibration and verification of seasonal climate numerical models; verification and integration of the consensus forecasts; development of additional products for monitoring and forecast and tailoring forecast.

It is also very important to have an integration of the numerical models in our region. This is not easy due to the poor skill that most models have in many regions of South of South America. This makes more evident that calibration and a study to decide which models should be integrated based on their performance are needed.

In addition, there are possibilities of incorporating new products in order to improve the monitoring in sub seasonal to seasonal scale. There is an experimental distribution of precipitation forecast based on RCC statistical model. An identified challenge is to work on impact-based forecast. Actually, efforts are being done in developing strategies for an early warning system of droughts.