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## **The Bolivian Drought Monitor: an operational tool, calibrated on impact records, to identify and communicate drought severity conditions.**

**Lauro Rossi**<sup>1</sup>, Alessandro Masoero<sup>1</sup>, Anna Mapelli<sup>1</sup>, and Fabio Castelli<sup>2</sup>

<sup>1</sup>Cima Foundation, Savona, Italy (lauro.rossi@cimafoundation.org)

<sup>2</sup>Department of Civil and Environmental Engineering, University of Florence, Florence, Italy (fabio.castelli@unifi.it)

Within the framework of the CIF financed “Pilot Program for Climate Resilience”, the Drought Monitoring and Early Warning System for Bolivia was developed and implemented. The system is operational since July 2020 and aims at detecting emerging severe drought conditions in the country, in order to trigger timely warnings to stakeholders and the general public.

The Bolivian Drought Monitor has two main components: a technical one (data gathering and analysis, performed through the multi-hazard early warning “myDEWETRA” platform) and an institutional one (creating consensus and disseminating warnings). The system design followed a participatory approach, involving since the early stages the Ministry for Water and Environment (MMAyA), the National Hydrometeorological Service (SENAMHI), the Vice-Ministry for Civil Defence (VIDECI). These institutions actively contribute to the monthly edition of the drought bulletin, each one for its own sector of competence, through a dedicated IT tool for synchronous compilation. Ongoing drought conditions are reported in a national bulletin, issued monthly and published on a dedicated public website: <http://monitorsequias.senamhi.gob.bo/>

Given the Bolivian data-poor context, analysis strongly relies on a large variety of multi-source satellite products, spanning from well consolidated ones in the operational practice to more experimental ones such as from the SMAP mission. This information is used to monthly refresh the spatial maps of 17 indexes covering meteorological, hydrological and agricultural droughts for different aggregation periods (from 1 to 12 months). Simulation of the system performance over a long period (2002-2019) and comparison with recorded socio-economic drought impacts from the National Disaster Observatory (Observatorio Nacional de Desastres- OND) of the Vice-Ministry of Civil Defence (VIDECI) was used to define a most representative compound index, based on a weighted combination of a selection of 4 indexes with their related thresholds. The combination of 3-month SPEI, 2-month SWDI, 1-month VHI and 1-month FAPAR indexes performed the best in the comparison with impact records. This combination encompasses both the medium-term effects of meteorological and hydrological deficits (3-month SPEI and SWDI), both the short-term effects on vegetation (1-month VHI and FAPAR). This set of indexes proved to be a solid proxy in estimating possible impacts on population of ongoing or incoming drought spells, as happened for most significant recent drought events occurred in Bolivia, such as the 2010 event in the Chaco region

and the 2016 drought event in the Altiplano and Valles regions, that heavily affected the water supply in several major cities (La Paz, Sucre, Cochabamba, Oruro and Potosí).

The design of the monitoring and bulletin management platform, together with its strong remote-sensing base, give to the system a high potential for easy export to other regional and national contexts. Also, the variety of the different computed drought indexes and the replicability of the procedure for the best compound index identification will allow for efficient evolutionary maintenance as new remote-sensing products will be available in the future.