**Minutes of Teleconference on Extremes - 29 June 2017**

Were present: Frédéric Vitart, Hai Lin, Christophe Lavaysse, Yuhei Takaya, Christopher Castro, Michael Deflorio and Aneesh Subramanian

1. **"Predictability of meteorological droughts and extreme temperature anomalies in Europe" by Christophe Layasse**

Early warning systems for droughts and extreme temperature anomalies can provide valuable information for decision makers in areas such as water resources management or international aid.

However, predicting such extreme events is still a big challenge. In our studies, we analyzed the predictability of these events using the Extended Ensemble system from ECMWF. The results showed that the predictability of droughts using precipitation with one month lead time are significant, with a maximum of about 40% of droughts detected, and provide a benchmark for drought prediction. Then we used large scale atmospheric predictors, and more precisely the monthly occurrence anomaly of weather regimes (WRs), instead of precipitation forecasts for providing valuable early warnings of drought events. Results based on comparison in between forecasted precipitation and forecasted WR occurrences show a substantial improvement in the drought forecast, especially in winter in the northern and eastern part of the European continent where more than 65% of droughts are detected one month in advance. Some sensitivity test were conducted to highlight the potential impacts of the initial conditions (defined by the previous SPI2) and the drought intensities (from lower than -1 to lower than -2). The results showed that the model is better to predict persistence than onset of droughts, and the decrease of the predictability following the drought intensities. The interest of using predictors is higher when the most extreme cases are studied.

The same study were performed for extreme temperature anomalies. The detection of hot/cold waves are defined according to persistence (at least 3 days) of Tmax and Tmin above Q90. Cases studies of heat (France in 2003 and Russia in 2010) or cold waves (central Europe in 2012) highlighted the potential good probability of wave durations and intensities once the onset of the heat or cold is predicted. These conclusions were confirmed by statistical analysis showing that more than 60% are correctly predicted during the first days and more than 40% one week in advance. They also shown the difficulties to predict the onset of waves after 7-day lead time. The explanations of these errors are under investigations and could be associated with the challenge to predict the onsets of large scale blocking situations.

1. **"Updates on the Science for Citizens Project" by Christopher Castro**

The objective of the Science for Citizens Project is to assess the potential utility of sub-seasonal predictions as part as an early warning system, in the context of a demonstration Climate Services exercise for Disaster Risk reduction, developed as a case study in the Southwestern Amazon. The main goals of this projects include:

* To  promote  use  of  these  forecasts  and  their  uncertainty estimates  by  the  applications  community
* To unveil the role (if there is) of sub-seasonal forecasts to promote preparation and/or preparedness for disasters
* To assess the quality of pilot tailored forecast products, for aiding  decision in a strategic  economic sector (to be selected during the communication process)

Users and scientists can have different views on what forecast is useful and usable. Therefore, the project includes two different approaches to forecast verification:

* The “Physics approach” which is to evaluate the model skill over the whole South America at a grid point level, following standard verification procedures. The variables to be evaluated are temperature and precipitation (dry spells and heat waves).
* The “Social approach”. This second approach will consider to evaluate the usefulness of the S2S prediction from the perspective of key social-economic sectors in the Acre’s State.

One of the objectives of the project is to develop an Early warning system in the context of the Acre state pilot project. Climate projections indicate an increase in the frequency and intensity of extremes. In the Acre region, emergency was declared for floods in Rio Branco in 2006, 2009, 2010, 2011, 2012, 2013, 2014. In 2005 large areas of the Amazon river basin experienced one of the most intense drought episodes of the last 100 years. During the “summer”, fire destroyed 300,000 hectares of rainforest, and caused over US$50 million of direct economic losses (BROWN *et al*., 2006; SHIMABUKURO *et al*., 2009).

The early warning system in the context of the Acre state pilot project has four components:

* Risk Knowledge
* Technical monitoring and warning service
* Communication and dissemination of warnings
* Community response capability

1. **"Verification of sub-seasonal prediction of tropical cyclones in the Southern Hemisphere" by Frédéric Vitart**

Tropical storm strike probability maps for weeks 1 to 4 are part of the ECMWF extended-range products. They provide a link between medium-range forecasts of tropical cyclone tracks and seasonal forecasts of tropical storm activity over a basin and therefore could be part of a ready-set-go system with seasonal forecasts as “ready”, extended-range as “set” and medium-range as “go”. Verification of the extended-range forecasts of weekly probabilities of TC strikes has been documented in Vitart et al. (2010). This paper indicated some significant skill over the Southern Hemisphere up to week 4, particularly over the Indian Ocean basin. This skill can be explained by the strong modulation of tropical cyclone activity by the Madden Julian Oscillation (MJO) and also by ENSO. Since the ECMWF model has changed many times since 2010, this verification needs to be revisited, first with the ECMWF re-forecasts and then with the other S2S models. In this skill assessment, the probability of weekly mean Accumulated Cyclone Energy (a better measure of TC activity than the number of TCs) to be above climatology over a 20 degree longitude by 10 degree latitude domain has been calculated for each grid point (in a 1x1 degree grid) over the Southern hemisphere. Grid points where the weekly ACE climatology is 0 have been eliminated. The forecast probabilities have been verified against observed ACEs from the best track data. Reliability diagrams indicate reliable ACE anomaly forecasts up to week 4 although the ECMWF model tends to be strongly overconfident. As in Vitart et al. (2010) the TC extended-range forecasts are more reliable over the South Indian Ocean than over the other Southern Hemisphere basins. This study will be extended to other ocean basins (northern Hemisphere) and to other S2S models.

*Vitart, F., A. Leroy and M.C. Wheeler, 2010: A comparison of dynamical and statistical predictions of weekly tropical cyclone activity in the Southern Hemisphere. Mon. Wea. Rev, 138, 3671–3682.*

1. **Future case studies**

Possible case studies of recent events were discussed:

* Hai mentioned a very persistent rainfall episode which led to flooding in Canada in May 2017. The Canadian model was not successful in predicting it in the extended range. Hai and Frédéric will investigate its prediction in the S2S database.
* Frédéric mentioned a current heat wave taking place over Europe in June. Christophe will investigate its predictability as part of his effort to assess the predictability of meteorological droughts and extreme temperature anomalies in Europe.
* Aneesh mentioned a very drought over South-West of US in 2016 and volunteered to investigate its sub-seasonal predictability.