OUR COMMON FUTURE UNDER CLIMATE CHANGE

International Scientific Conference

ABSTRACT BOOK

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This Abstract book is based on a compilation of all abstracts selected for oral and poster presentations, as of 15 May 2015.

Due to the inability of some authors to attend, some of those works will therefore not be presented during the conference.

OUR COMMON FUTURE UNDER CLIMATE CHANGE

Welcome to the Conference

Welcome to Paris, welcome to 'Our Common Future under Climate Change'!

On behalf of the High Level Board, the Organizing Committee and the Scientific Committee, it is our pleasure to welcome you to Paris to the largest forum for the scientific community to come together ahead of COP21, hosted by France in December 2015 ("Paris Climat 2015").

Building on the results of the IPCC 5th Assessment Report (AR5), this four-day conference will address key issues concerning climate change in the broader context of global change. It will offer an opportunity to discuss solutions for both mitigation and adaptation issues. The Conference also aims to contribute to a science-society dialogue, notably thanks to specific sessions with stakeholders during the event and through nearly 80 accredited side events taking place all around the world from June 1st to July 15th.

When putting together this event over the past months, we were greatly encouraged by the huge interest from the global scientific community, with more than 400 parallel sessions and 2200 abstracts submitted, eventually leading to the organization of 140 parallel sessions.

Strong support was also received from many public French, European and international institutions and organizations, allowing us to invite many keynote speakers and fund the participation of more than 120 young researchers from developing countries. Let us warmly thank all those who made this possible.

The International Scientific Committee deserves warm thanks for designing plenary and large parallel sessions as well as supervising the call for contributions and the call for sessions, as well as the merging process of more than 400 parallel sessions into 140 parallel sessions. The Organizing Committee did its best to ensure that the overall organization for the conference was relevant to the objectives and scope. The High Level Board raised the funds, engaged the scientific community to contribute and accredited side events. The Conference Secretariat worked hard to make this event happening. The Communication Advisory Board was instrumental in launching and framing our communication activities on different media. We are very grateful to all.

We very much hope that you will enjoy your stay in Paris and benefit from exciting scientific

interactions, contributing to the future scientific agenda. We also hope that the conference will facilitate, encourage and develop connections between scientists and stakeholders, allowing to draw new avenues in the research agenda engaging the scientific community to elaborate, asses and monitor solutions to tackle climate change together with other major global challenges, including sustainable development goals.

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The Lake Victoria basin, in the headwaters of the Nile in East Africa, is home to over 30M people. As the population continues to increase, demands for water for irrigation, hydropower, and domestic and industrial supply are growing rapidly. The significant drop in Lake Victoria water levels, beginning in 2000 and reaching the lowest recorded level since the 1940s six years later, inconvenienced those who depend on the lake for their livelihoods and generated not just a regional, but a global, debate. A number of conflicting narratives regarding the cause of the decline were advanced by the scientific community, the regional press and the citizens of the five riparian countries, namely Burundi, Kenya, Rwanda, Tanzania and Uganda.

Lake levels are a primarily a function of regional climate and resultant lake rainfall and evaporation; the impact of water releases for hydropower and other abstractions within the basin is still relatively minor. The Lake Victoria region is characterised by high intra- and inter-annual climatic variability, the consequence of which is significant uncertainty in future rainfall on, and inflows to, the lake. Long good quality hydrometeorological time series records have always been considered important for the assessment and management of water resources. However, many countries in sub-Saharan Africa, and elsewhere, have experienced a marked decline in hydrometeorological data collection and management in recent years.

An increasing need is emerging for long-term datasets to understand how national and basin-scale hydrological regimes are responding to climatic variations and anthropogenic influences. Predicting future water availability, for effective water resource planning under climate change and population growth, requires well-founded predictions of regional climate, hydrology and societal demands across the basin. Whilst climate and hydrological models can inform about expected impacts of change, validation of these models requires real data. In an interesting paradox which illustrates the current lack of capacity to predict the impacts of climate variability and change on water resources, the East African long rains are observed to be decreasing, whilst climate models predict an increase.

Initiatives to improve understanding of the climate and hydrology of the lake basin are welcomed e.g. GEWEX HyVic regional hydroclimate project, DFID-NERC FCFA (Future Climate for Africa) programme, and WMO data rescue activities which aim to identify and preserve records that capture natural variability.

K-3330b-03

Using climate information to build resilience agriculture for farmers in Kaffrine district in senegal

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Senegal, at the image of many sahelian countries, is one of the most affected area by climate variability. Climate is varying at decadal, inter-annual and sub-seasonal time scales. So population living in such environment are affected by climate shocks in their livelihood.

Funded by the CCAFS initiative there is a 5 years going on project with farmers demonstrating how to use climate information to help farmers in their decision making. This initiative is a pluri-disciplinary and multi-scale processes. In the course of this project many lessons were learnt and many good successful actions that lead to improve farmers decision system.

Downscaled climate and weather is produced for the district of Kaffrine. This information is then provided to a local pluri-disciplinary working group (GTP) which interpret it into actionable decision. In this GTP sit representative of farmer's organization, local decision makers, boundary organization and local department extensions working on agricultural related issues (agriculture, crop protection, forestry, water, seed producers, ...). Then the advices coming out of the GTP is broadcasted through rural radio, bulletin, text messaging as well as during social gathering (naming ceremony, funeral, ...). In this process indigenous knowledge is also used beside state of arts climate forecasting. During all the crop cycle, each ten days period, information is provided to farmers to help them to make the best decision. These decisions include choice of the planting dates, avoiding false start, applying fertilizer, removing the herb, harvesting and storage. In this project all initiatives are discussed with farmers representatives and evaluated after the cropping cycle.

A monitoring and evaluation study has shown that farmers in this project was able to cope with climate shock better than other farmers which lead to increase substantially their yields. Today this project in Kaffrine is owned by local government representative who calls and leads such meeting. Now the project is at its upscalling phase to other districts of Senegal using rural radio network. In the upscaling process community radio journalists are trained to understand climate information in order to disseminate such information at broader scale.

We will present lesson learnt and evidence in this project during these 5 years for a climate smart agriculture.

O-3330b-01

Yield Gap and the shares of climate and crop management in yield and yield variability of staple crops in West Africa

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« Yield gap » (Yg) is a key concept of agricultural science for identifying the room for improvement of yields through better management of the agroecosystem. In rainfed agriculture Yg is the difference between actual yield (Ya) and the theoretical water limited yield (Yw) that would be achieved if solar radiation, temperature and precipitations were the only factor limiting the crop's growth and yield. Changes in Yw over regions and years are due to climate-soil interactions that are not easily modified by crop management, whereas changes in Yg are due to limiting factors that are typically within the scope of crop management such as nutrient availability, weeds, and pests.

We provide an example of yield gap estimates in semi-arid Africa, using yield and other agronomic data collected in famers' fields of Senegal in 1990 and 1991 and from 2006 to 2012. It illustrates how contrarily to what most people would expect climate is not, on average, what most limits yields in that region: yet, actual yields are on average a quarter of water limited yield, and this is due to constraints whose reduction is technically possible albeit subject to the economic and environmental relevance of doing so.

Most studies dealing with the impact of climate change on agriculture in West Africa compare Yw under present and future climate as predicted by climate models. The magnitude of those predicted long term changes in Yw by 2050 is down to -20% in the worst scenario combining a +6°C change with a -20% rainfall change. Such changes in water limited yields are certainly concerning, but they are remarkably small compared to the potential +390% increase that would result from closing the current yield gap.

When considering yield variations observed across plots and years, and not anymore regional averages over a few years, what strikes is the stability of observed yields compared to variations of Yw. We used crop model simulations with historical series of 20 years of weather data to compare yield distributions over years of a crop grown using 3 contrasted levels of fertilisation and no incidence of weeds, pests or diseases. For each fertilisation level, the simulated yield reached a maximum value the 'best year' of the series. The three fertilisation levels were chosen so that the maximum simulated yield reached 0.25 Yw, 0.5 Yw, and 0.75 Yw respectively. The resulting simulated yield distributions show that even if management allows increasing the median yield, in many years the climate is the main limiting factor and fertilising has no or a slight impact only. In other words, the way the current climate limits crop production in this region is by making uncertain the output of investing for high yields. Buying fertilizers or working hard for manure collection, transport and distribution do not translate, a certain number of years, into more production. For farmers struggling for the daily subsistence of their family, that kind of risk may not be justified while alternative use of family resources in cash and labour force provide less risky ways to produce subsistence means. Until recently, in many farming systems of West Africa, the growth in food needs due to population growth in rural areas was matched thanks to increases in cultivated or pasted areas rather than increases in crop yields or livestock pressure on land (i.e extension rather than intensification of crop or livestock activities). When rural families reached the limits of this strategy, migrations of many kinds of distance and duration became the adjustment variable to the gap between resources available from farming and population needs. This suggests that for many, it is less risky to leave home than to intensify cropping or livestock systems. Anyway, as job opportunities for migrants from the rural zones are currently low in West African cities and elsewhere, there are legitimate concerns about the way this strategy may soon reach its limit as well.

In terms of climate change, the worst scenario for farmers of that region would be if crop intensification became even more risky under future climate than at present. There is thus an urgent need for joint agronomic and climate research to go beyond the prediction of Yw or of yield under unchanged crop management and determine whether or not the future climate will increase the yield risks associated with crop intensification in that region. But this should not divert from designing and implementing policies incentive to such intensification under present climate, as this might be much easier now than later.

O-3330b-02

The re-greening Sahel: How green is green enough ?

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The Sahel region has long been the focus of a debate on its possible desertification, especially because of its sensitivity to climatic variations. This debate was fuelled following the extreme droughts that occurred and peaked in the mid 1970s and mid 1980s. Since the appearance of global and frequent satellite observations, a re-greening theory emerged in the 1990s, in total contradiction with a desertifying Sahel. This re-greening is simply defined as an increase in a vegetation index such as the Normalized Difference Vegetation Index (NDVI), widely used by the community as a proxy for aboveground Net Primary Production (ANPP).

The AVHRR instruments onboard the NOAA satellites provide daily NDVI data since 1981 at the global scale, and thus have been widely used for monitoring vegetation production over time. Their analysis regarding temporal trends over the Sahel since the 1980s clearly evidence the re-greening of the Sahelian belt. However, such data are subject to uncertainties, so that there is a real need for independent validation of this re-greening observed from space. However, this validation is very difficult to make since field measurements of vegetatio mass are scarce at a matching scale, especially in the Sahel, and especially over long time periods.

In the framework of an ILRI-ILCA project and afterwards thanks to the AMMA-CATCH observatory, we beneficiated from a long-term database of field measurements collected over the pastoral Gourma region in Mali (1984-2011) and over the agro-pastoral Fakara region in western Niger (1994-2011). These databases provide, among other variables, the aboveground herbaceous mass used at the end of the growing season as a proxy for ANPP. Data are available over a large number of sites covering the landscape heterogeneity.

The objective of this study was to evaluate the performance of NDVI products (especially the new GIMMS3g dataset) as compared with long-term field observations. Our analysis over the Gourma region showed that both datasets detected a strong re-greening over the 1984-2011 period, whereas a negative trend was found over the Fakara region in Niger. Moreover, we were able to show contrasted changes depending on the different soil types found in the Gourma: whereas the deep sandy soils show a clear recovery from the droughts, the trend is heterogeneous over the shallow soils with some sites showing a recovery and others not. The picture is also variable over the clayed soils usually located in small depressions. The negative trend found over the Fakara region could be attributed to changes in land use, since this region has experienced a large increase in agriculture since the 1950s. However, the landscape being fragmented and very dynamic, further studies have to be done to fully understand the changes observed in the vegetation cover.

In both cases, a very good agreement is found between remote sensing data and field observations, giving additional confidence to the satellite archive. The Sahelian re-greening observed over the past three decades therefore seems undisputable. However, this re-greening does not happen everywhere, and contrasted changes may have happened at a finer spatial scale, thus demanding caution in concluding about the resilience of the ecosystems. In any case, since the re-greening is mostly explained by a recovery in rainfall over the past decades, the future climatic conditions and especially the rainfall trend will have a tremendous impact on the evolution of the vegetation cover in the semi-arid Sahel. Of particular concern is the fate of areas already showing an absence of greening (eroded shallow soils, Fakara area for instance).

O-3330b-03

The probable impacts of climate change on malaria and Rift Valley fever in Africa

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Dynamical models of disease transmission between vectors and hosts and back to vectors have been developed for diseases including malaria and more recently Rift Valley fever. These models are driven by climatic and other environmental variables. This is a complex task, as the models require both accurate projections of the seasonally varying mean values of the climatic drivers and their correct variability across a range of time scales from days to multi-decades.

The relationship between finding parameter settings that represent the correct sensitivities to the climate drivers and the inherent spread of these drivers within an ensemble of climate models; develops the inherent uncertainties in the model outcomes. By using an ensemble of climate models then a signal to noise ratio can be used to display the outcomes of the model projections to decision makers.

Recent FP7 projects QWeCI in West and southern Africa and HEALTHY FUTURES in East Africa have run two dynamical malaria models, the Liverpool Malaria Model (LMM) and VECTRI (ICTP) across Africa with a range of bias corrected CMIP5 GCMs. Patterns of changes in malaria distribution in West Africa and East Africa have consistent signals seen into the future using climate model projections. The simulated malaria incidence is increasing over the tropical highlands and the uncertainties related to the disease models are generally larger than that from the climate models. The largest GCM related uncertainty is found at the arid fringes in areas, which have simulated epidemic malaria transmission. Generally the signal to noise ratios in the malaria outcomes improve with increasing projection time and also with higher RCPs.

Recently a new model the Liverpool Rift Valley fever model (LRVF) has been developed using the framework of the LMM but with much more complex structure. It has two dynamic vector models and a dynamic age stratified host model. One main task in its development was parameterising the two different behaviours of the two vectors correctly in the model whilst maintaining the correct sensitivity to the climate drivers.

For both diseases the main uncertainly lies with the future projections of seasonal rainfall patterns and the interannual and intraseasonal variations of this rainfall within the climate models. By using an ensemble of climate models to drive an ensemble of impact disease models, an improved assessment of the model-related uncertainty of the future projections of climate-driven health hazard can be obtained.