

Climate Information: User Needs and User Uses

Walter E. Baethgen

IRI, Columbia Climate School

Early approach: Supply Driven (1990s)

“We produce great climate information □ Use it in your Decisions, Plans, Policies”

IRI Lesson learned

Understand the System / Understand the Challenges (Participatory)

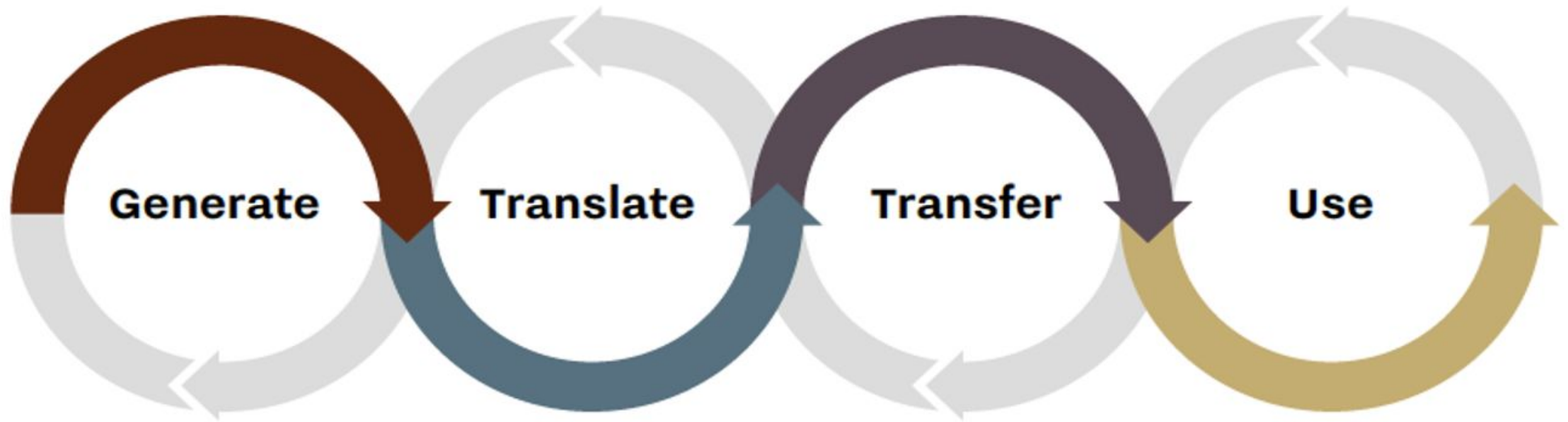
Identify the Role of Climate Information (Participatory)

Explore Tools, Products to Inform Solutions (Participatory)

Translate “Climate” into “Agronomic” (or Water, Public Health, Energy, etc.)

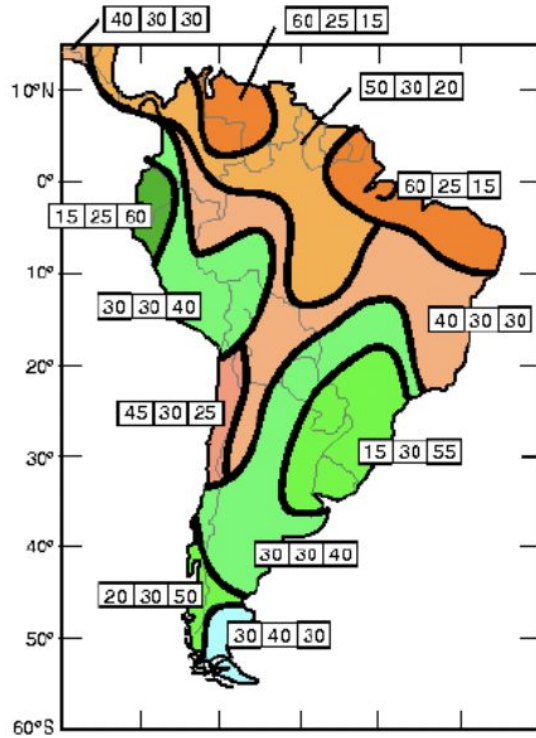
Identify “Intermediaries”, “Next Users” (as opposed to “End Users”)

Climate Services



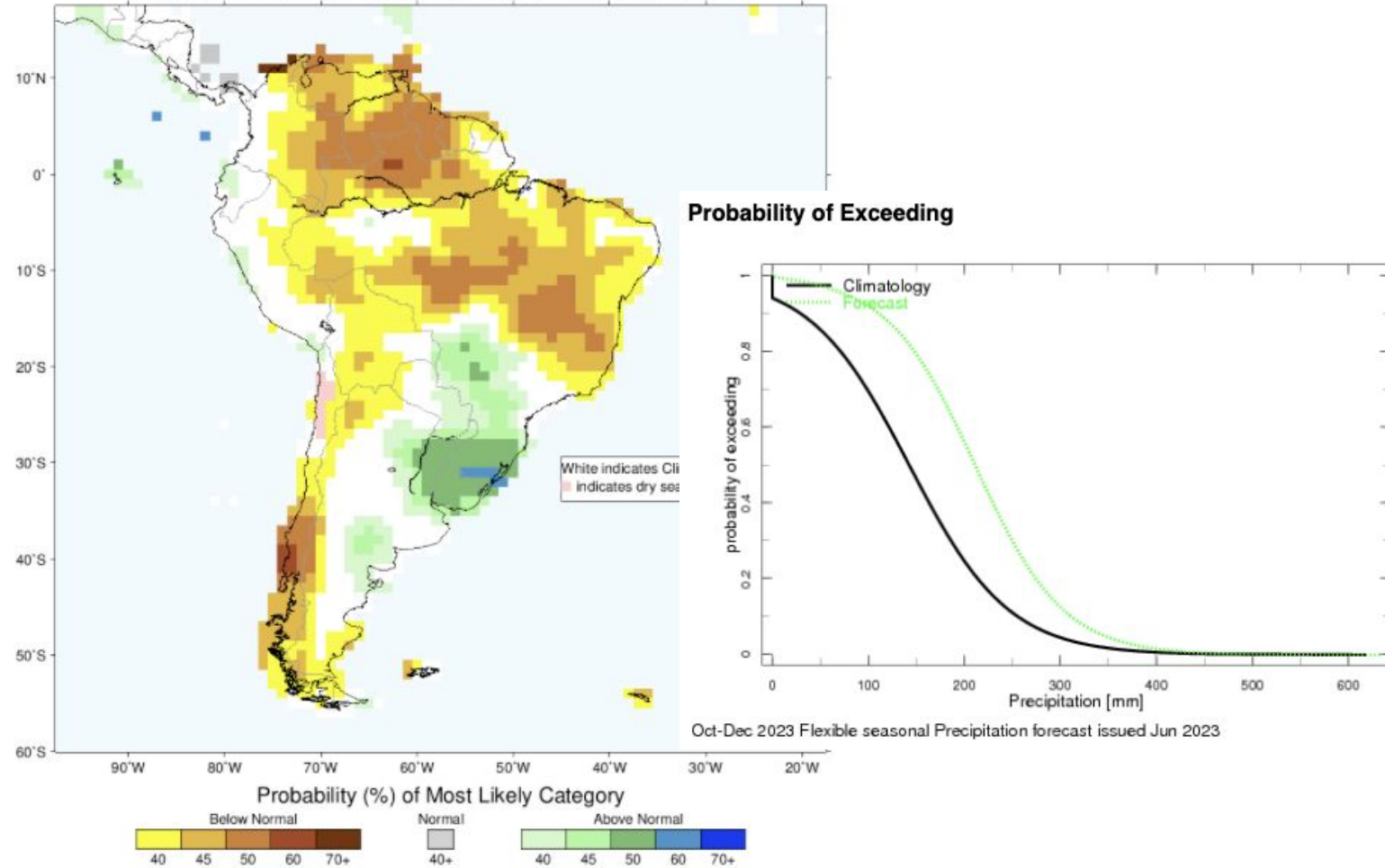
GENERATION:

IRI INTERNATIONAL RESEARCH INSTITUTE FOR CLIMATE PREDICTION



Subjective, Consensus, expressed as Terciles (Regional Climate Outlook Forums)

IRI Multi-Model Probability Forecast for Precipitation for October–November–December 2023, Issued June 2023

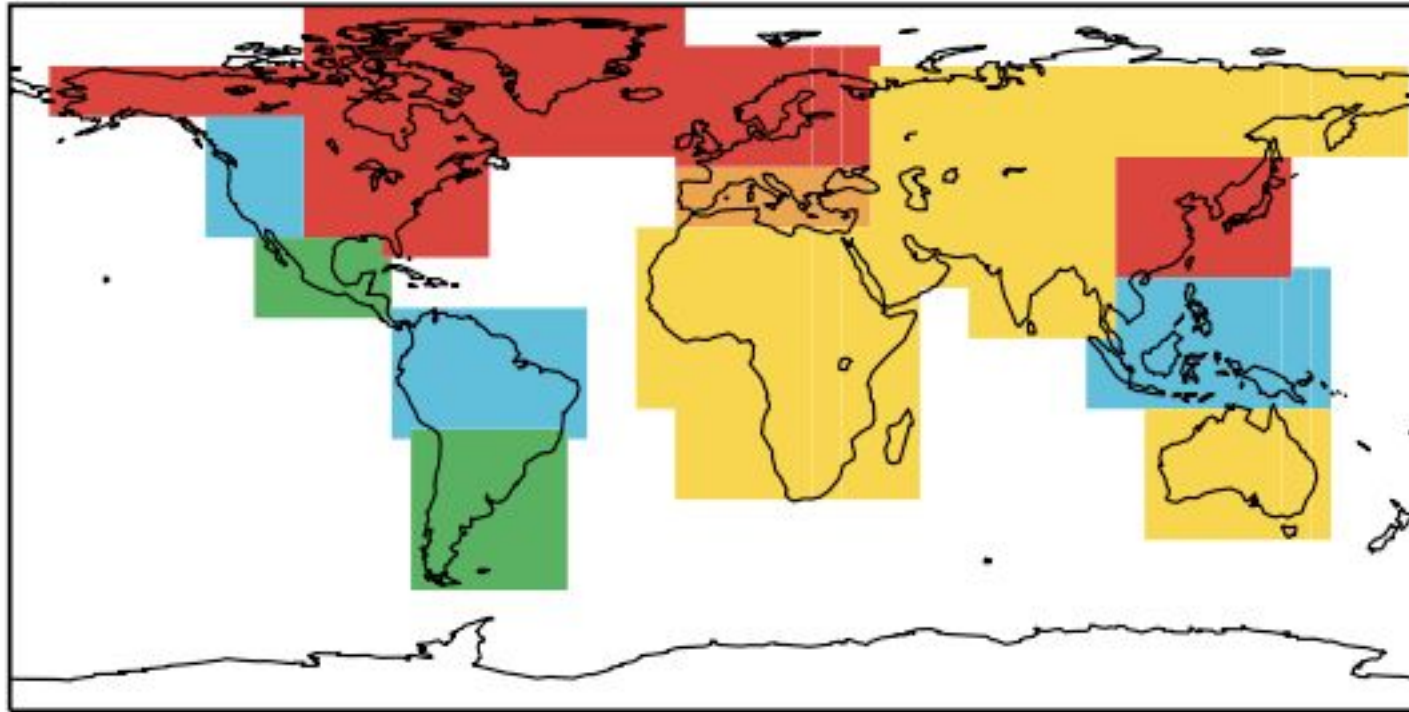


Objective, Verifiable, using full Probabilities (NextGen being used in RCOFs)

Challenges for Using Forecasts

(1) Reliability of Seasonal Forecasts

Example: Dry DJF (ECMWF)



Role of Subseasonal Forecasts
in regions with no ENSO signal
(and/or years with no ENSO)

5 perfect 4 still useful 3 marginally useful 2 not useful 1 dangerous

(Forecast frequency vs Observed frequency)

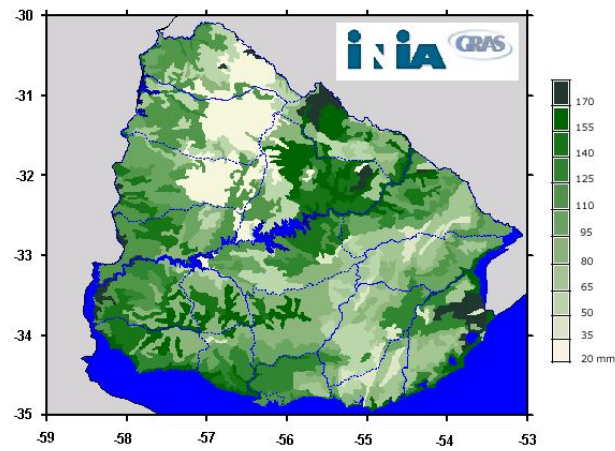
Often Monitoring is Enough

Uruguay Drought in 2015:

Provided information to
Ministry of Agriculture

Current Soil Water Content
(Translate "Climate into Agronomy")

Original Soil Water Balance
per Soil Type



Often Monitoring is Enough

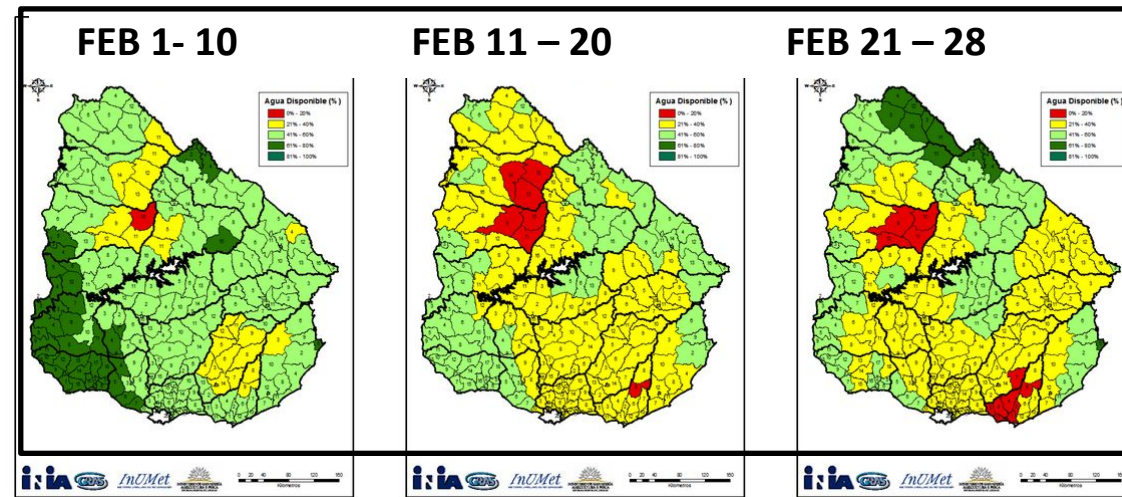
Uruguay Drought in 2015:

Provided information to
Ministry of Agriculture

Current Soil Water Content
(Translate "Climate into Agronomy")

Original Soil Water Balance
per Soil Type

But Decisions: per County



Often Monitoring is Enough

Uruguay Drought in 2015:

Provided information to
Ministry of Agriculture

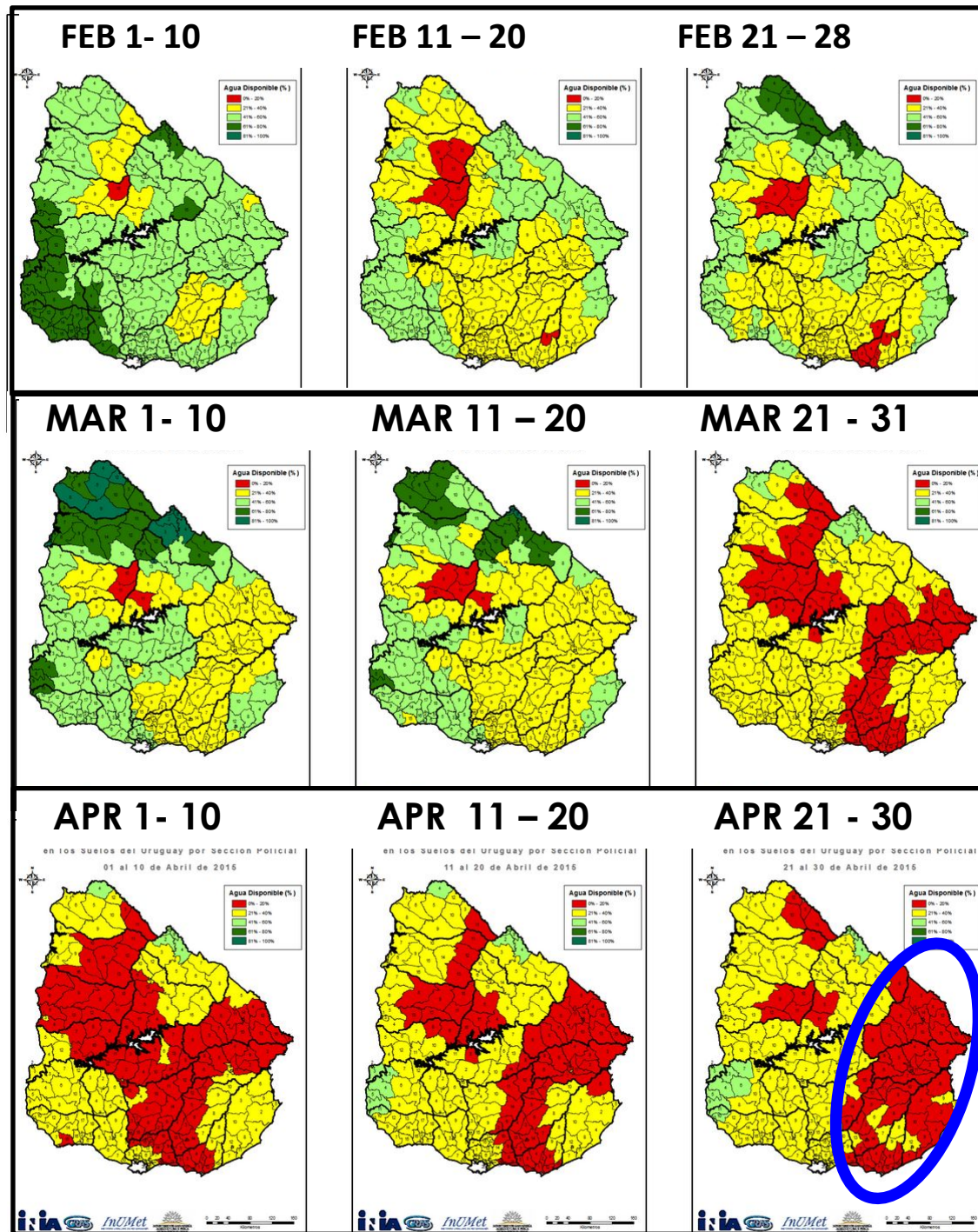
Current Soil Water Content
(Translate "Climate into Agronomy")

Original Soil Water Balance
per Soil Type

But Decisions: per County

5 May:
Ministry declared
Emergency in
4 Eastern provinces

-Special Credit for feed
-Prioritize response



Often Monitoring is Enough

Uruguay Drought in 2015:

Provided information to
Ministry of Agriculture

Current Soil Water Content
(Translate "Climate into Agronomy")

Original Soil Water Balance
per Soil Type

But Decisions: per County

5 May:
Ministry declared
Emergency in
4 Eastern provinces

-Special Credit for feed
-Prioritize response



Challenges for Using Forecasts

(2) Decision System in Place

- Algorithms, Models / Simple Decision “mental model”?
- Individual? Group? Structure?
- Options for Decisions (e.g., Inputs? Credit?)
- When? Needed Lead time?

Who Makes Decisions?

- Ministry of Agriculture?
- Agri-business?
- Farmer / Adviser?

Decision System Sophistication and Impact

Include ENSO based Seasonal Forecast in the Electric Power System Simulator (SimSEE) to optimize the integrated power system in Uruguay (100% electricity is renewable).

2/3 of the years: significant net benefits

Maciel et al., Int. J. Climatol. (2015)



Decision System Sophistication and Impact

Include ENSO based Seasonal Forecast in the Electric Power System Simulator (SimSEE) to optimize the integrated power system in Uruguay (100% electricity is renewable).

2/3 of the years: significant net benefits

Maciel et al., Int. J. Climatol. (2015)

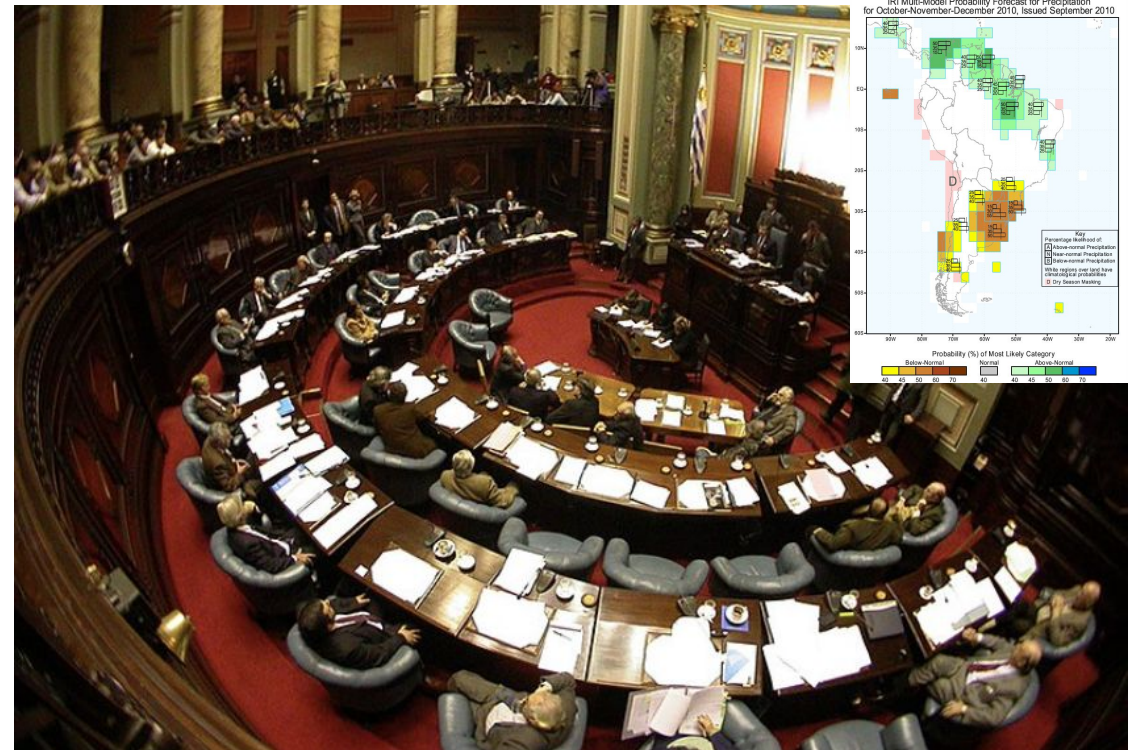


Minister of Agriculture in the Parliament during a Drought

“Need more funds, Drought is not Over”

Based on a Screen capture of **IRI Seasonal Forecast**

Simple info □ **Big Impact**



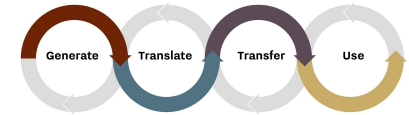


Produce and Make Available Climate Information
Very Useful but: Not Enough to Inform Decisions / Policies

No Decisions / Policies are based on “One Dimension”

- **Climate**
- **Prices and Costs**
- **Farm characteristics**
- **Policies in Place**
- **Personal / Cultural preferences**
- **Many possible others...**

Need to Integrate Information



Translate / Transfer / Use

Decision Support Systems (Extension / Advisers)



Provide Quantitative Information
to Farmers and Policy Makers to
Assess Risks, Inform Decisions



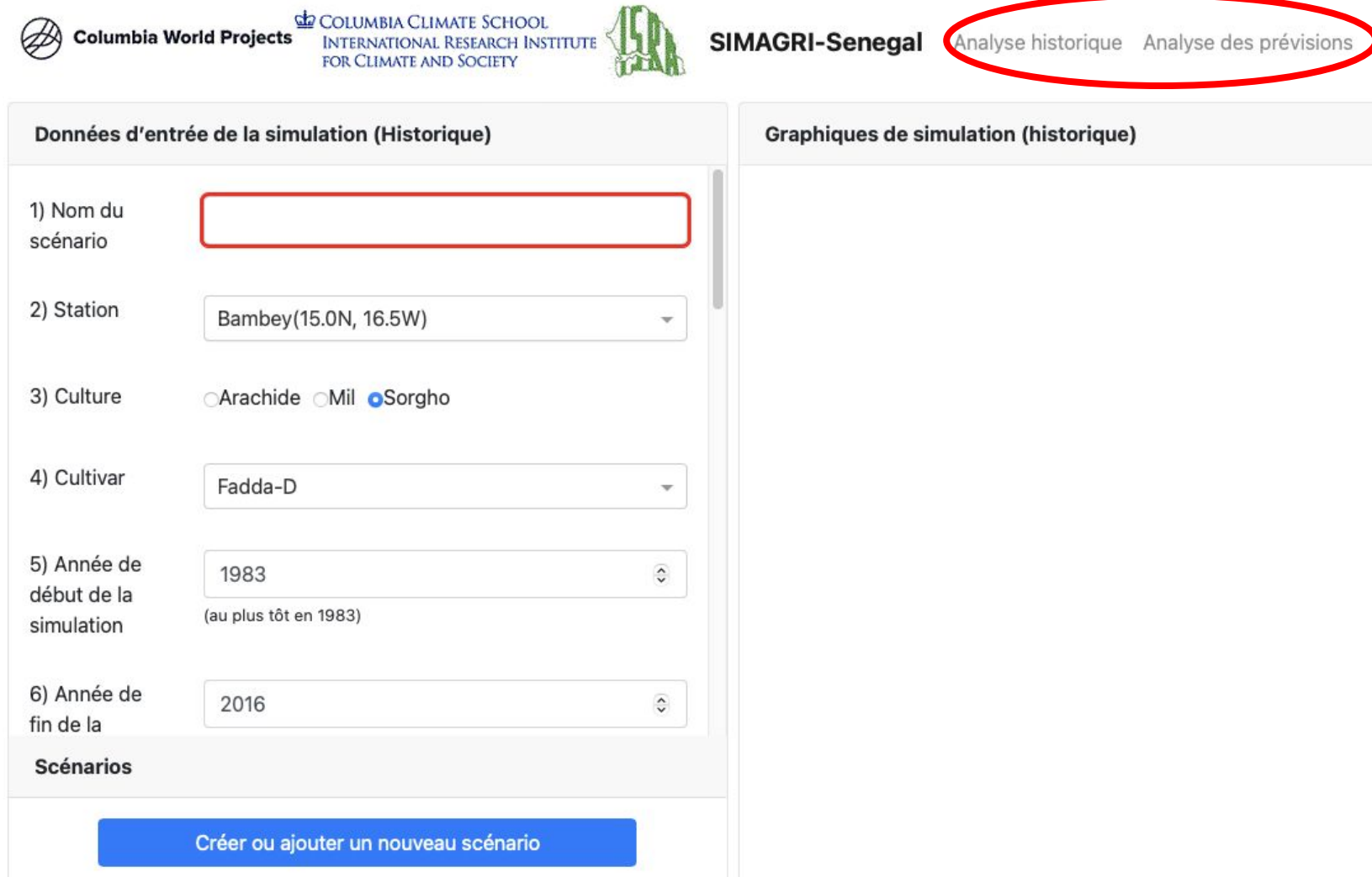
Use Crop Simulation Models

Problem:

- Not user friendly
- “Dangerous”

IRI’s Solution: “SIMAGRI”

- Easy to Use Interface
- Online



The screenshot displays the SIMAGRI-Senegal web interface. At the top, there are logos for Columbia World Projects, Columbia Climate School, and IRI. The main navigation bar includes "SIMAGRI-Senegal" and two menu items: "Analyse historique" and "Analyse des prévisions", with the latter circled in red. The interface is divided into two main sections: "Données d'entrée de la simulation (Historique)" and "Graphiques de simulation (historique)".

Données d'entrée de la simulation (Historique)

1) Nom du scénario:

2) Station: Bambey(15.0N, 16.5W)

3) Culture: Arachide Mil Sorgho

4) Cultivar: Fadda-D

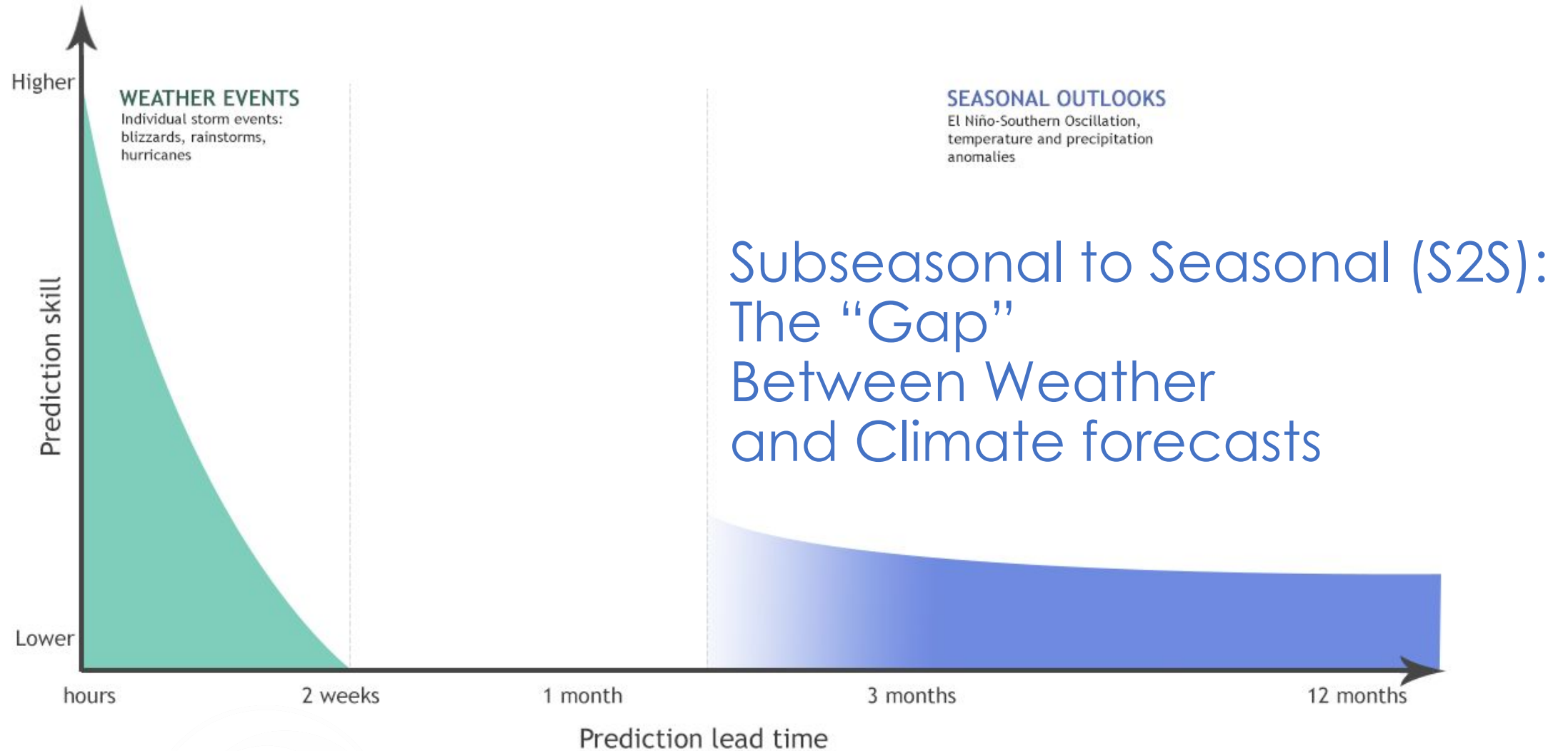
5) Année de début de la simulation: 1983 (au plus tôt en 1983)

6) Année de fin de la simulation: 2016

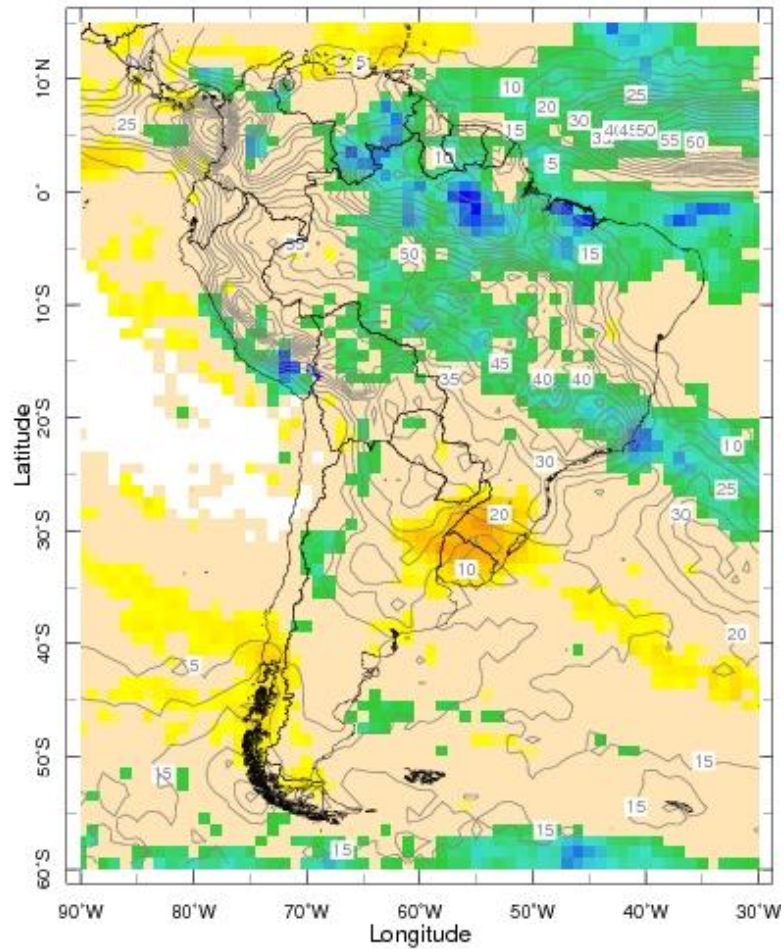
Scénarios

[Créer ou ajouter un nouveau scénario](#)

Informing Decisions with Weather & Climate Forecasts



Subseasonal Forecasts Complementing Seasonal



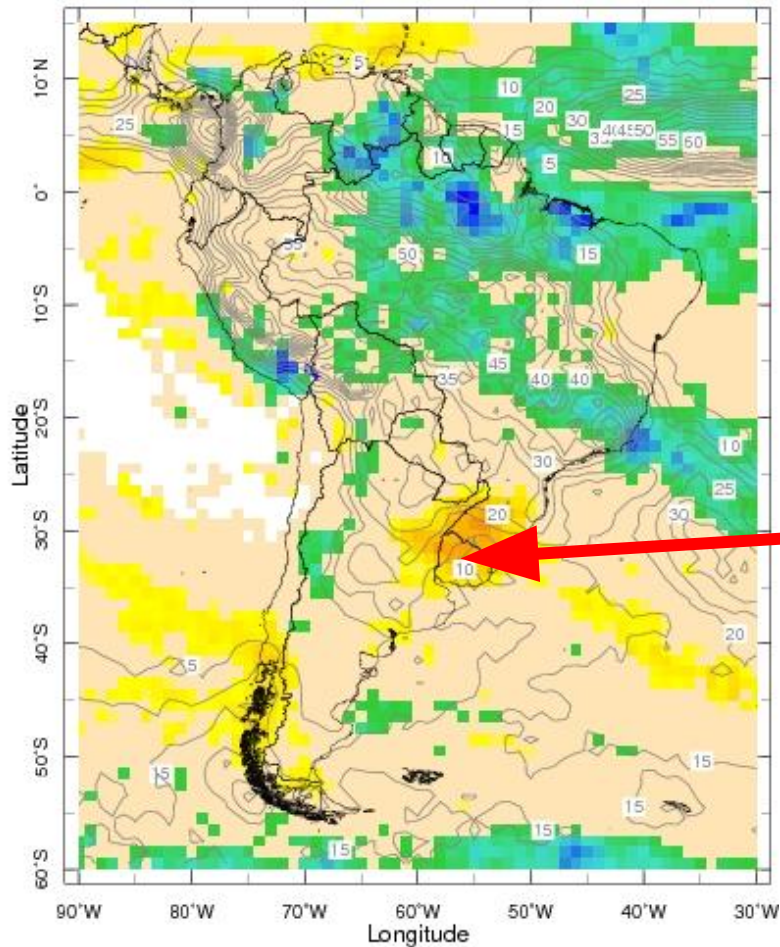
4-17 Dec 2021 Flexible SubX Precipitation forecast issued 26 Nov 2021



Probability of non-exceeding
(30th percentile)

Subseasonal Forecasts Complementing Seasonal

Forecast made for [57.5W-55W, 35S-32.5S] located in , CANELONES , Uruguay



4-17 Dec 2021 Flexible SubX Precipitation forecast issued 26 Nov 2021
 Probability of non-exceeding (30th percentile)

At Selected Point:

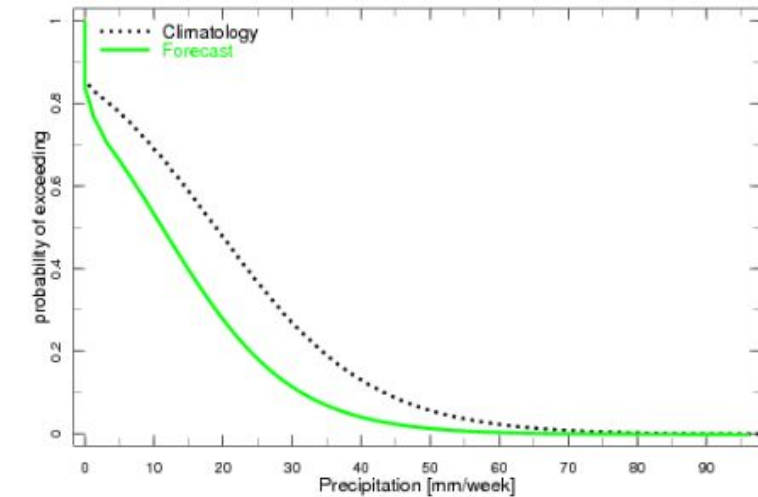
Rainfall Full Distribution For Weeks 3 and 4

- Forecast
- Climatology

Expectation:

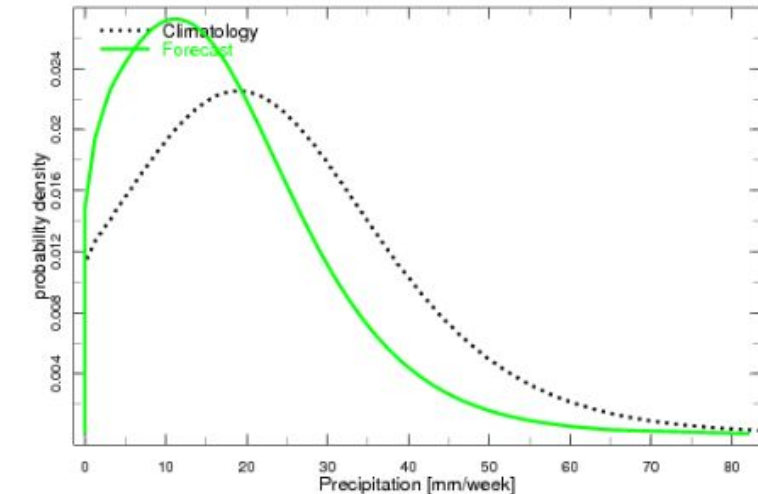
- Plan with Seasonal
- Adjust with Subseasonal

Probability of Exceedance



4-17 Dec 2021 Flexible SubX Precipitation forecast issued 26 Nov 2021

Probability Distribution



4-17 Dec 2021 Flexible SubX Precipitation forecast issued 26 Nov 2021

Subseasonal Forecasts

Subseasonal forecasts of precipitation and temperature.

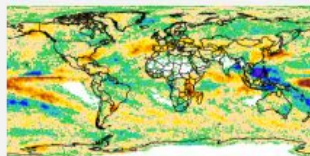
This section is dedicated to subseasonal forecasts, i.e. that bridge the gap between medium range weather forecasts (up to 10 days) and seasonal climate predictions (above a month). They are issued at different frequencies (from daily to once or twice a week) forecasting daily values with lead times from 1 to about 40 days, depending on the Global Producing Center (GPC). The availability of forecast products in the subseasonal-to-seasonal time range offers an unprecedented opportunity to develop intra-seasonal forecast information that other forecasts can't, in association with increased lead time compared to medium range weather forecasts, and with higher temporal resolution than seasonal forecasts that give an overview of an upcoming

SubX Forecasts SubX Hindcast Skill S2S Lagged Forecasts

SubX Forecasts

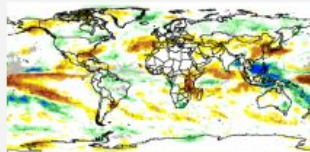
Precipitation Median Probability Forecast

Calibrated Subseasonal Two-category precipitation real-time forecasts

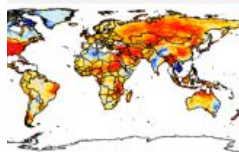


Precipitation Biweekly Probability Forecast

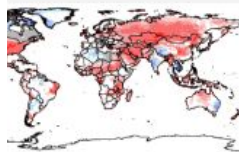
Calibrated Subseasonal tercile category biweekly-precipitation forecasts



Temperature Median Probability Forecast

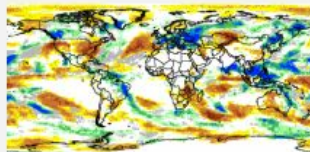


Temperature Biweekly Probability Forecast



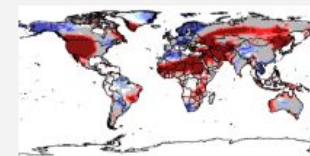
Precipitation Weekly Probability Forecast

Calibrated Subseasonal Tercile categories precipitation real-time forecasts



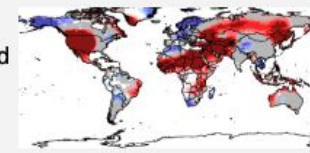
Temperature Weekly Probability Forecast

Calibrated subseasonal tercile categories temperature forecasts



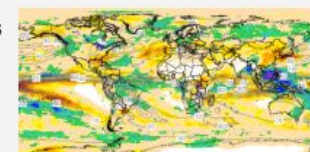
Temperature Weekly Probability Forecast (LELR)

Subseasonal tercile categories temperature forecasts with pattern-based calibration



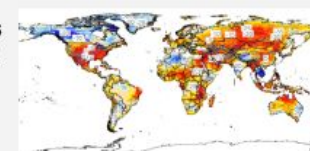
Precipitation Flexible Biweekly Forecast

This subseasonal forecasting system consists of probabilistic precipitation forecasts based on the full estimate of the probability distribution.



Temperature Flexible Biweekly Forecast

This subseasonal forecasting system consists of probabilistic temperature forecasts based on the full estimate of the probability distribution.



For instance, subseasonal

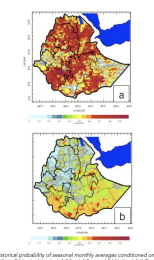
forecasts may allow delivering relevant information about key climate characteristics such as the timing of the onset of a rainy season for agriculture, the risk of extreme rainfall events or heat waves in regards to public health.

Early Warning / Early Action Informed with Climate

Learn from the Past

The ENACTS Advantage

- Availability**
 - Blended data to overcome observational gaps
 - Result: Over 30 years of high-resolution rainfall and temperature data now available, enabling climate analysis from community to national levels.
- Access**
 - Online Maprooms
 - Result: User-friendly tools for the analysis, visualization and downloading of climate information.
- Built capacity and empowerment**
 - Empowered stakeholders with increased capacity
 - Result: Strengthened policy analysis, relevant for multiple sectors.

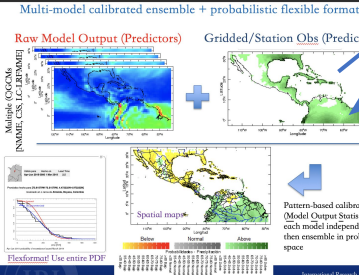


Historical probability of seasonal monthly averages conditional on El Niño. El Niño is considered for all the model high-resolution data.

Forecast Future

Multi-model calibrated ensemble + probabilistic flexible format

Raw Model Output (Predictors) + Gridded/Station Obs (Predictand)



Spatial map

Pattern-based calibration (Model Output Statistics), each model independently, then ensemble in probability space

Download! Use online PDF

International Research Institute for Climate and Society

GOBIERNO DE GUATEMALA | SECRETARÍA DE SEGURIDAD ALIMENTARIA Y NUTRICIONAL | SECRETARÍA DE LA ECONOMÍA Y DESARROLLO | Columbia World Projects Datos | Desarrollo

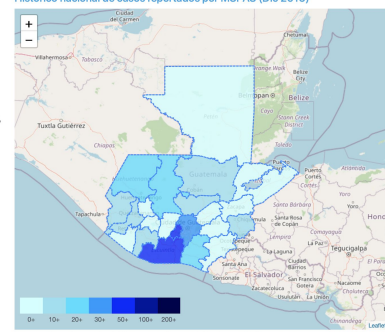
Modelo de Pronóstico Para la Desnutrición Aguda

El Instituto Internacional de Investigación para el Clima y la Sociedad (IIRI) por sus siglas en inglés, a través del proyecto ACToday, ha trabajado con distintas instituciones en Guatemala para apoyar al país en alcanzar el Objetivo de Desarrollo Sostenible número 2. Junto con la Secretaría de Seguridad Alimentaria y Nutrición de Guatemala (SESAN), ambas instituciones han trabajado conjuntamente para desarrollar una herramienta que permita obtener de forma automatizada, un pronóstico probabilístico del número del número de casos de desnutrición aguda infantil en función de una combinación de pronósticos de precipitación a escala estacional (próximos 3-6 meses) y sub-estacional (1 a 6 semanas). Este modelo probabilístico, se nutre de un nuevo sistema de generación de pronósticos (NextGen) desarrollado por el IIRI.

Más sobre NextGen

DESNUTRICIÓN AGUDA EN NIÑOS MENORES DE 5 AÑOS

Histórico nacional de casos reportados por MSPAS (Dic 2016)



Fuente: Situación epidemiológica de la Desnutrición Aguda (DA) moderada y severa en niños menores de 5 años.

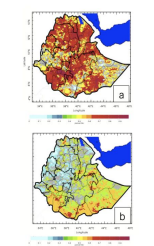
Early Warning on Child Undernutrition (Guatemala)

Early Warning / Early Action Informed with Climate

Learn from the Past

The ENACTS Advantage

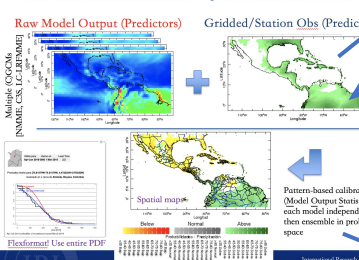
- Availability**
 - Blended data to overcome observational gaps
 - Result: Over 30 years of high-resolution rainfall and temperature data now available, enabling climate analysis from community to national levels.
- Access**
 - Online Maprooms
 - Result: User-friendly tools for the analysis, visualization and downloading of climate information.
- Built capacity and empowerment**
 - Empowered stakeholders with increased capacity
 - Result: Strengthened policy analysis, relevant for multiple sectors.



Forecast Future

Multi-model calibrated ensemble + probabilistic flexible format

Raw Model Output (Predictors) + Gridded/Station Obs (Predictand)



Spatial map

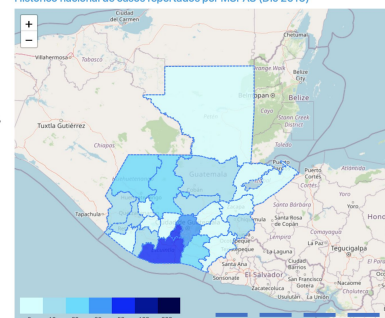
Pattern-based calibration (Model Output Statistics), each model independently, then ensemble in probability space

Transform! Use online PDF

Modelo de Pronóstico Para la Desnutrición Aguda

El Instituto Internacional de Investigación para el Clima y la Sociedad (IIRI) por sus siglas en inglés, a través del proyecto ACToday, ha trabajado con distintas instituciones en Guatemala para apoyar al país en alcanzar el Objetivo de Desarrollo Sostenible número 2. Junto con la Secretaría de Seguridad Alimentaria y Nutrición de Guatemala (SESAN), ambas instituciones han trabajado conjuntamente para desarrollar una herramienta que permita obtener de forma automatizada, un pronóstico probabilístico del número del número de casos de desnutrición aguda infantil en función de una combinación de pronósticos de precipitación a escala estacional (próximos 3-6 meses) y sub-estacional (1 a 6 semanas). Este modelo probabilístico, se nutre de un nuevo sistema de generación de pronósticos (NextGen) desarrollado por el IIRI.

DESNUTRICIÓN AGUDA EN NIÑOS MENORES DE 5 AÑOS
Histórico nacional de casos reportados por MSPAS (Dic 2016)



Más sobre NextGen

Open: <https://worldprojects.columbia.edu/> in a new tab

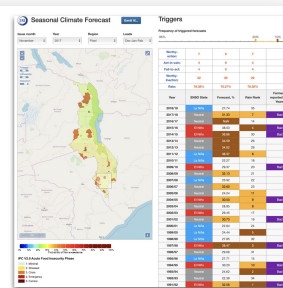
Fuente: Situación epidemiológica de la Desnutrición Aguda (DA) moderada y severa en niños menores de 5 años.

Early Warning on Child Undernutrition (Guatemala)

ACToday is working with WFP, INSIVUMEH (NMS) and other partners in Guatemala to use the recently implemented #NextGen for a drought FbF in the Dry Corridor.

Xandre and Rémi are helping us to develop a "trigger maproom" like this one developed by FIST.

Clear potential to scale up, similar to other work is already happening using ELR.



"Triggers" for Action: Financing based on Forecasts (FbF) (Niger)

Potential to Adjust with Subseasonal Forecasts



Actions based on Forecasts (FBA)

Final Comments

- Demand Driven, Problem Driven, Understand the System
- Participatory, “Next Users”, Intermediaries
- Forecasts, but also Historical Analyses and Monitoring
- Translate and Integrate to make it Understandable and Actionable
- Expectations on Subseasonal

Thank You

Walter E. Baethgen



International Research Institute
for Climate and Society
EARTH INSTITUTE | COLUMBIA UNIVERSITY

