WCRP Conference for
Latin America and the Caribbean:
Developing,linking and applying climate knowledge

Climate Knowledge to Assist Decisions and Planning in the Agricultural Sector

The International Research Institute for Climate and Society

Walter E. Baethgen
Head, Regional and Sectorial Research Program
Leader, Latin America / Caribbean
IRI, The Earth Institute at Columbia University

Climate Services Partnership

http://www.climate-services.org/

"Climate services involve the Production, Translation, Transfer, and Use of Climate Knowledge and Information in climate-informed decision making and climate-smart policy and planning."

1. **Production, Translation, Transfer, and Use**
2. **Climate Knowledge and Information**
3. **Climate-informed decision making, policy and planning**

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Climate Services: (1) Production, Translation, Transfer, and Use

Example of a Medical Service

Problem: Patient with Headache (+ other symptoms)
Doctor's recommendation: Take CAT Scan

- Fundamental **research** on X-Rays (didn't think/didn't care about applications)
  - Basic **research** on Digital Geometric Processing (didn't think/didn't care about applications)
    - Applied **research** that connected images with edemas, etc. (thought about applications)
      - Technician: CAT scanner operator (Operational)
        - Doctor / Neurologist
          - **Patient**

All links are needed (eliminate one and the chain falls)

Each one can give information to the Patient (end user) based on their knowledge and experiences

Only one can give the Patient "ACTIONABLE" information

The patient still decides What to do (maybe nothing)

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Actions / Interventions Needed to Improve the Service

Fundamental **research** on X-Rays (didn't think/didn't care about applications)

Basic **research** on Digital Geometric Processing (didn't think/didn't care about applications)

Applied **research** that connected images with edemas, etc. (thought about applications)

Technician: CAT scanner operator (Operational)

Doctor / Neurologist

Patient

Environment to Enable Production, Communication, Learning in the Research Community (funding, literature, congresses, training)

Training to ensure good Operation (Understand enough science, training in actual operation)

- Training in Interpreting CAT
- Research and Training in COMMUNICATING RESULTS to trigger action

Education on General Health and on Using the Information (why should he/she change?)

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Climate Services

1. Production, Translation, Transfer, and Use of

Climate Knowledge

(Future but also Past and Present)

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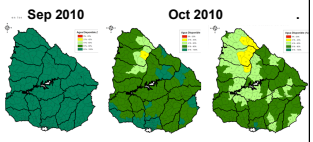
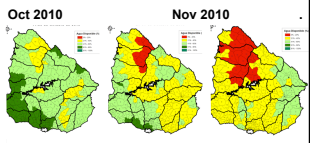
Monitoring the Present: Drought in Uruguay 2010 / 2011

Monitoring "Translated Climate"
(Soil Water Balance) by County

INIA GRAS - IRI
Provided this Information
to Ministry of Agriculture
(Evolution of the Drought)

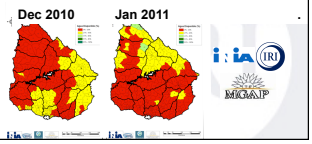


December 2010:
- Official Declaration of Emergency based on this Information
- Implemented financial tools
- Established Objective Priority for Aid



Early Warning / Early Response

Parliament: "Drought may not be over"
Opening: IRI Seasonal Forecast



SNIA 2013: MGAP-World Bank Project

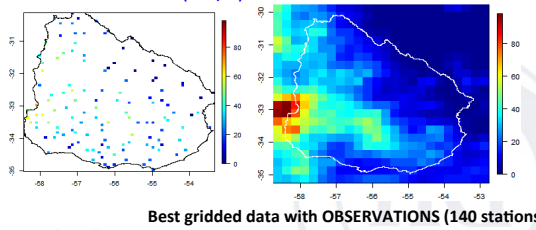
Past: Much can be learned from understanding past Climate characteristics
Risks? Decadal Variability? Frequency / Intensity of Droughts? Interventions?

But: Lack of long-term records with adequate coverage in developing countries

IRI's Work (T. Dinku)

Weather Stations + **Satellite Estimate Interpolation** + **Combined product** (X years of daily data)

SNIA: INUMET + UdelaR + IRI (2013/14)



Best gridded data with OBSERVATIONS (140 stations)
Nothing beats a good Observation Network

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Interaction with Stakeholders:
Expand from Seasonal to also longer term Climate Change

Planning, Decision Making, Policy Making

Adaptation to What?
What Can We Expect?

What Mitigation options are likely to succeed?
(REDD+, NAMAs, CDM)

Information on Future Climate

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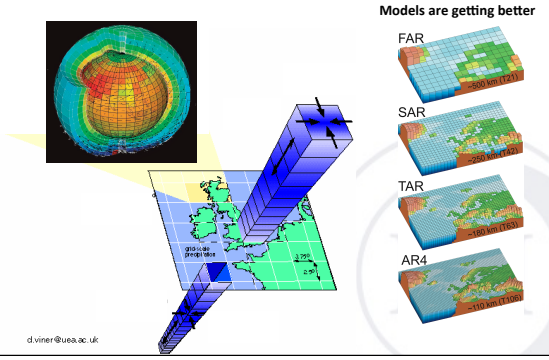
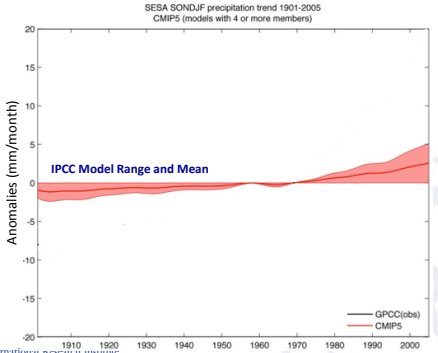
Future Climate Scenarios: Climate Models (GCMs)

Complex models that simulate physical processes in the atmosphere, oceans and land



Climate Models: Simulating Past Observed Climate
Example: SE South America SONDJF



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Paula Gonzalez, IRI

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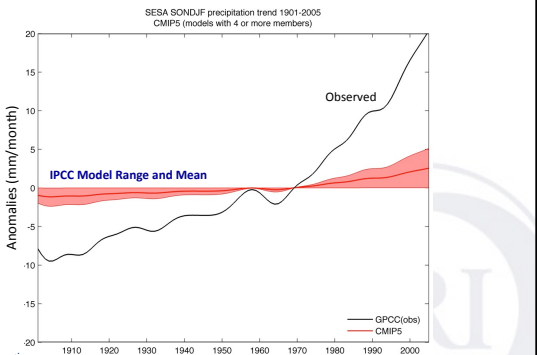

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Future Climate Scenarios: Using Climate Models (GCMs)

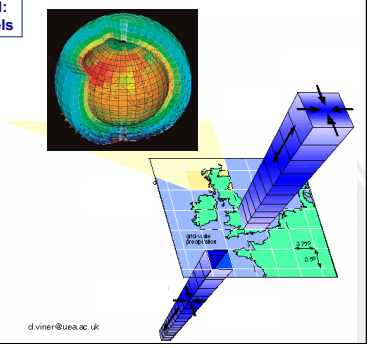
1. **Great advances in science, but still lots to understand: Uncertainties due to Models**

2. **Key Input: GHG Emissions**

Assumptions:
(e.g., in 2080-2100)

Technologies?
Energy Sources?
Deforestation rates?
Population?

Uncertainties
(IPCC Scenarios)



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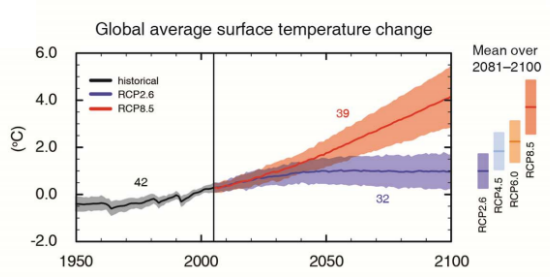
d.viner@uea.ac.uk

Expected Global Temperature For Different Possible Socioeconomic Scenarios
(Reference: 1986 – 2005)



Source: IPCC, 2013 (Draft)

Uncertainty is huge!

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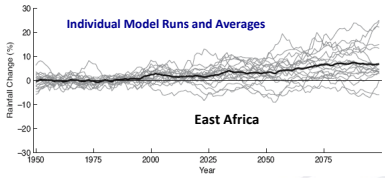
For Precipitation Uncertainties are Much Larger

Example in East Africa: 90% of the Climate Models agree it will become wetter



+25%

-10%

All scenarios have equal chances

This is for large "Windows"
At Local level Uncertainties are much larger

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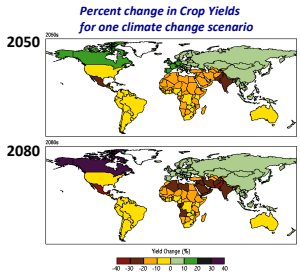
Giannini et al., 2007

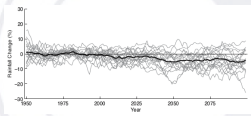
Conclusion: Climate Change Scenarios are Uncertain
IPCC's objective was not to create scenarios for impact assessment

However: Published articles with Crop Yield Projections *(equivalent to Simon's rainfall for 24 April 2015)*

Percent change in Crop Yields for one climate change scenario



This is Wrong!
EXTRA PROBLEM:
This is easily understood
Can be "erroneously" believed
Maladaptation / "Malmitigation"



Uncertainty?

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Need a new Paradigm

(Rafael Terra, 2014, in prep)

Current Paradigm: Noah's Ark

Perfect Information about the Future: a Climatic Cataclism is coming

Action: Build infrastructure and save Biodiversity

But: We do not have (will not have) Perfect Information of the Future Climate

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Paradigm 2: Ginkgo biloba

2 million years of Evolution

Adapted to a wide range of conditions

Unexpected extreme event (A-bomb)

Somehow 6 Ginkgos Survived

Paradigm: Adapt with "flexibility"

- **We will not have "perfect" information**
- **Adapt to a range of plausible conditions**
- **Start by Adapting to today's conditions**

Ginkgo biloba
(2,000,000 year old species)

Approx 1,000m from epicenter in Hiroshima

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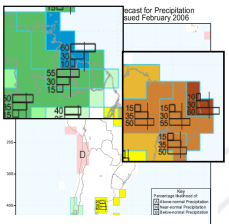
Walter E. Baethgen, Shukkeien, Ginkgo

(Rafael Terra, 2014, in prep)

Seasonal Climate Forecasts



White areas in the map

Above	33	Vs.	10	60
Normal	33		30	30
Below	33		60	10

Probability of Next Season being

"Wetter"
"Drier"

Than "NORMAL"

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Actually, we are much better than before

- Probability of Average Year = 0 (still some decisions based on "Average Year")
- Probability of 2 "Normal" seasons is ≈10% (0.33 x 0.33), 90% of "not normal"
- Much Better than nothing

Uncertainties

Decisions are made under Uncertainty (Energy, Agro, Disasters)
How are uncertainties considered in the decisions?

Understand how it is done, hopefully assist to improve

Communicate the right Expectation (much better than nothing)

It may help to use examples from other activities

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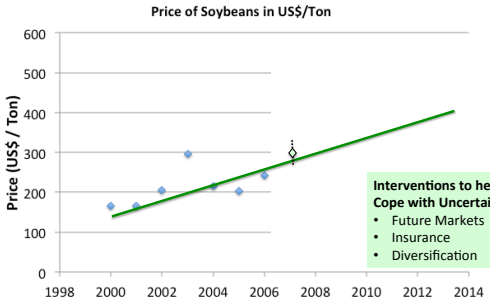
An Example of Crop Prices



Interventions to help Cope with Uncertainties

- Future Markets
- Insurance
- Diversification

Model: Prices = f(China, India, Stocks, Brazil, USA, ...)

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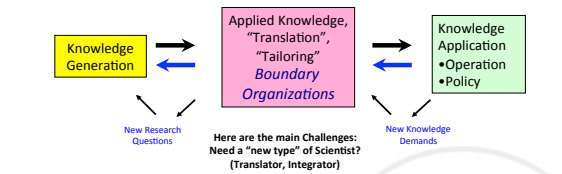
Climate Services: Generation, Translation, Transfer, and Use of Climate Knowledge

Information Chains, Networks



Take Advantage, Understand constraints, etc of Existing Information Networks: "Simplified" Example in Agriculture

Skipping Links is usually a bad idea
(very healthy exercise for learning)

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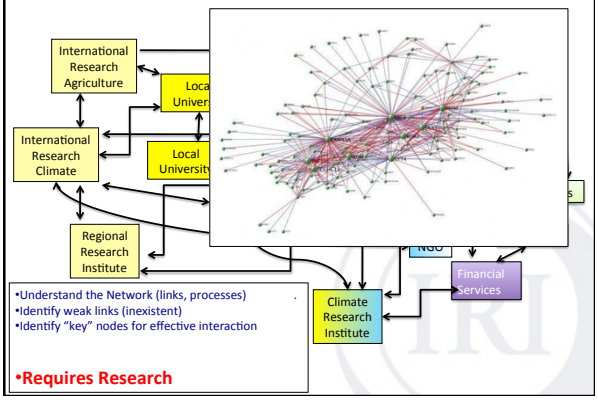
Interaction with Stakeholders: Information Networks

(Very) Simplified Example in Agriculture



•Understand the Network (links, processes)
•Identify weak links (inexistent)
•Identify "key" nodes for effective interaction

•Requires Research

Interaction with Stakeholders, Information Networks

Do we understand the Network? Are we skipping links?
Are we aware of the key links in the Network?
Are we asking the "right" questions?

E.g., What climate variables do you need? What Format?
What temporal scale / spatial resolution?
When do you need it most?

Vs. What problems / challenges are you facing for which climate knowledge may help?

How do you handle Uncertainties in your decisions?

This needs GOOD ROBUST RESEARCH
Cecilia, Guillermo, Diana, IAI, CRED's work
Cathy, Gabriela, Clara's work

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Climate Services: Generation, Translation, Transfer, and Use of Climate Knowledge

Gap between Science and Applications / Society

1. Decision-makers approach problems holistically and often intuitively
2. Science traditional reductionist approach:
   Create 'islands of knowledge in a sea of ignorance'

The Maldives: Venue for next WCRP LAC meeting?

Need Tools/Approaches to Integrate Knowledge (Decision Support Systems)

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(Meinke et al., 2007; 2009)

URUGUAY: SNIA = **Integrated** Climate Risk Management Approach and Tools

(Applied Systems Analysis Approach)

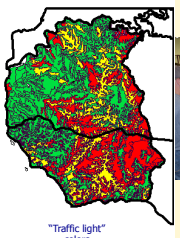
Information and DECISION SUPPORT SYSTEMS

URUGUAY: SNIA = **Integrated** Climate Risk Management Approach and Tools

(Applied Systems Analysis Approach)

Information and DISCUSSION SUPPORT SYSTEMS

CLIMATE INFORMATION
REMOTE SENSING
PRICES
EXISTING DATABASES
INFRASTRUCTURE
SIMULATION MODELS
GIS



"Traffic light" colors

Discussion Support
Decision Support

- Climate Variability Increases
- Policies / Regulations change
- Given a Seasonal Forecast

Similar to Playing Games

Different Spatial Resolutions: Region → Country → Provinces → Farm

Different Temporal Resolutions: Seasons → Decades → Climate Change

Easily Understandable / **Actionable**: Inform Decisions, Planning

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(IRI's Maprooms, Work in Chile, SNIA)

Final Comments

1. Production, Translation, Transfer, and Use

- Do we understand the Knowledge Network for the Climate Services?
- Where are we (our institutions) in the Climate Services Network / Chain?
- Are we asking the right questions? Are we interacting with the right links?

2. Climate Knowledge and Information

- Decentralize focus in Future Climate (Seasons or Decades): Also Past and Present
- If Climate Change Scenarios are Requested, Include the Right UNCERTAINTIES
- Adaptation: Paradigm shift → Noah's Ark to Gingko biloba (Predictive to Flexible)

3. Climate-informed decision making, policy and planning

- Integrate Climate Knowledge with other Relevant Knowledge (connect islands)
- Innovate in Communication/Interaction: Games, Discussion/Decision SS
- Research in Decisions, Communication, Interaction with different links

Thank you
Gracias
Obrigado
La Paloma, Uruguay, 2014