



World Meteorological Organization

Working together in weather, climate and water

Agricultural Risk Management and Forecasting

Robert Stefanski

Agricultural Meteorology Division

Climate Prediction and Adaptation Branch

Climate and Water Department



World Meteorological Organization

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Agricultural Risk Management (GEOSS Task AG0702)



Outline

- **Agricultural Risk Management**
- **Agricultural Forecasting**
- **Climate Prediction and Agriculture**
- **Summary**



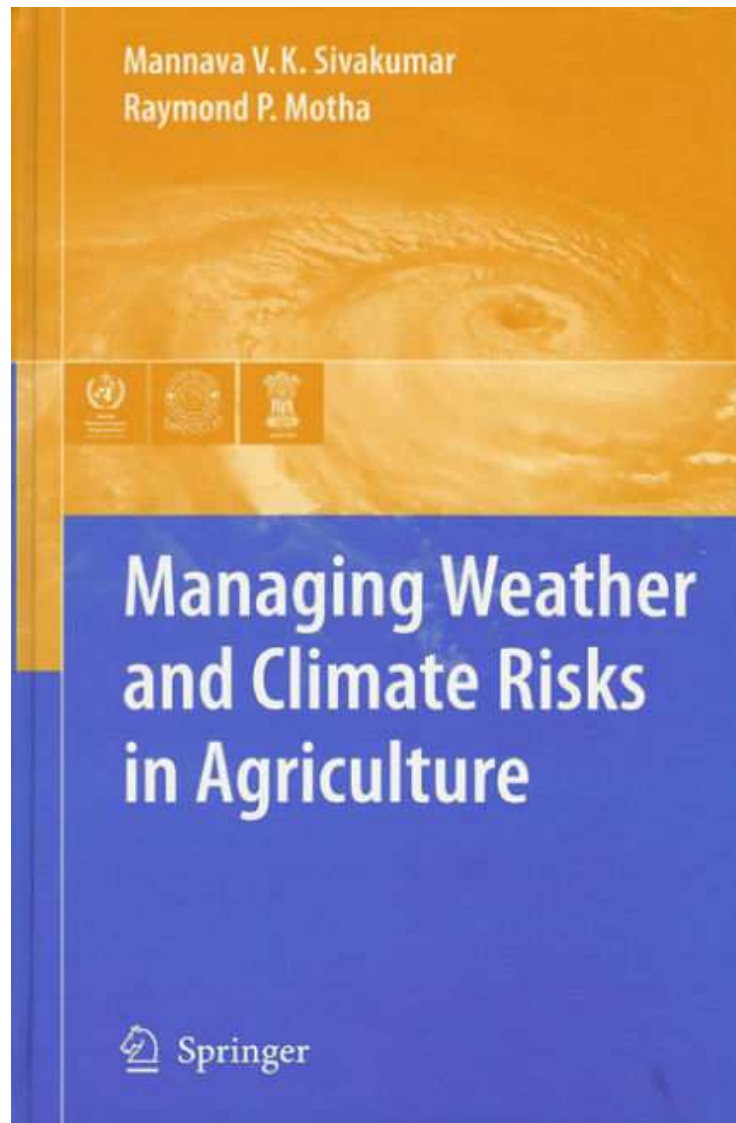
GOESS Task AG0702

- **Dr Sivakumar (WMO) started as Task Leader**
- **Robert Stefanski (WMO) replaced him Jan 2009**

- **First meeting of Task members (China Feb 2009)**

- **Take advantage of expertise and input from WMO Commission for Agricultural Meteorology (International Workshops, Expert Team Meetings, etc)**

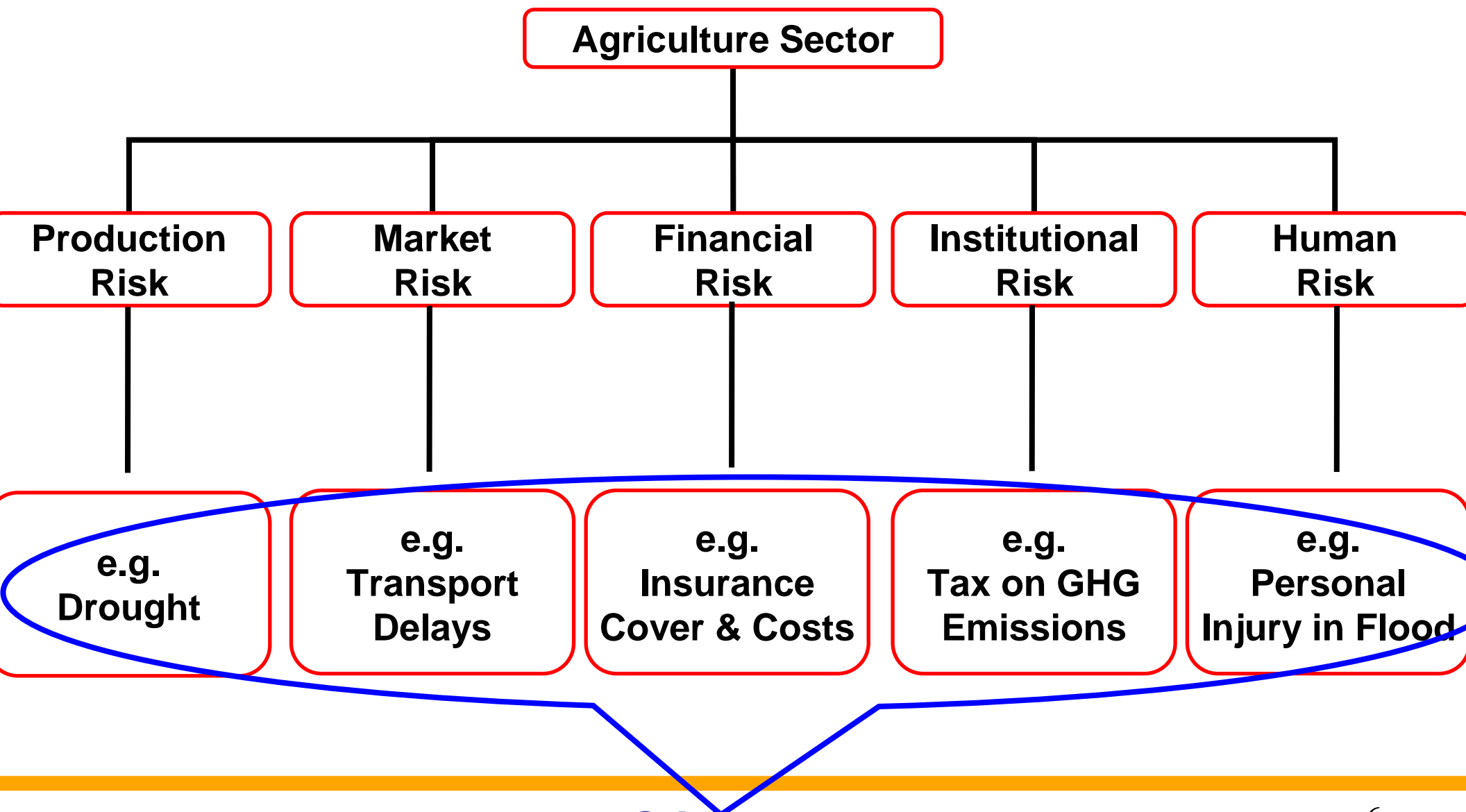
Summary of WMO Risk Workshop



**International Workshop on
Agricultural Risk Management:
Opportunities and Challenges New
Delhi, India October 2006**
(188 participants from 78 countries)

**In Conjunction with 14th Session of the
WMO Commission for Agricultural
Meteorology (CAgM)**

Risk in the Agriculture Sector

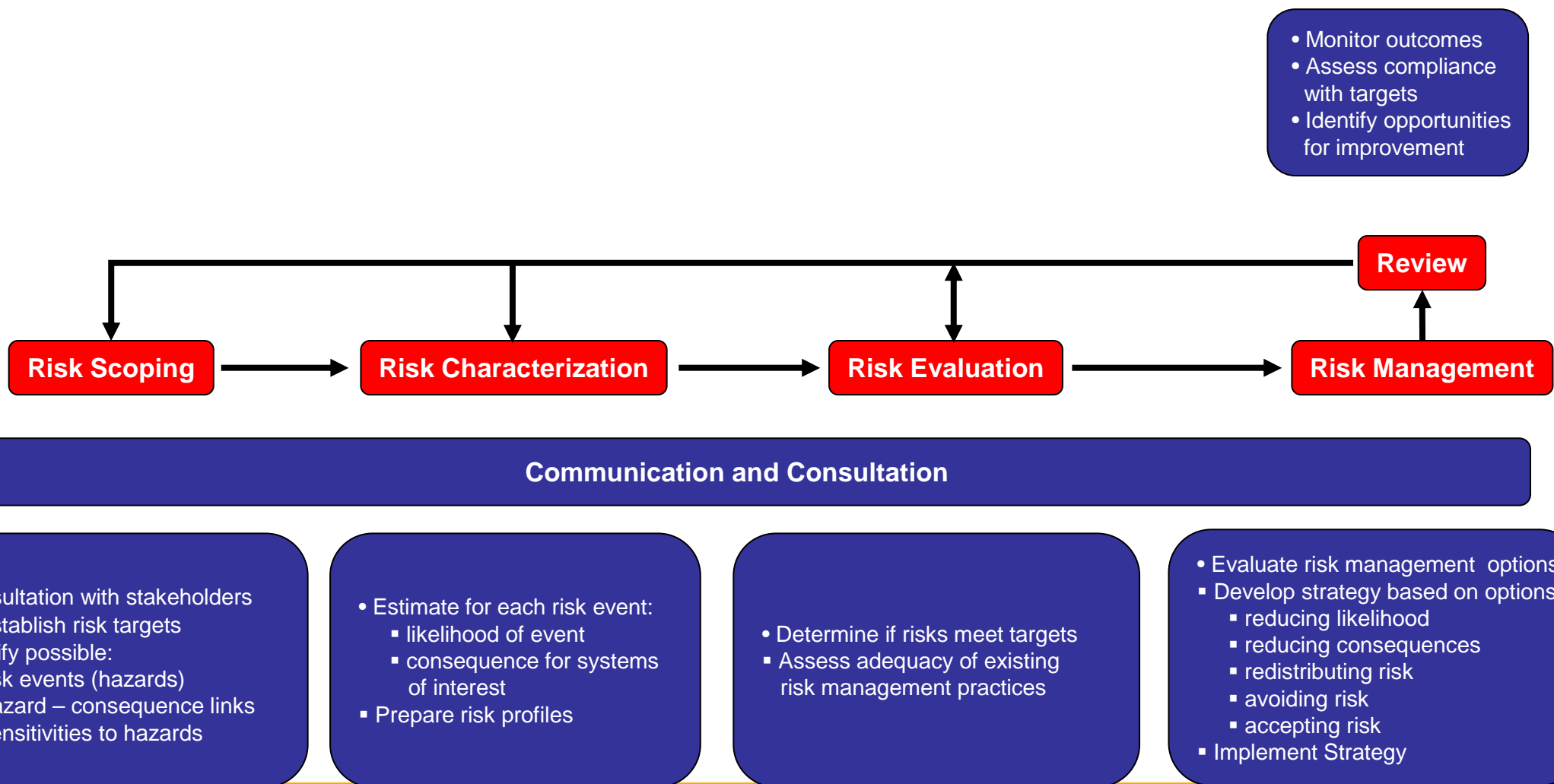




Why a Risk-based Approach?

- Recent, major advances in:
 - Short-term and seasonal weather predictions
 - Climate modelling
- Improvement in early warnings, seasonal weather forecasts and longer-term projections
- Increased emphasis on proactive approaches to managing adverse consequences
- Increased diversity of management options
- Increased need for decision-making guidance
- Direct functional link between assessing hazards and selecting best management options

Characterizing and Managing Risk

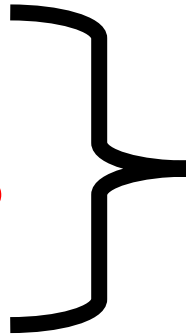


Risk management strategies....

- Avoid dangers
- Prevent/reduce the frequency of impacts
- Control/reduce consequences (adaptation measures)
- Transfer the risk (e.g. insurance)
- Respond appropriately to incidents/accidents (e.g. disaster management)
- Recover or rehabilitate asap (e.g. media response)

Themes from Risk Workshop

- Risk management
- Risk management tools
- Research needs
- Policy issues ???
- Emphasis on user needs
- Communication
- Marketing



**Focus of GEO
Workshop**



Risk Management

- Develop a **pro-active risk-based management approach** to deal with the adverse consequences of weather extremes and climate anomalies
- Emphasize **preparedness planning and improved early warning systems** to lessen societal vulnerability to weather and climate risks.
- Provide accurate, timely, consistent, and widely-available information to optimize decisions relative to the risks and uncertainties within the global agricultural production and distribution system.

Risk Management Tools

- **Decision-support systems** as risk management tools should be promoted as an effective means of providing output of integrated climate-agronomic information as scenario analyses
- For medium and low input systems in the developing countries, **crop or agro-ecosystem modeling** be used to guide general decision-making on a higher institutional or farm advising level.
- Current and future trends of **simulation model outputs** be analysed for sensitivity to climatic hazards of different agricultural systems. Possible use in crop protection methods, irrigation programs, cultivation techniques, harvesting, storage and commercialisation strategies can be evaluated in conjunction with economic aspects.

Risk Management Tools

- Risk assessment and risk management models supporting coping strategies for **integrated pest management** could be used in a prototype conceptual framework that can be utilized in other agricultural-related risk approaches.
- **Statistical forecasting tools** to link observed weather data to crop yields in major crop-producing regions should be developed
- **Emergency response system (ERS)** based on advanced Information Technology (IT) such as information network, simulation models, tools for GIS and remote sensing could be developed to address agricultural hazards and early warning.
- **Climatic risk zoning** could be used for quantifying climate-plant relationships and the risk of meteorological extremes in agricultural financing programs



Research Needs

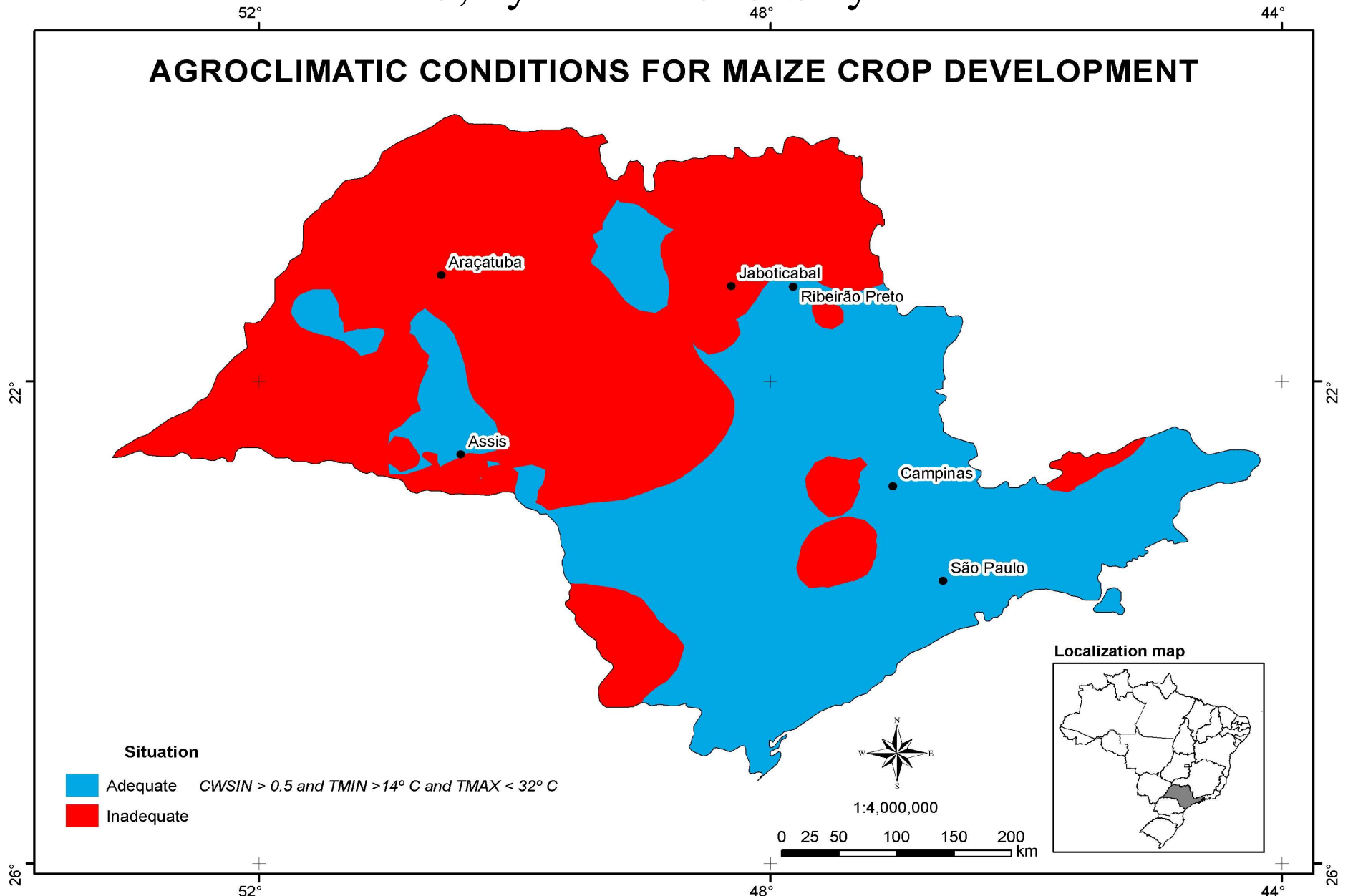
- Blend **new scientific-based weather/climate forecast services** with local indigenous knowledge may help farmers improve yields and cope with risks.
- Need for the **development of standards, protocols, and procedures** for the international exchange of data, bulletins, and alerts for agricultural hazards.
- Application of **seasonal forecasts** for crop management strategies, risk management planning, and national policy implications as these outlooks become more accurate
- Developing methods for **screening satellite imagery** to identify crop-specific impacts of weather in crop regions
- **Integrated climate-crop modeling systems** need to be developed at the appropriate farm or regional scale suitable for the decision-makers needs.



Policy issues

- Rural areas need to gain access to **support mechanisms** in terms of technical expertise or technological innovations (credit or crop insurance)
- **Drought contingency planning, drought preparedness, and drought impact assistance** policies need to be considered under long-term climate change.
- **Public-private partnership models** need to be further explored in order to 'mainstream' drought risk management.
- Promote concept of a **drought mitigation and monitoring center**.
- A **scientific desertification monitoring and evaluation system** should be established.
- Measures to **combat desertification** must be vigorously pursued.

Average conditions of water stress on the maize crop in the State of São Paulo with overlapping of the areas with minimum air temperature below 14°C , by the ARC-GIS system.



The National Agricultural Monitoring System:

- Publicly available climatic, production, and commodity information for agricultural industries at national, state/territory, and regional scales – online and at your fingertips.
- User-friendly and easy to read maps and graphs available for local regions throughout Australia.
- Reports can be generated for a range of purposes, including seasonal conditions, regional profiles, and drought assessments.
- Designed to streamline the application and assessment processes for Exceptional Circumstances (drought assistance), initially for dryland/broadacre industries.



www.nams.gov.au

The NAMS is a collaborative project between Australian, State, and Territory governments

Bureau of Meteorology



Bureau of Rural Sciences



Department of Primary Industries, New South Wales



Snowy Hydro Limited



Australian Bureau of Agricultural and Resource Economics (ABARE)



Department of Agriculture and Food, Western Australia



Goulburn-Murray Water



Queensland Department of Primary Industries and Fisheries



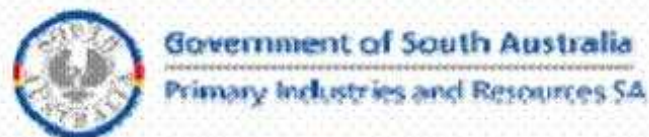
New South Wales Department of Water and Energy



Meat and Livestock Australia



Department of Primary Industries and Resources SA



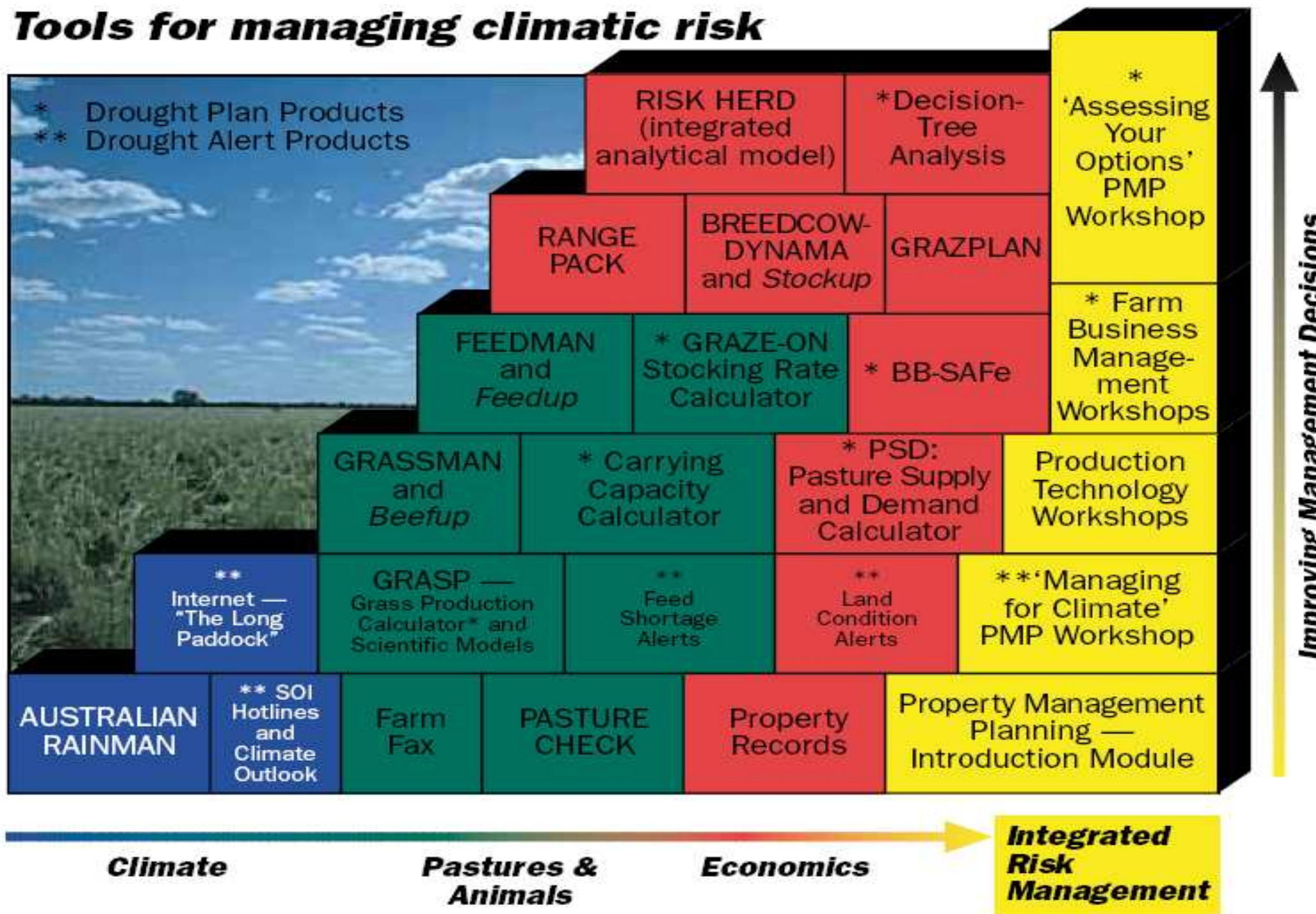
Department of Primary Industries, Victoria, Australia



Murray-Darling Basin Authority



Tools for managing climatic risk



Agricultural Forecasting



Agricultural Forecasting

- **Integrates crop growth process (development, reproduction, maturity), weather, soil, management practices to estimate crop yield and crop quality**
- **Statistical: regression of historical crop yield vs weather (rainfall, temperature)**
- **Crop simulation models include:**
 - **Soil information**
 - **Crop variety characteristics**
 - **Management practices**
 - **Disease and pest interactions**
 - **Remotely sensed information (Leaf Area Index – LAI), crop stress, crop phenology, etc**



Crop Models

- **FAO Agromet Shell (AMS)**
- **DSSAT - Decision Support System for Agrotechnology Transfer**
- **APSIM**
- **WOFOST**
- **CropSyst**

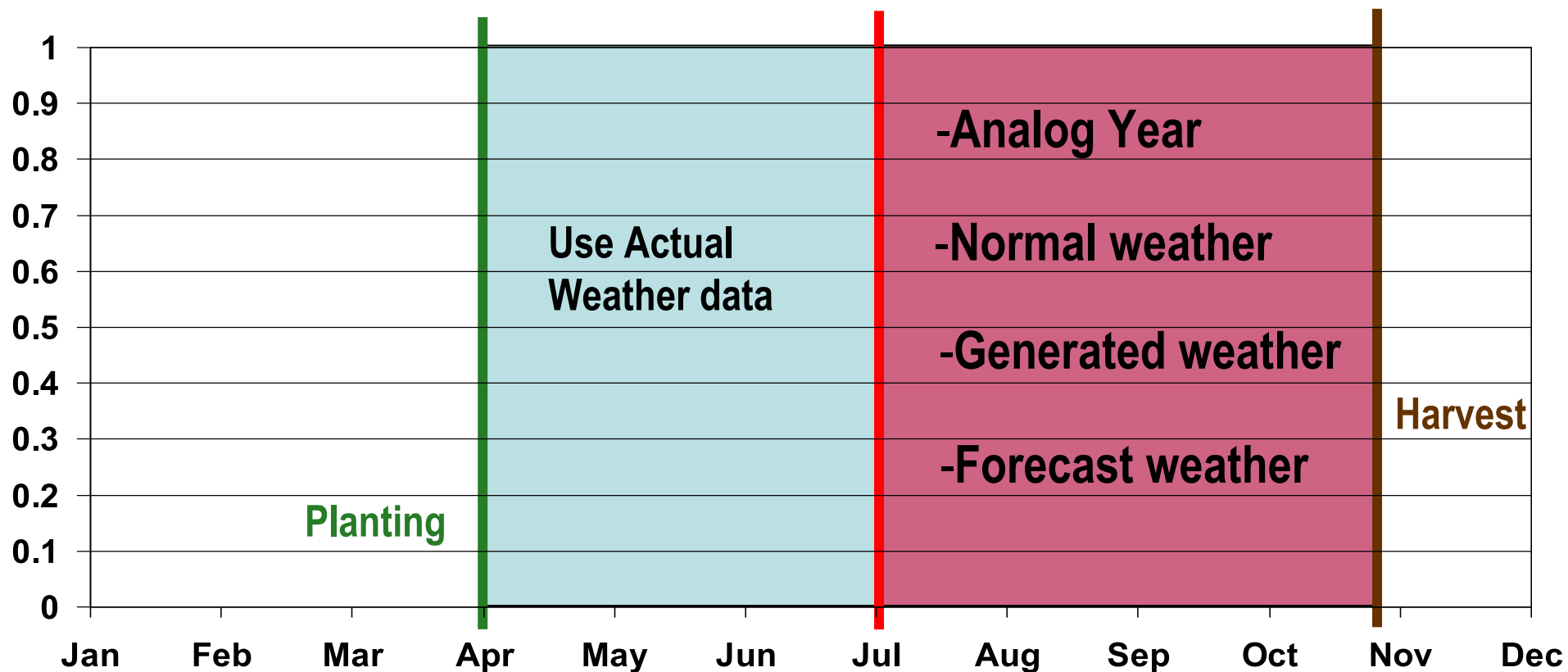


Data Requirement FAO AMS

- **Weather**
 - Actual Rainfall
 - Normal Rainfall
 - Actual Evapotranspiration data (temp. wind etc..)
 - Normal Evapotranspiration data
- **Crop data**
 - Which crops
 - Planting date
 - Cycle length
- **Soil data**
 - Water Holding Capacity Pre-season crop coefficient

Agricultural Forecasting 2

For in-season crop estimates, crop simulation models use actual weather data,



but at crop forecast time (red line) which weather to use?



Agricultural Forecasting 3

- **Agricultural forecasting is done at many levels**
 - **Farm**
 - **Small Administrative unit (county, shire)**
 - **Large Administrative unit (state, province)**
 - **Country**
 - **Regional**
- **Therefore, different scales with different data issues.**



Agricultural Forecasting 4

- **If used for national policy decision making, need to rely on many sources of information: weather, remotely sensed, crop model output, economic, field travel, official reports**
- **Verification is sometimes difficult. Actual crop yield data is sometimes not available.**
- **Avoid black box output. Analog to weather forecasting**
- **Recent work on climate forecasts and crop modeling**

Climate Prediction and Agriculture



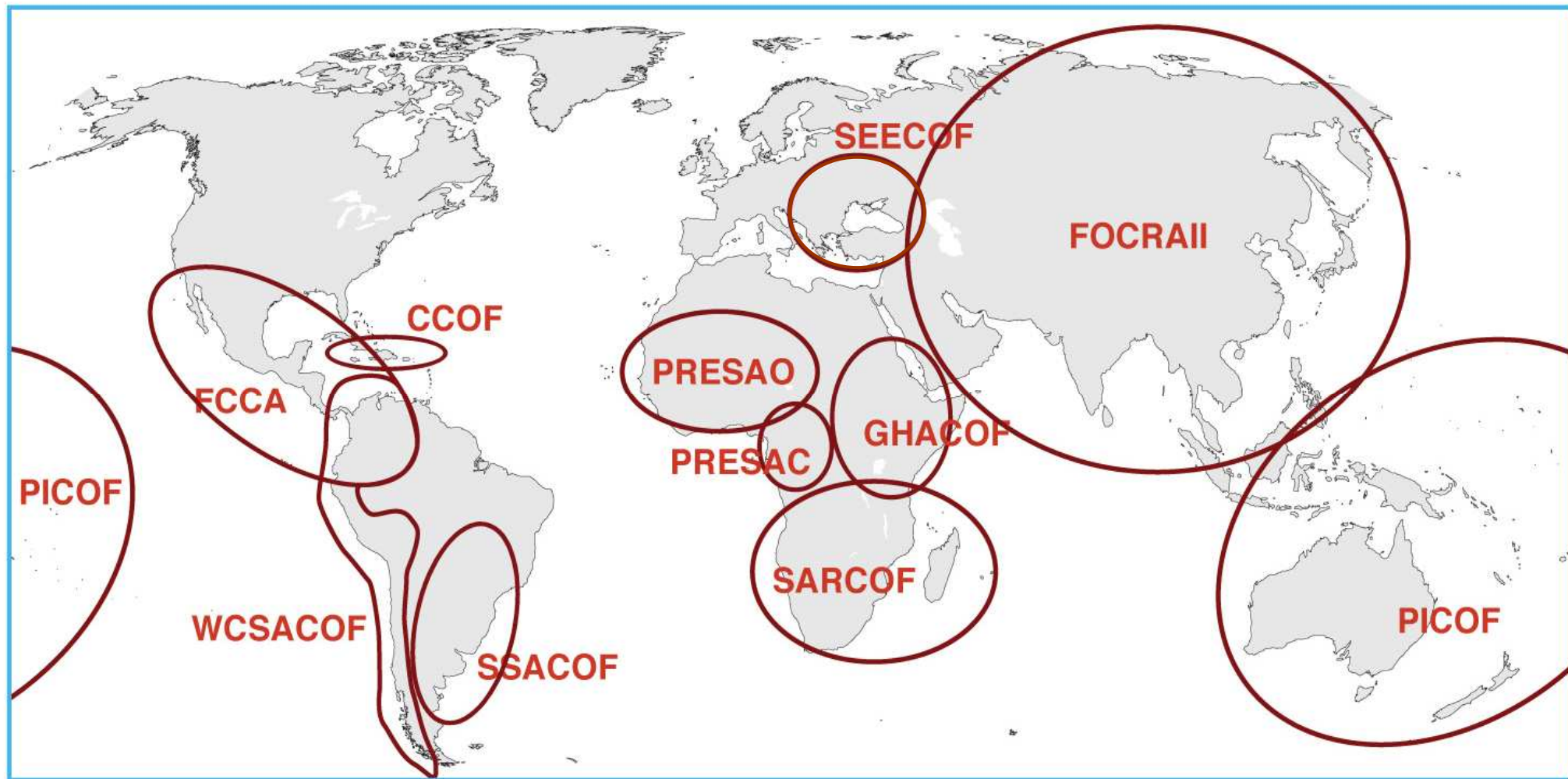
Regional Climate Outlook Forums (RCOFs)

- First established in 1996 at a Meeting in Victoria Falls, Zimbabwe.
- Gained momentum as a regional response to the major 1997–1998 El Niño event.
- RCOF Concept was pioneered in Africa and spread worldwide.
- WMO and a number of national, regional and international organizations (e.g., NOAA, IRI, Meteo France, World Bank, etc.) have supported their growth and expansion.



WMO OMM

Existing RCOFs worldwide





RCOF Concept

- Climate information including predictions/outlooks substantial benefit in adapting to and mitigating the impacts of climate variability and change.
- RCOFs have the responsibility to produce and disseminate a regional assessment (using a consensus-based approach) of regional climate for the upcoming season.
- Built into the RCOF process is a regional networking of the climate service providers and user-sector representatives.



Example: The Greater Horn of Africa Climate Outlook Forum (GHACOF)

- IGAD Climate Prediction and Applications Centre (ICPAC), formerly known as the regional Drought Monitoring Centre (DMC)-Nairobi has been organizing Climate Outlook Forums (COFs) at the beginning of every major rainfall season in the GHA, since 1998.
- Opportunity for the climate scientists from NMHSs , international and regional centers to develop a single best regional seasonal climate outlook products in order to avoid unnecessary competition and confusing users with products from the individual centers.
- Also include media experts, and experts from policy-makers, agriculture, food security, water resources, health, and the general user community.
- The COFs are preceded with capacity building workshop of national climate scientists on new developments in seasonal climate prediction.
- The workshop is normally opened by a senior government minister, and involves several lead speakers.

GHACOF Products & Applications

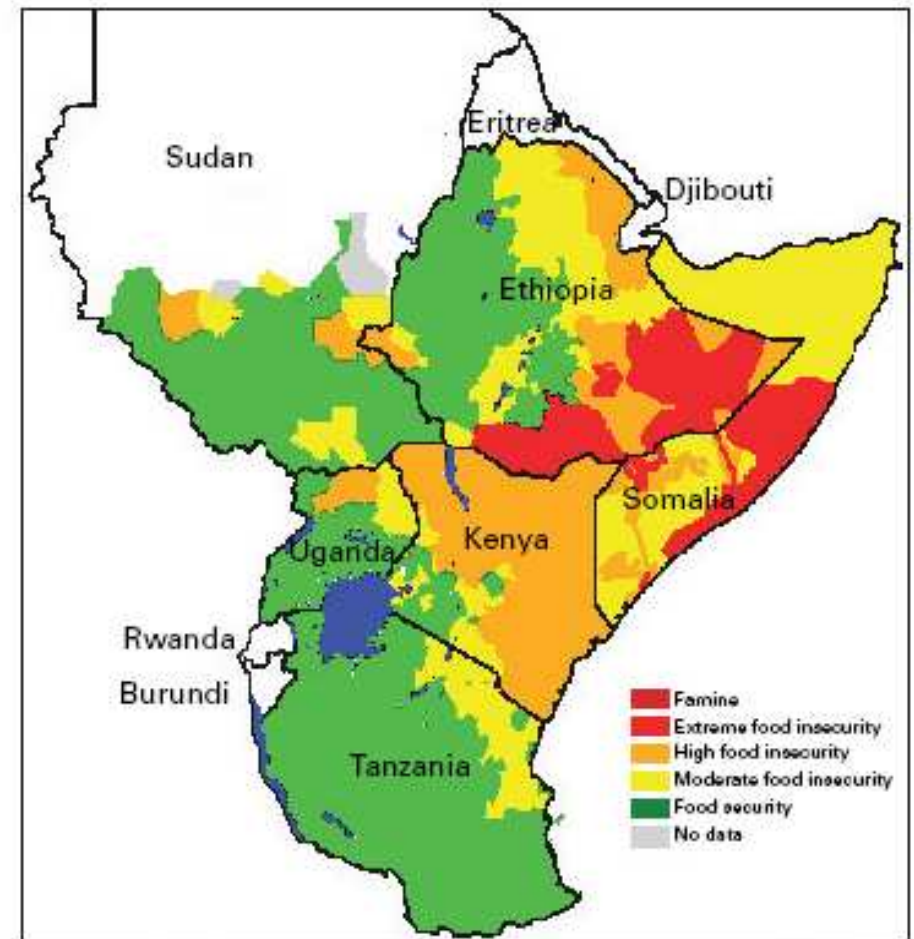
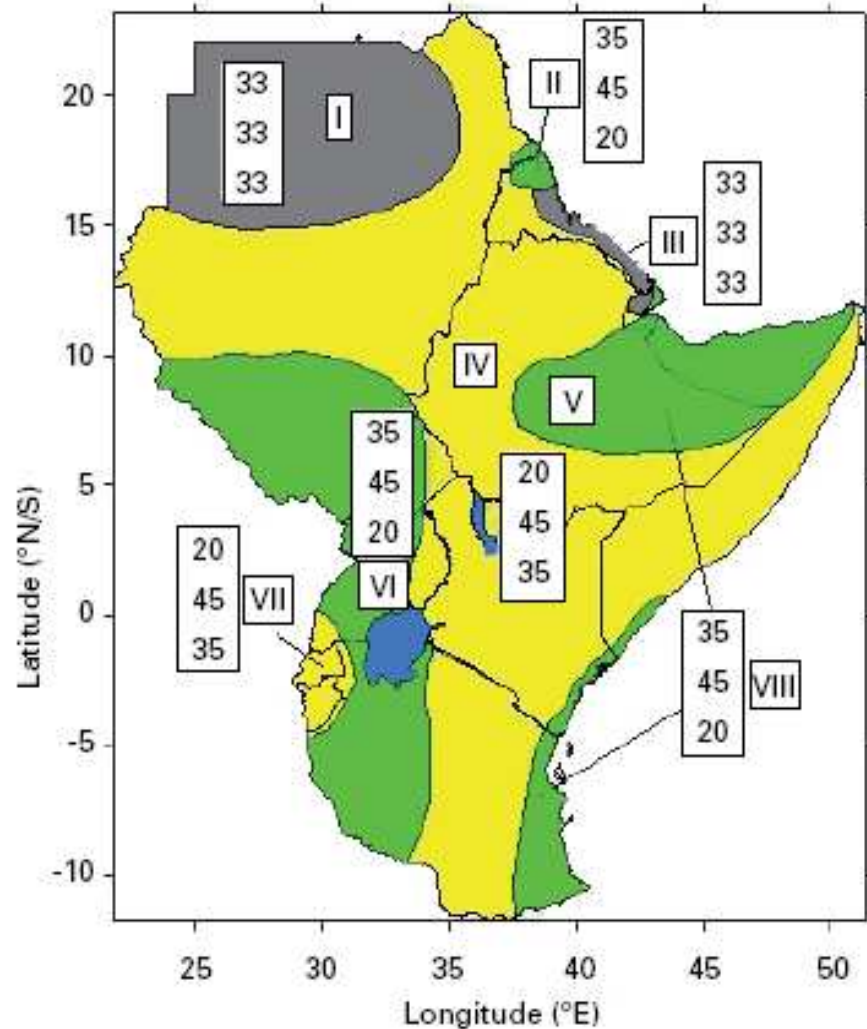


Figure 2(a) — Greater Horn of Africa Consensus Climate Outlook for March to May 2008 by ICPAC and partners including WMO and IRI.

Figure 2(b) — Food Security Outlook for March to July 2008 by Famine Early Warning Systems Network (FEWSNET)



DMCSEE

*Drought Management Centre
for Southeastern Europe*



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Drought Management Centre for Southeastern Europe - DMCSEE

Drought is a normal part of climate in virtually all regions of the world. South Eastern Europe is no exception; in past decades the drought-related damages have had large impact on the economy and welfare. Therefore the need to establish a Drought Center for SE Europe to alleviate the problems caused by drought in the area became evident at the end of the past century. The idea was further elaborated by International Commission on Irrigation and Drainage (ICID) and UN Convention to Combat Desertification (UNCCD). The UNCCD national focal points and national permanent representatives with the World Meteorological Organization have agreed upon the core tasks of the Drought Management Center for South Eastern Europe (DMCSEE) and the proposed project document.

The mission of the proposed DMCSEE is **to coordinate and facilitate the development, assessment, and application of drought risk management tools and policies in South-Eastern Europe with the goal of improving drought preparedness and reducing drought impacts**. Therefore DMCSEE will focus its work on monitoring and assessing drought and assessing risks and vulnerability connected to drought.

www.dmcsee.org

[DMCSEE Project Proposal](#)

Founding countries:

- Albania
- Bosnia and Herzegovina
- Bulgaria
- Croatia
- FYROM
- Greece
- Hungary
- Moldova
- Romania
- Slovenia
- Turkey
- Montenegro
- Serbia

Founding agencies:

- WMO
- UNCCD

User Community for Climate Forecasts

- **Producers use climate information to assist with many decisions:**
 - **Crop choice**
 - **Choice of cultivar (early or late)**
 - **Mixture of crops**
 - **Fertiliser use**
 - **Pest and disease control**
 - **Timing of the harvest**
 - **Irrigation scheduling**
 - **Area planted to a given crop (and/or rotation of fields);**
 - **Timing and amount of tillage**
 - **Stocking rates.**



Australian Journal of Agriculture Research

Special Issue

Climate Predictions for Better Agriculture
Management



Coordinating editor: Holger Mein

CLIMATE RESEARCH

Interactions of Climate
Ecosystems, and

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Volume 33 · Number 1
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PREFACE

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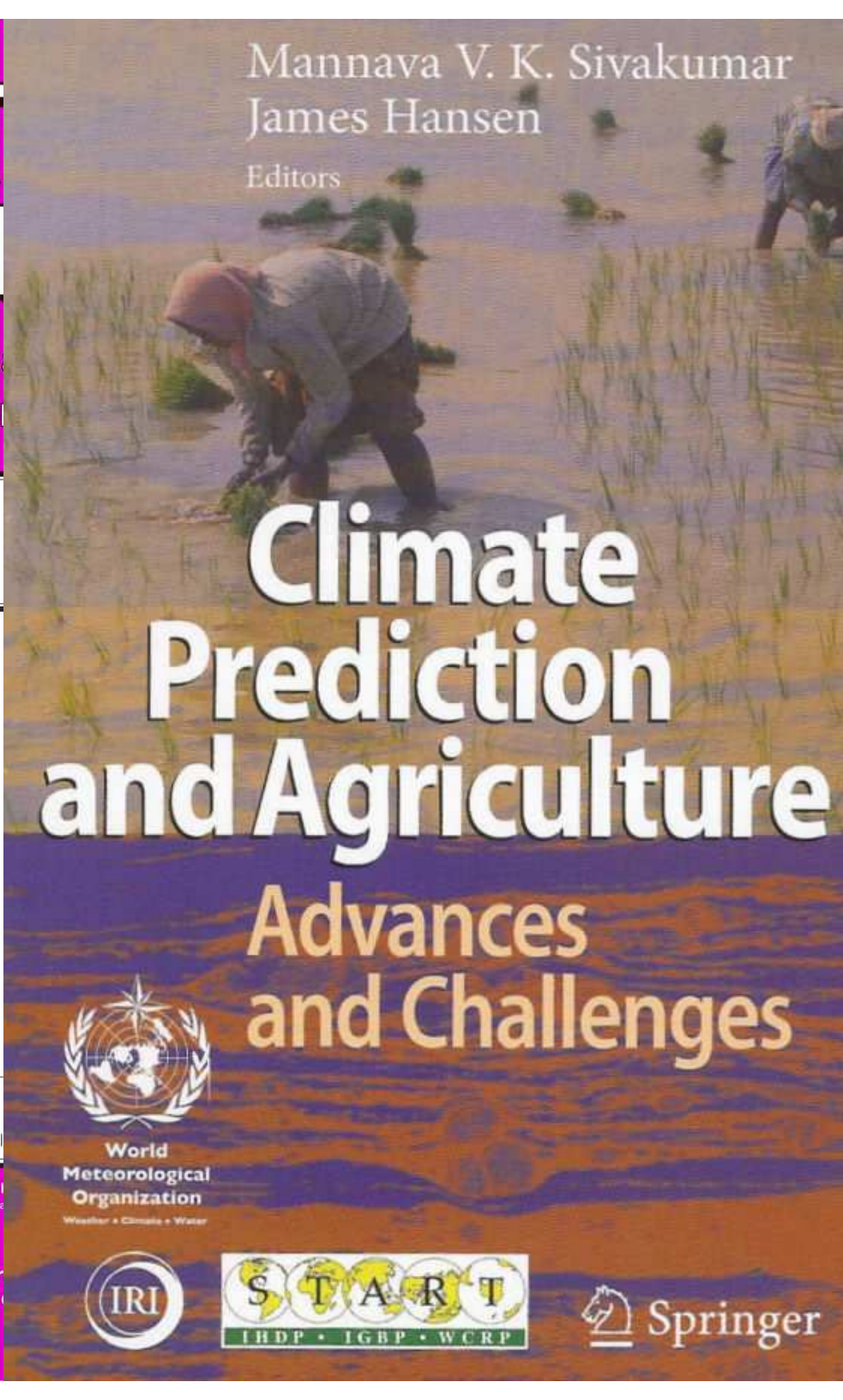
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Mannava V. K. Sivakumar
James Hansen
Editors

Climate Prediction and Agriculture

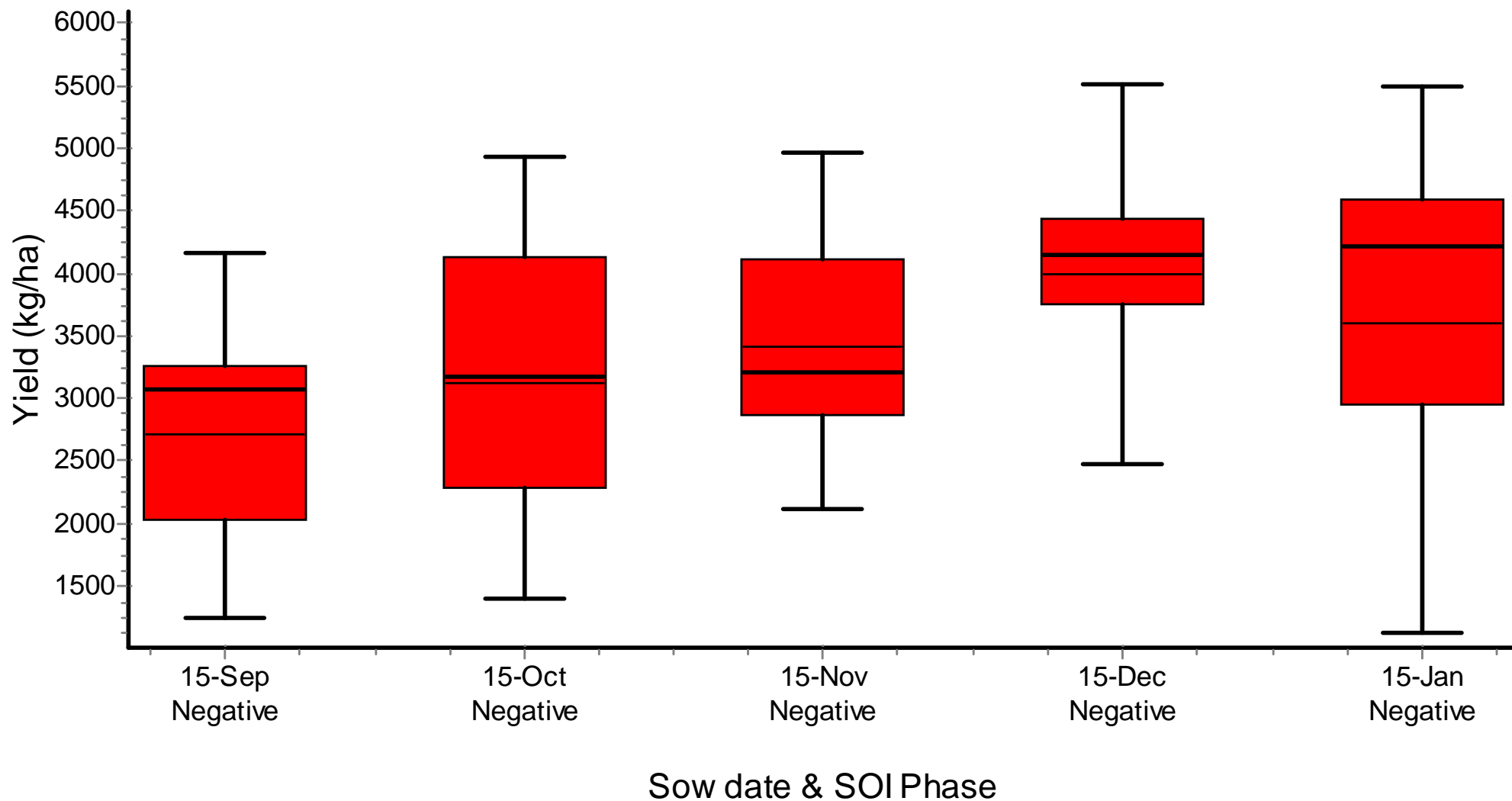
Advances and Challenges



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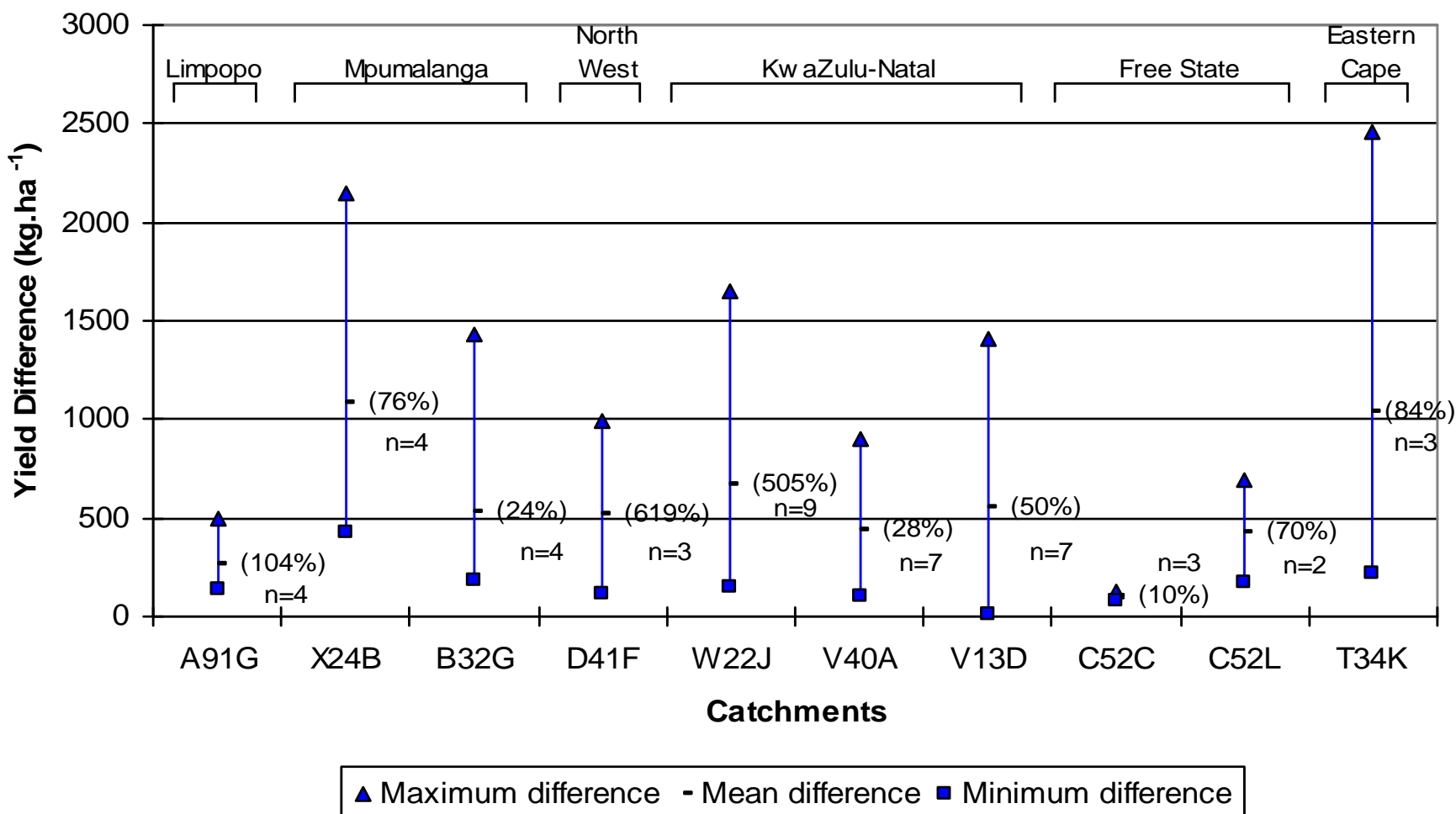


Springer

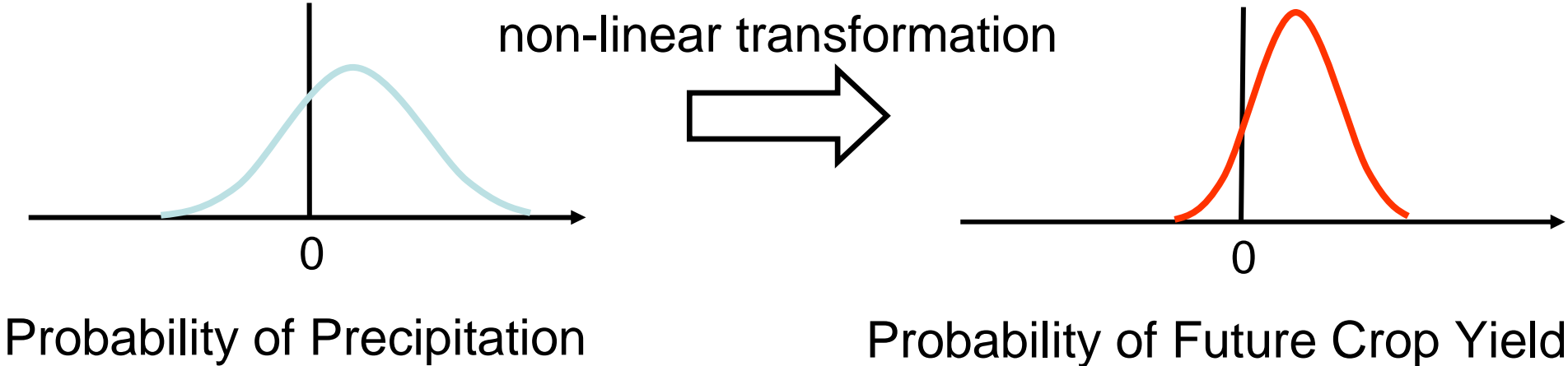
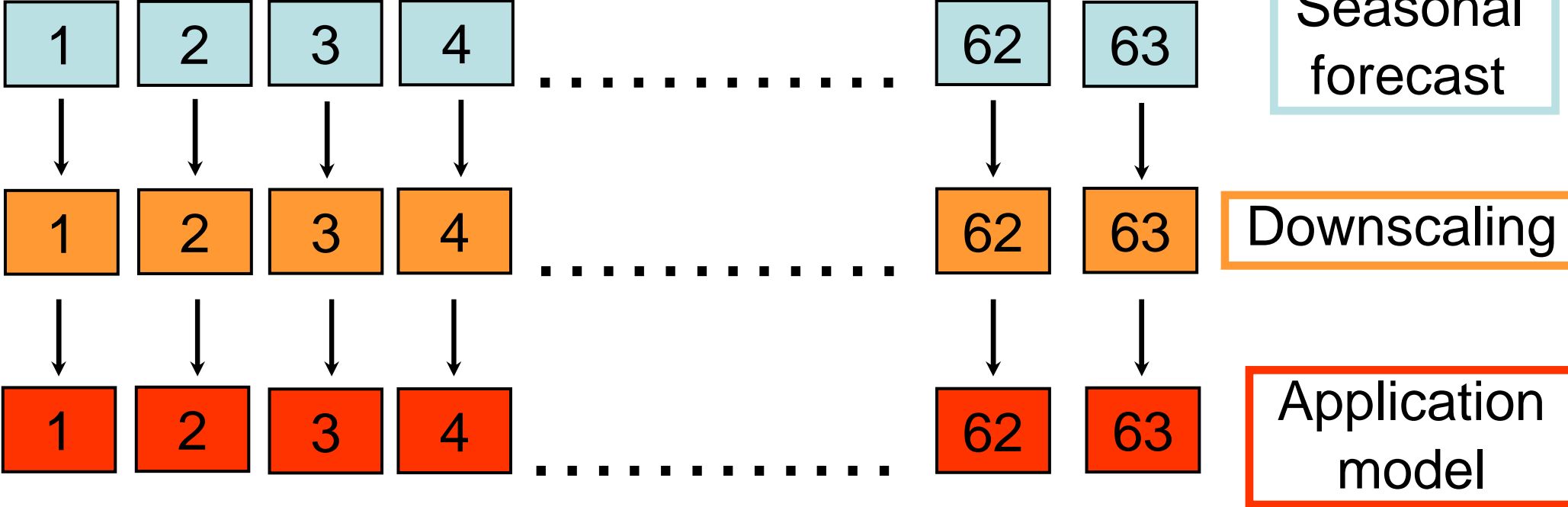


Preparedness information on which to make a decision: DSS 'Whopper Cropper' – integrates climate forecasting, crop simulation modelling, and agronomic information.

Differences in corn yields obtained from forecast selected and long term strategies (cases where former outperformed latter)



DEMETER end-to-end methodology



7 models x 9 ensembles = 63 members



Summary

- **Well established approach to characterizing and managing risks;**
- **Explicit link between weather- and climate-related risks and the actions required to reduce them to acceptable levels;**
- **Wide mix of risk management strategies;**
- **Need for decision support systems and discussion support systems.**



Challenges

- **Update Observing System Requirements from Agricultural Meteorology (input into Evolution of WMO Global Observing System)**
- **Develop AG0702 Task Workplan**



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Thank You

World Meteorological Organization

Geneva

Switzerland