Crop Modeling in Agriculture and Food Production Decision Support System

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Outline of Presentation

- Emergent issues and challenges in agriculture and food security
- Development of process-based crop models
- Use of crop models in agricultural land use studies
- Crop forecasting system for food security assessment
- R & D challenges and opportunities

Emergent Issues & Challenges

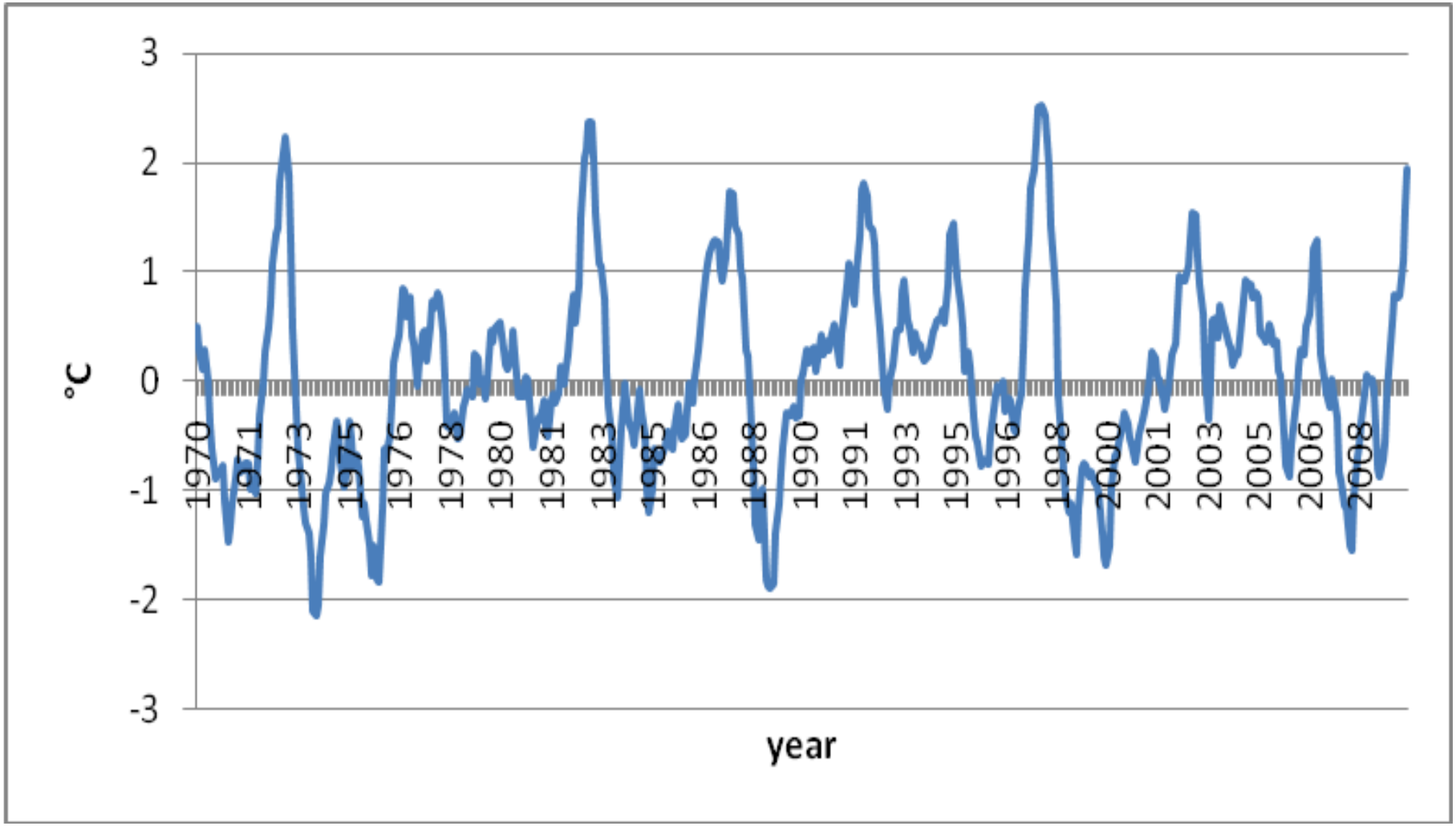
- Increasing population and demand for food
- Rapid urbanization
- Accelerated depletion of natural resources (e.g. land, water, biodiversity)
- Environmental degradation
- Climate change and climate variability

Land Use Planning to enhance food production

- Need for increased productivity (with less inputs)
- Need for reliable estimate of crop production
- Competition for land uses for food, feeds and fuel

Climate Change and Climate Variability

- Changing weather patterns such as rainfall affecting farm-level decisions e.g. cropping calendar, planting date, crops to grow, etc.
- Significant yield reduction due to global warming
- Crop loss and damages due to more intense extreme events, e.g.typhoons, droughts, pests and diseases, etc.
- Seasonal climate variability



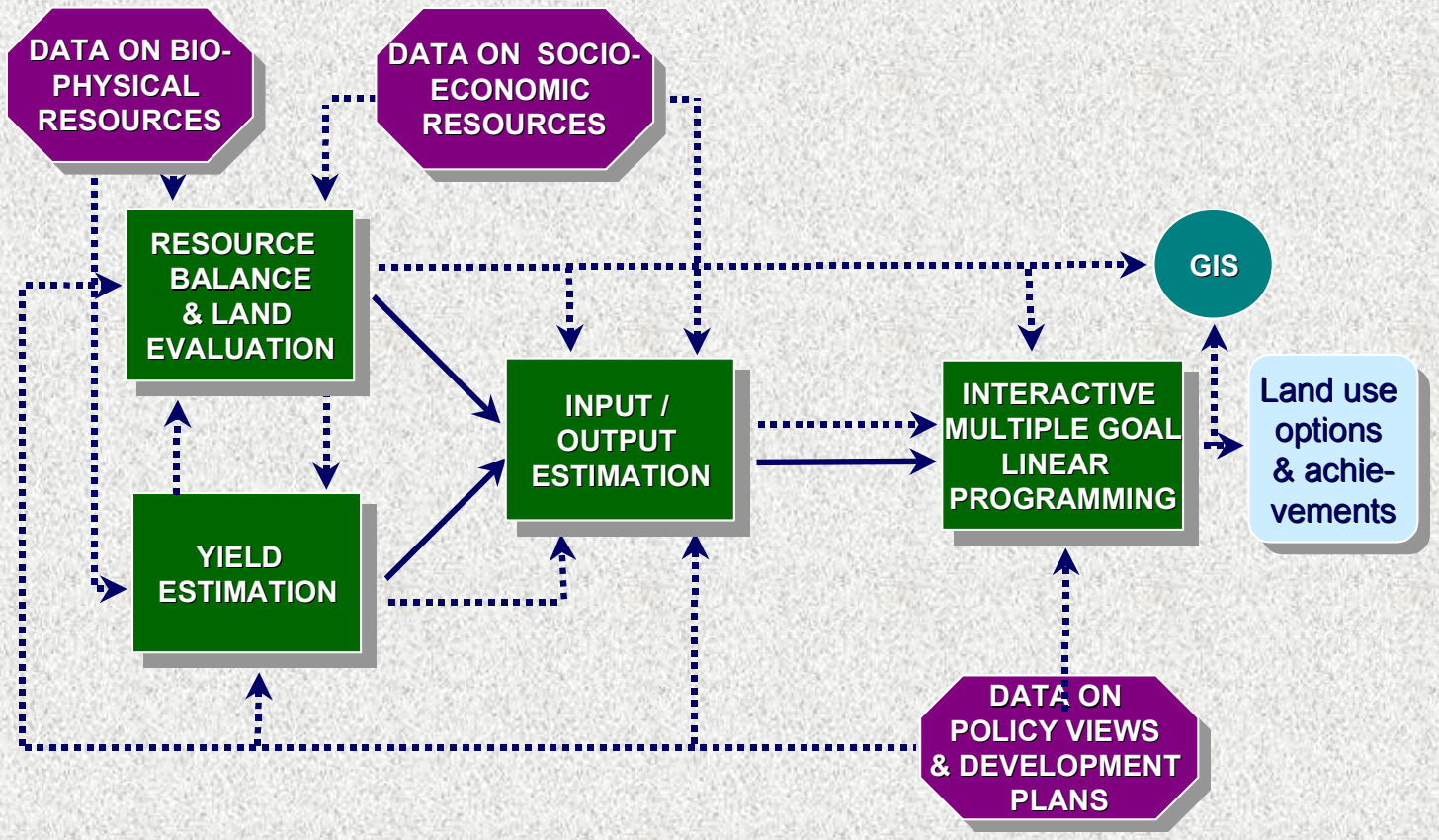
Sea surface temperature anomaly (SSTA) in Niño 3.4 region from 1970-2009. SSTA determines weather patterns in Philippines and in Indonesia 3-4 months in advance. Source of Data: (NOAA)

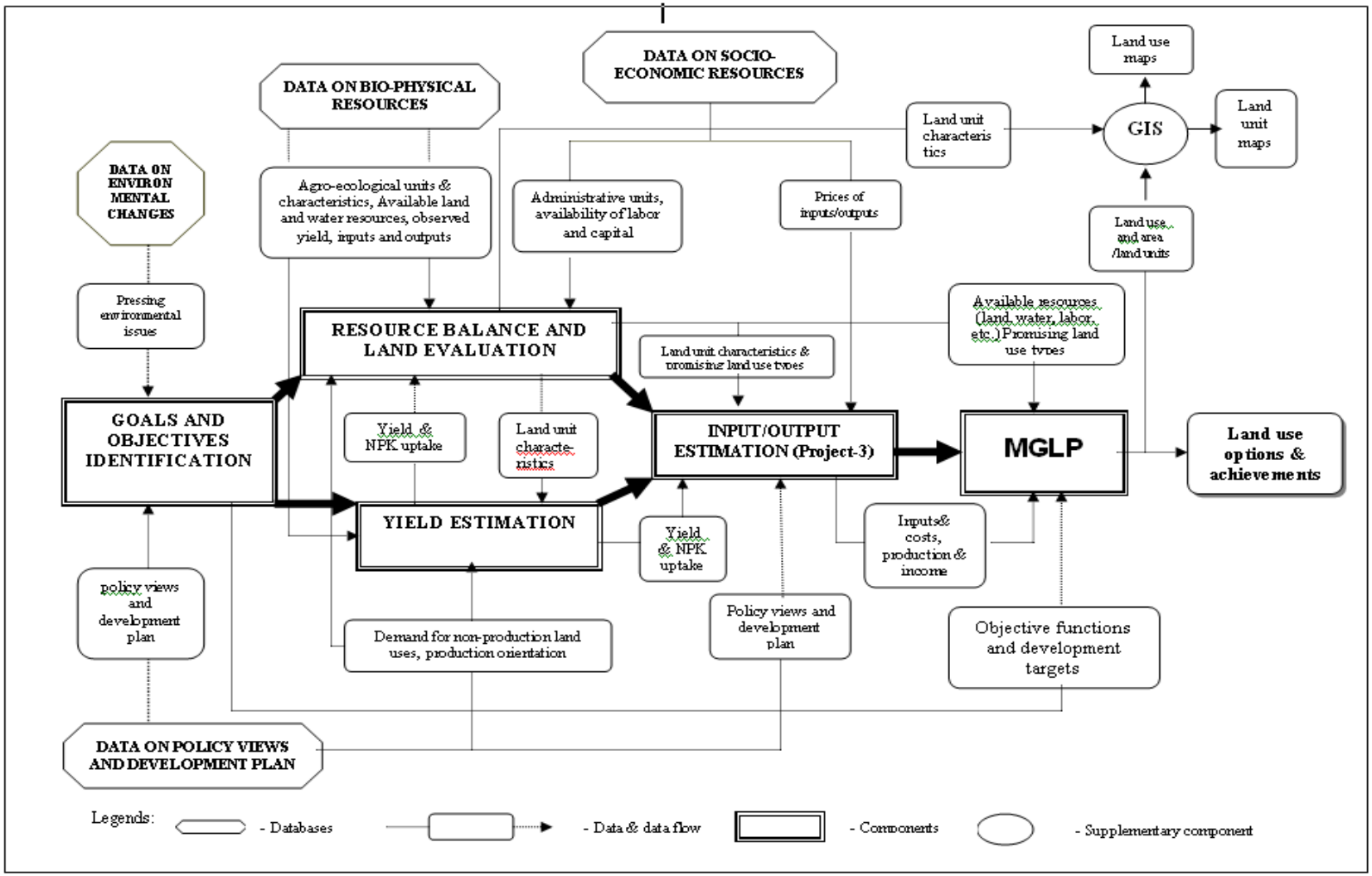
Use of Process-based Crop Models

- For exploratory studies on cropping systems
- Resource evaluation in land use studies
- Knowledge-based crop forecasting
  - yield estimation, best time to plant, etc.
- Food security impact assessment - e.g. effect of climate change, etc.

Crop Models in Farming Systems and Land Use Studies

Operational structure of LUPAS





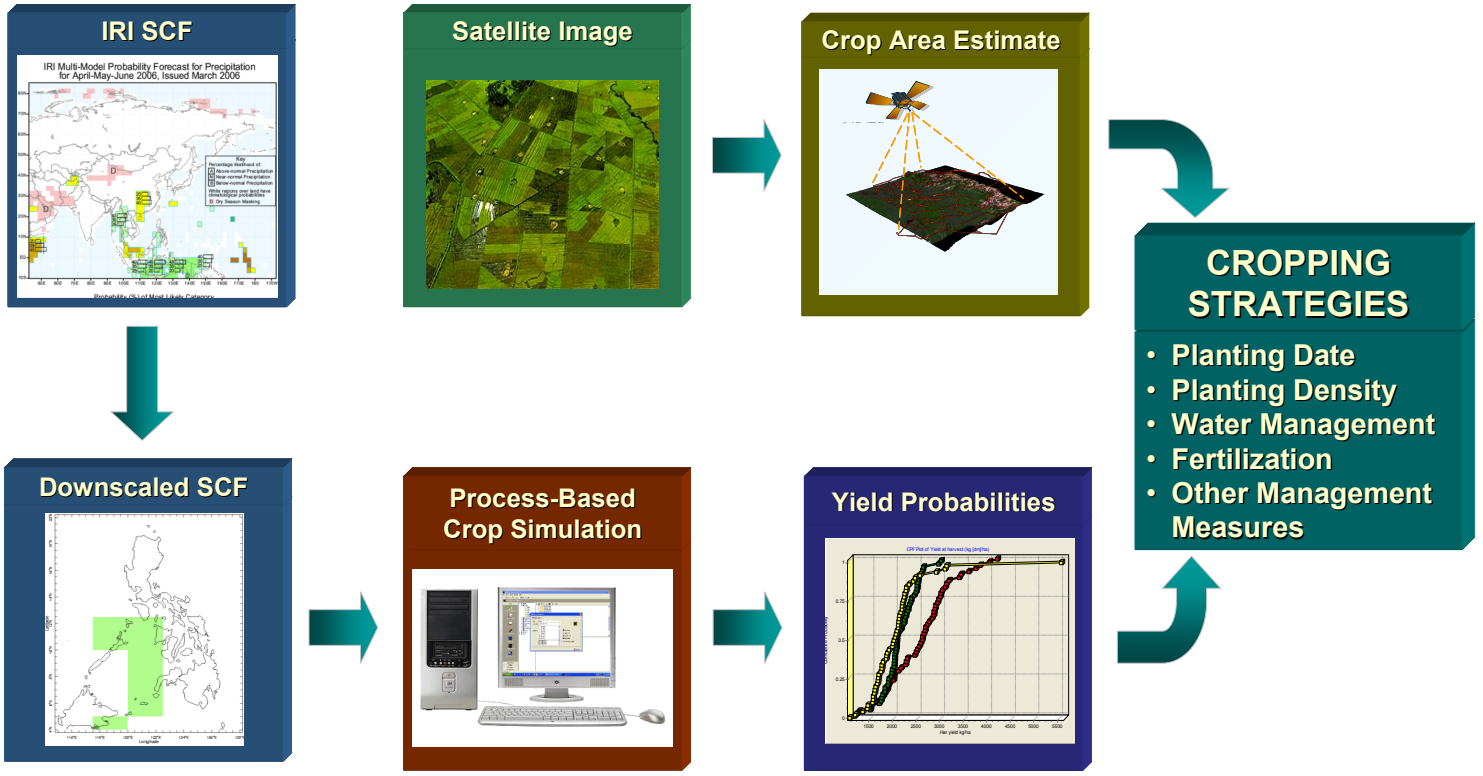
Land Use Planning Analysis System

Crop forecasting systems for food security assessment

Knowledge-based crop forecasting system

- Satellite imageries of areas planted to crops
- ENSO episodes and weather systems in the Philippines
- Seasonal climate variability and scheduling of farm activities (e.g. Rainfall probabilities vs. Yield probabilities)
- Eco-physiological-based estimation of crop yields

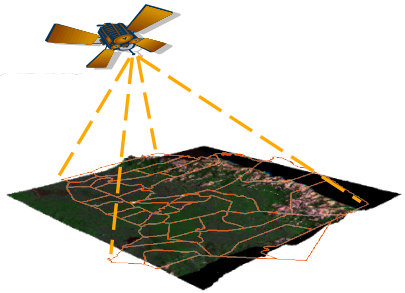
Early warning system and knowledge-based crop forecasting

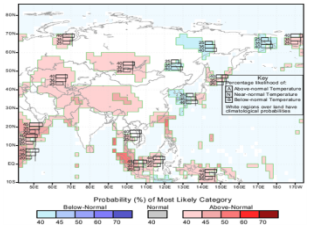


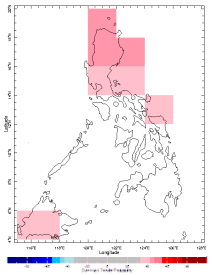
Knowledge-based crop forecasting system

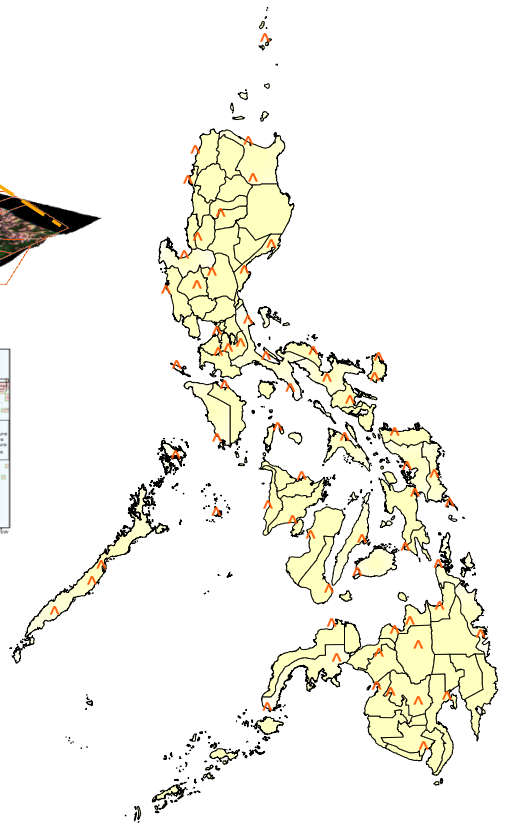
Forecasting and EWS

- Advances in S & T can be used for an early warning system.
- Need to invest on agromet data collection.
- Generation of weather data for specific location

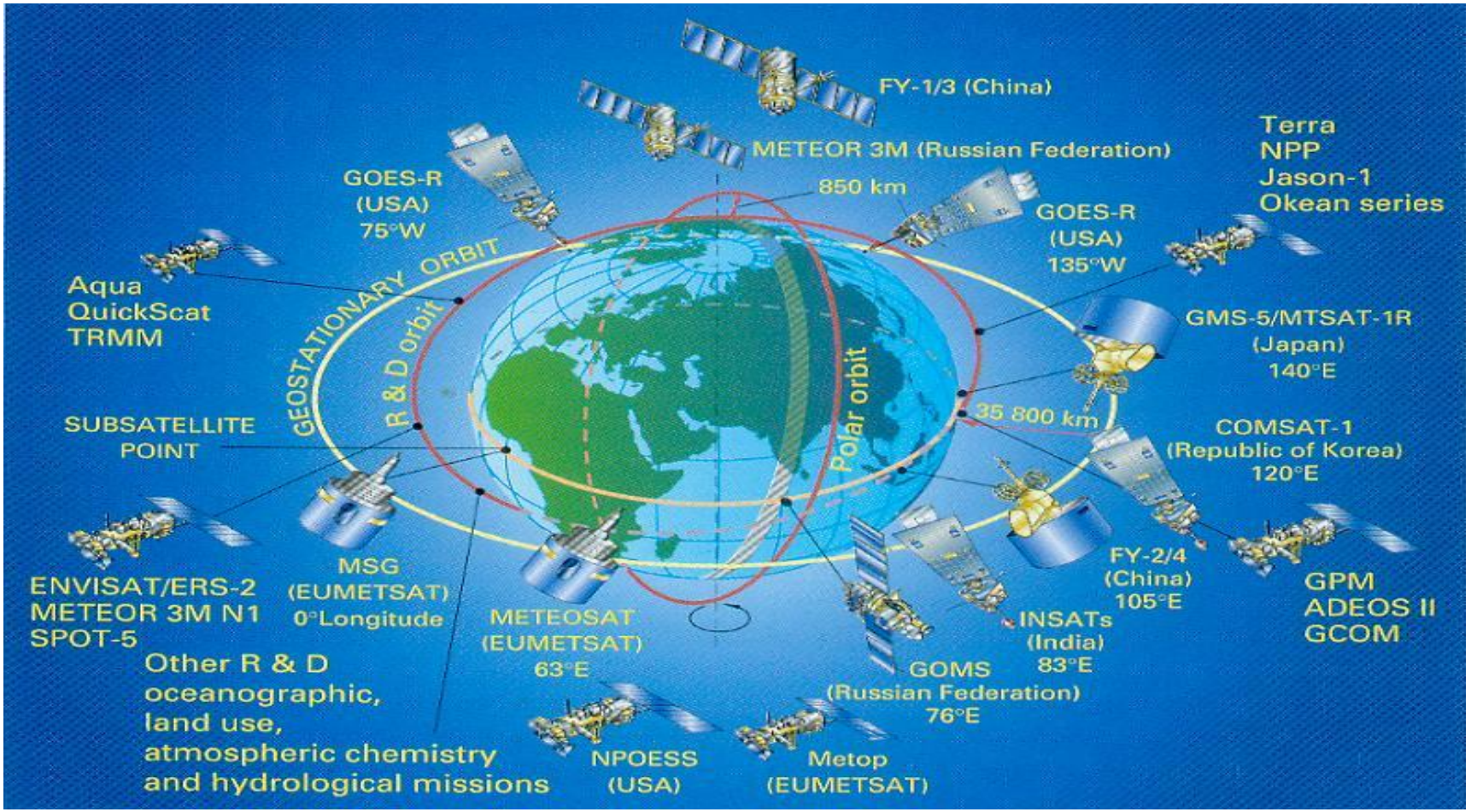








Use of Space Technology for improved Climate and Weather Forecasting



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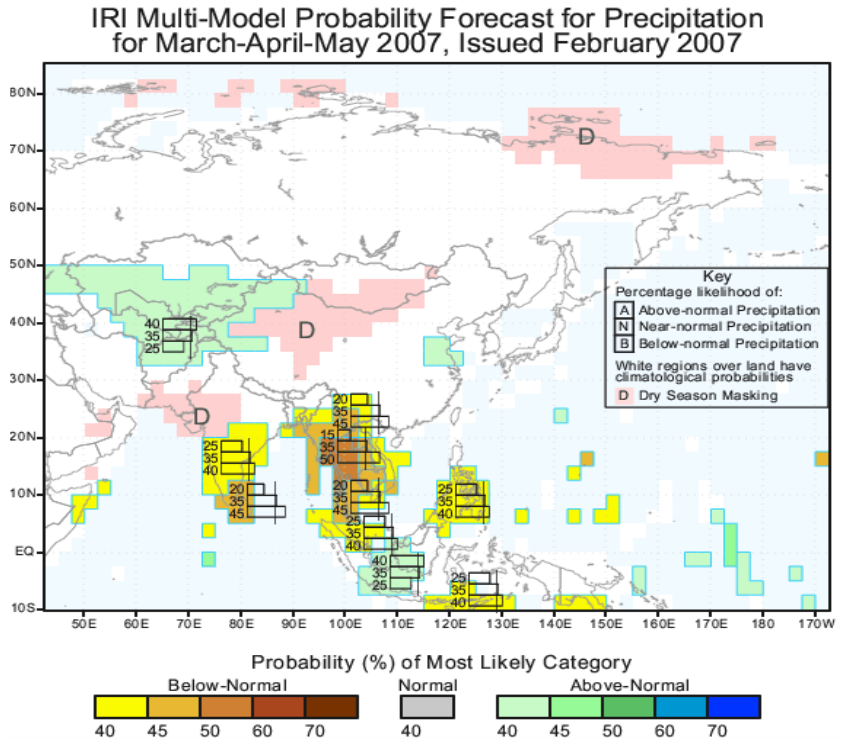
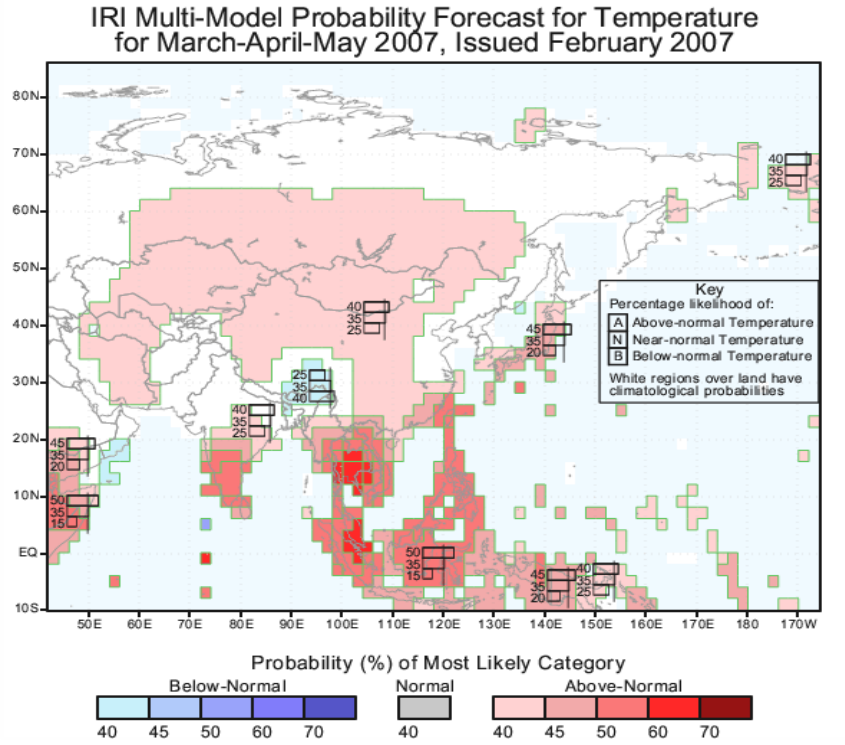
Improved Climate Forecast

IRI Regional Climate Forecast



Precipitation



Temperature

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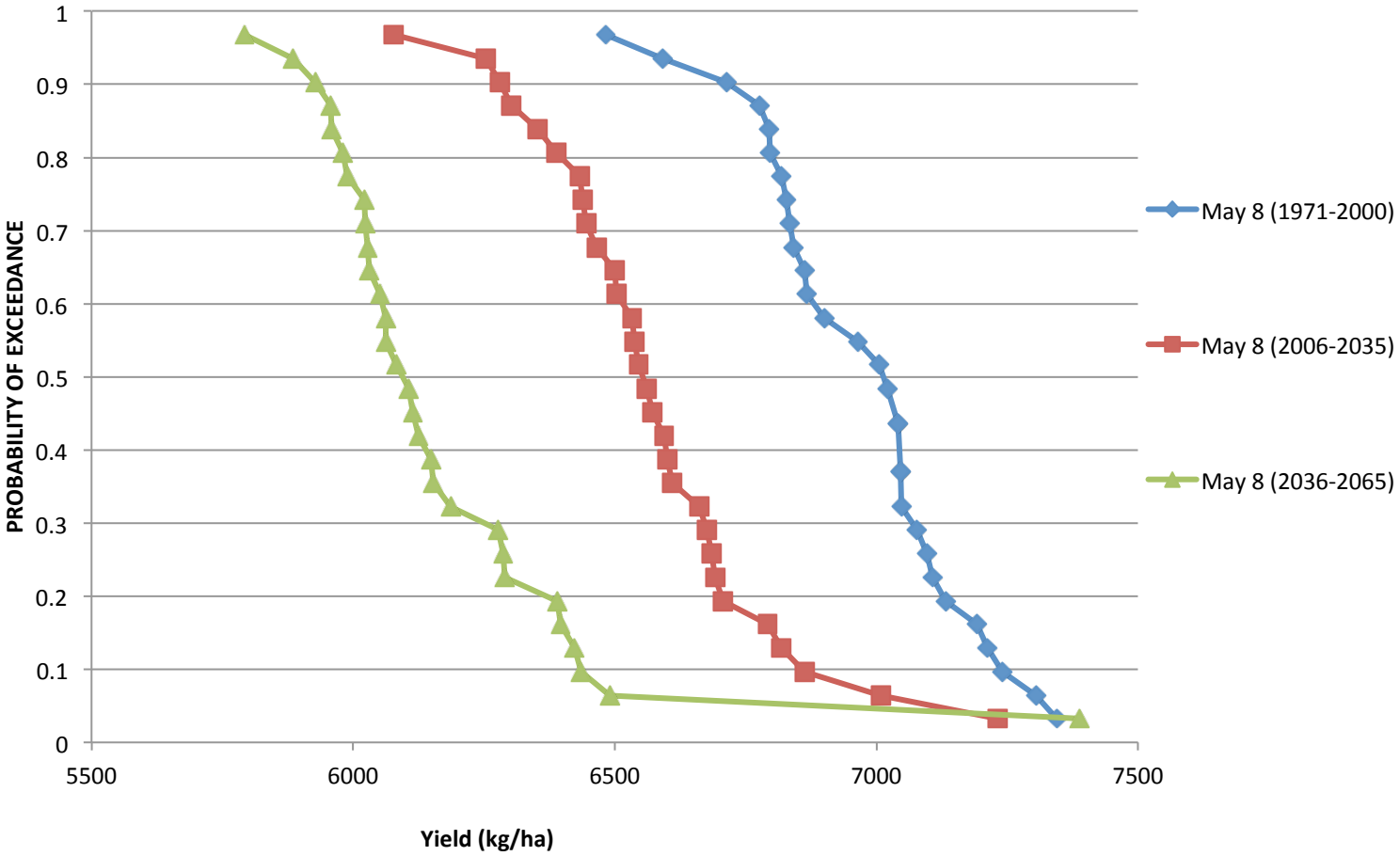
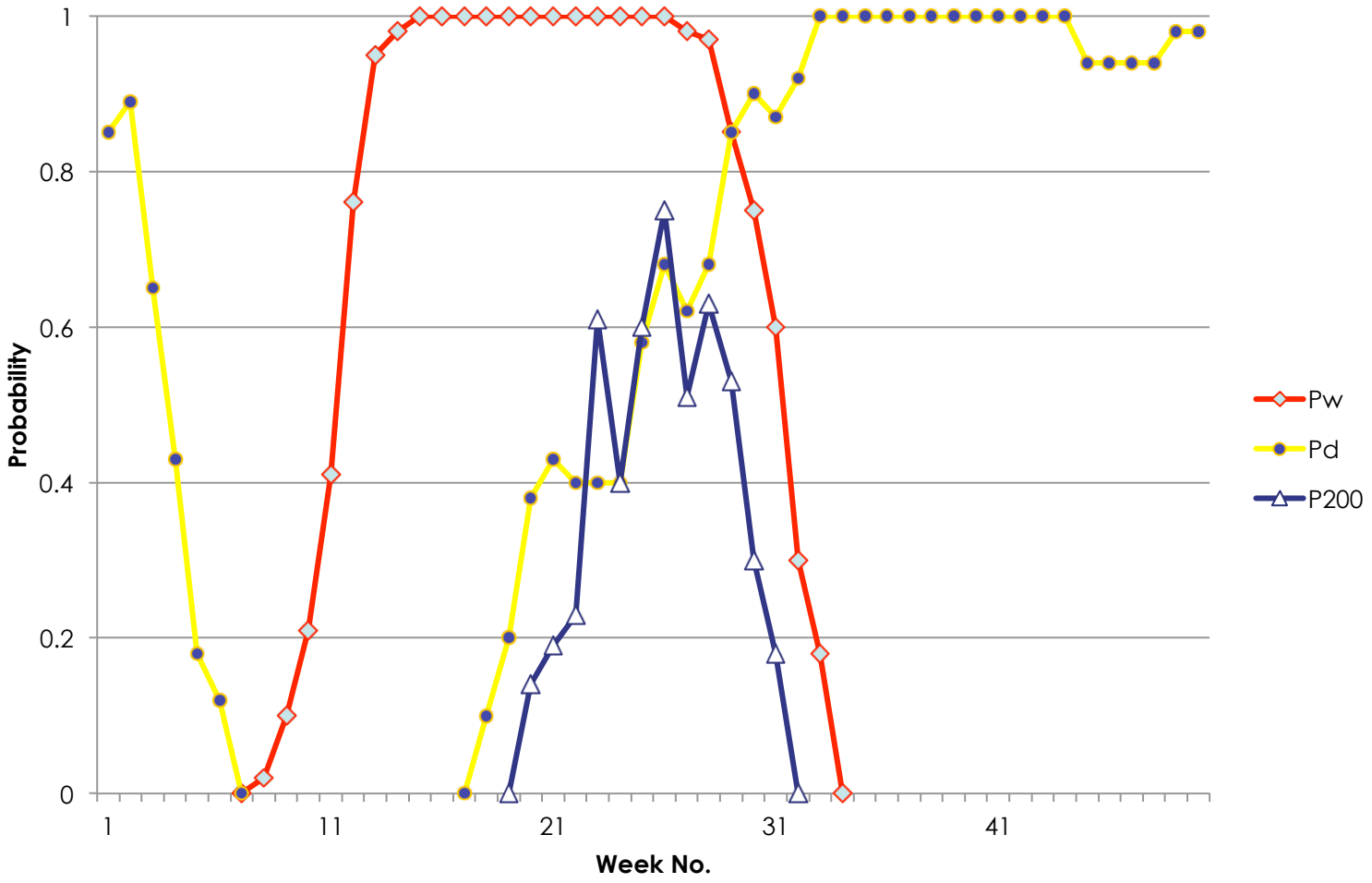
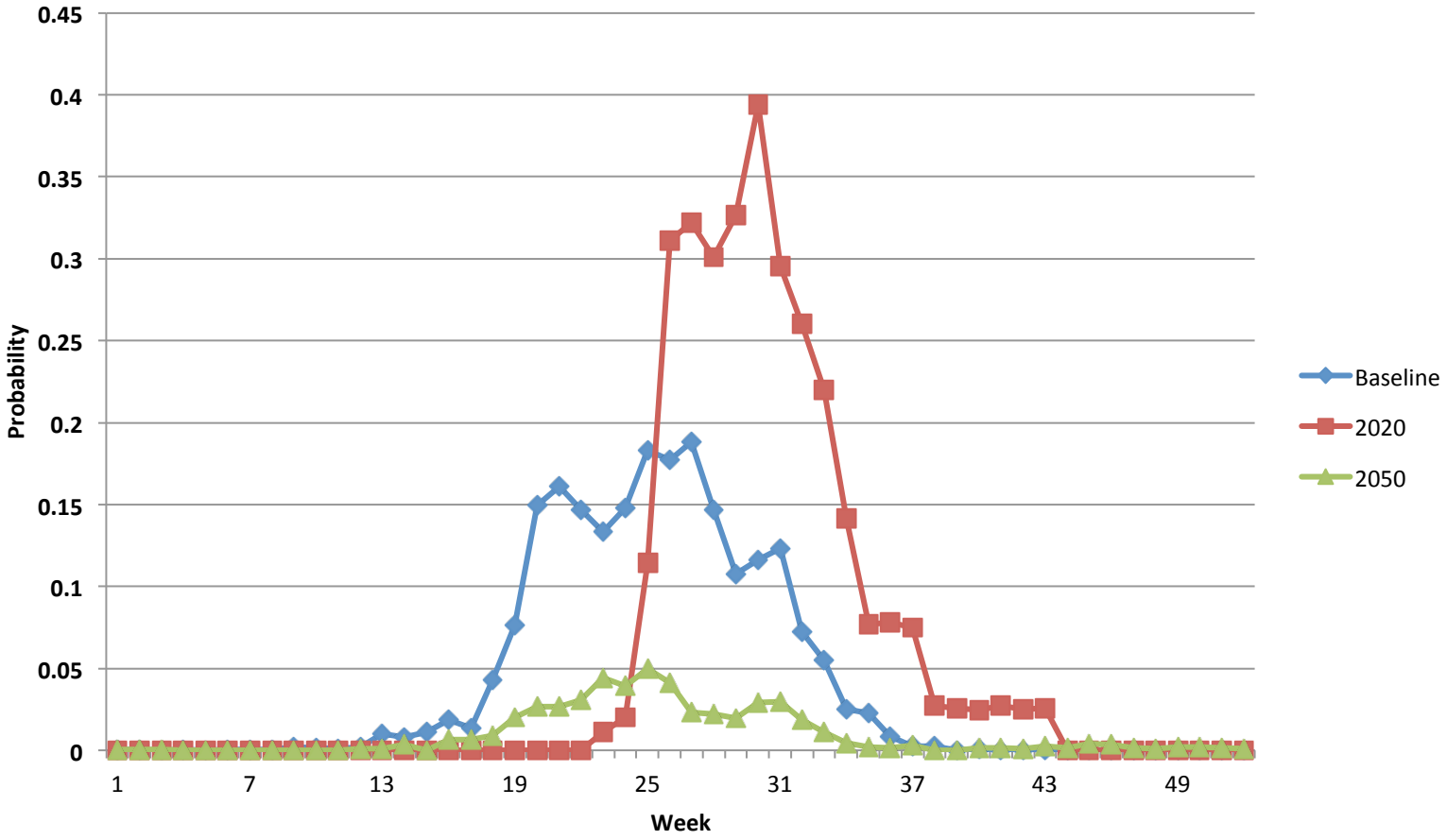
Challenge: Downscaling of forecasts to specific location.



Probabilities of exceedance of rice yields (IR64) during May 8 planting in Bukidnon, Philippines for the baseline period (1971-2000) and projected periods 2020 (2006-2035) and 2050 (2036-2065). (Source: Faderogao & Lansigan, 2011)



Plots of weekly probabilities of onset of rainy period or getting at least 200 mm. of rainfall, **P200**; weekly probabilities of required rainfall during crop growth, **Pw**; and weekly probabilities of dry harvest, **Pd**.



Comparison of the combined probability Q of meeting rainfall requirements for different crop growth and development stages for IR-64 for the baseline, 2020 and 2050 in Malaybalay, Bukidnon.
(Source: Lolos & Lansigan, 2012)

Issues and Challenges

- Data and information requirements of crop models
  - crop, soils, weather, management, etc.
  - data basing including reliability checks
  - data sharing
- Technical expertise required – i.e. technology transfer; capacity building
- Institutionalization of the decision support system to assist stakeholders

Concluding Remarks

- Meeting the emerging challenges of increasing demand for food, competition among alternative land uses, and ensuring ecological sustainability.
- Use of advances in science and technology to explore land uses, and efficient crop estimation, informed decision-making at farm level to better manage risks..
- Networking and collaboration vis-à-vis access to and sharing data and information, models, etc.