

**RICE AND CLIMATE VARIABILITY:
A POINT OF INTEREST FROM THE CONTEXT
OF
FOOD SECURITY, AGRO BIODIVERSITY & SOCIO-
ECONOMICS**

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Rice :What's known and What's projected ?

agro ecological system

Rice is crucial for food security, agro-biodiversity and socioeconomics (source of income and livelihoods)



Kropff et al 1993

Crop growth simulations show that rice yields decrease 9% for each 1°C increase in seasonal average temperature

Socioeconomics
Food security
Biodiversity

> Half of 25 biggest rice producing countries are located in South and Southeast Asia.

2 billion people in Asia depend on rice to obtain 60 to 70 percent of their calories

140,000 varieties of cultivated rice (species *Oryza sativa*) are thought to exist. More than 90,000 samples of cultivated rice and wild species are in International Rice Genebank

Ayappan "we need to discuss the challenges faced by the farm sector, from 0.5 degree rise in temperature that affects crop output"

Hindustan Times, Patna, September 22, 2012



- Trans- (inter)disciplinary and collaborative initiative
- To study multi-level (regional and local) impact of climate variability on rice.
- Aims to generate science-based evidence for planning adaptation strategies to cope with and respond to change.



Aim

To study climate related potential rice yield for the future for this region in-view of the projected climate change scenarios (crop modeling with ORYZA driven by coupled GCM predictions).

Approach

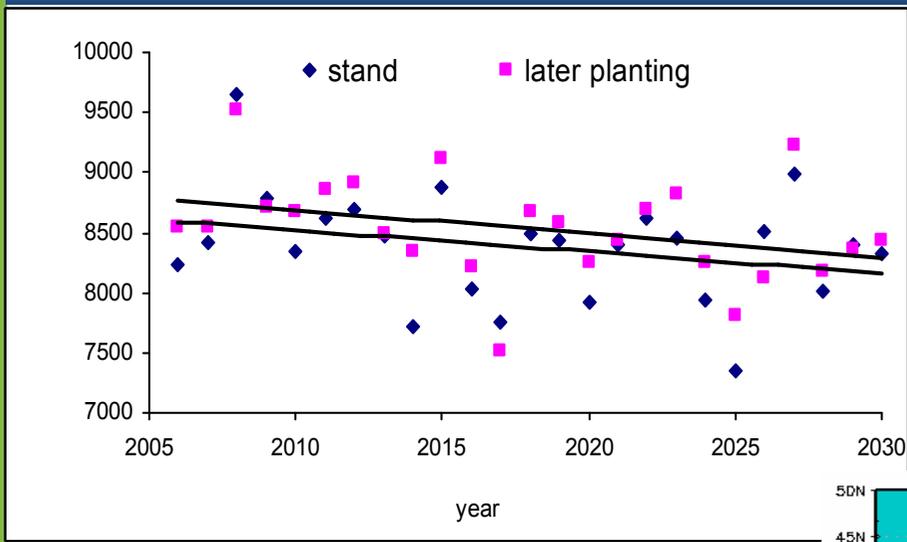
Change in rice production at regional level in last 50 years linking the rainfall pattern.

Application

Farmer's adaptive approach to climate is broadly through adjustment in planting dates, the cropping sequence and crop rotations (Lansigan *et al.*, 2000)



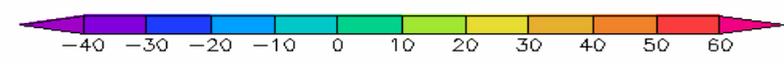
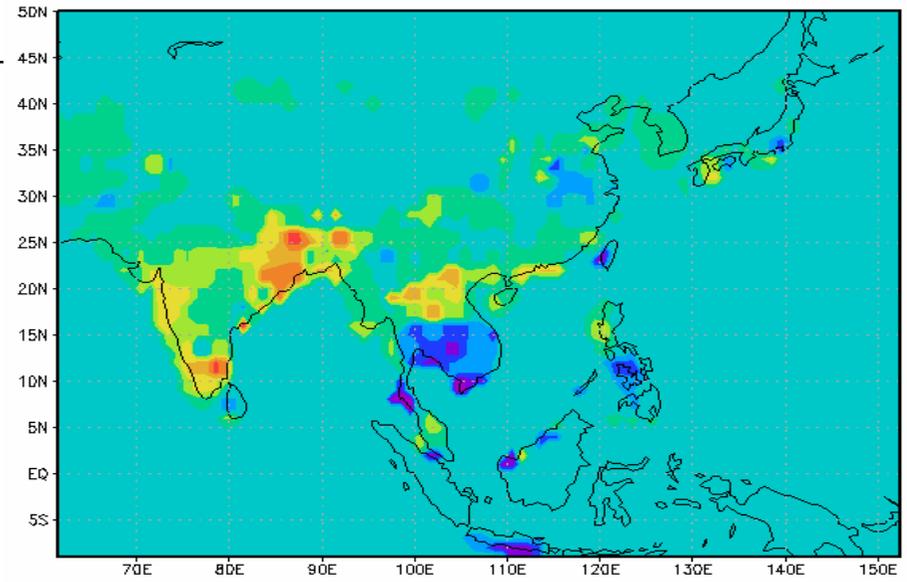
Modelling rice yield with changing climate in tropics



Change in yield while shifting planting date 15 days ahead the current planning date

Later planting to avoid excessive rainfall during harvesting

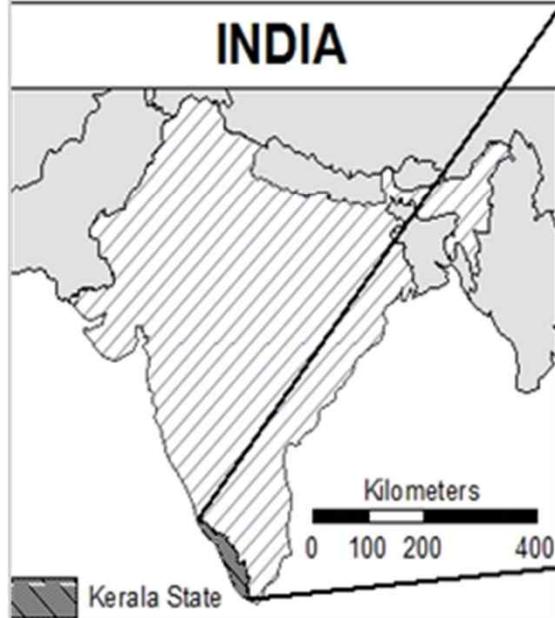
Change (+) in precipitation sum during the week of harvesting (2020-2030) – (2005-2010), that may be reduced due to 15 days later planting



Local level : Wayanad (Kerela-India)



Census 2011
Wayanad Population : 816 558



Kerala

Administrative center : Kalpetta
Three main blocks
Area : 2000 sq km

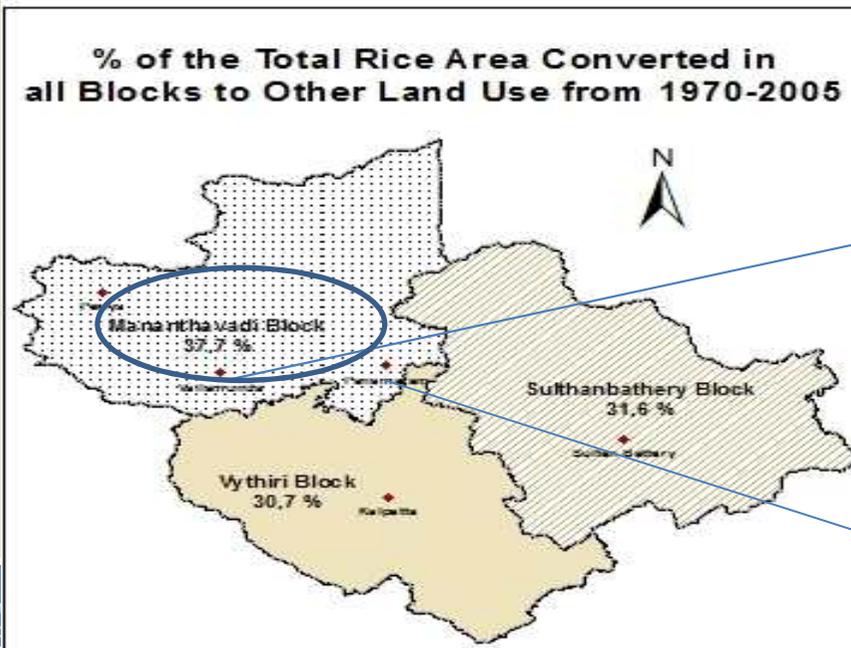
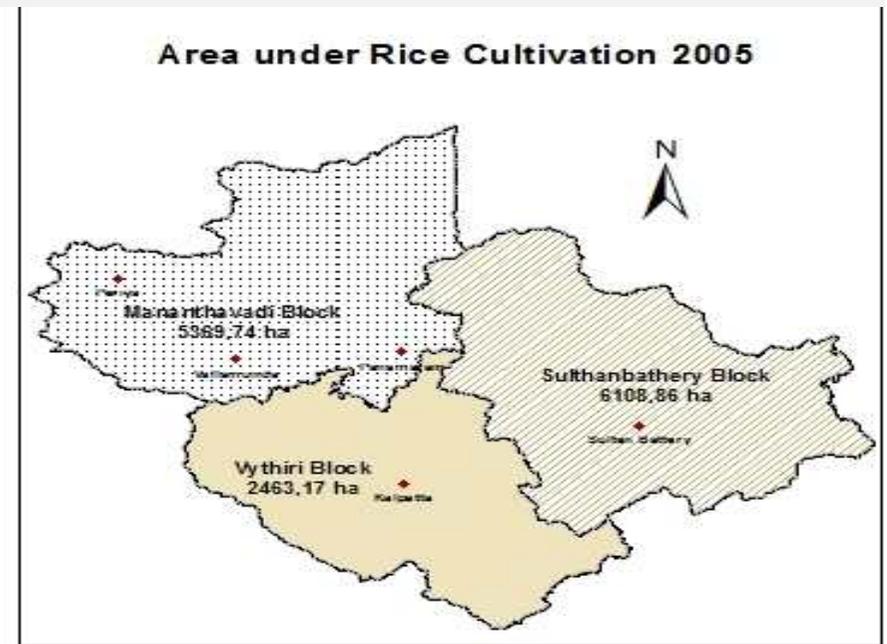
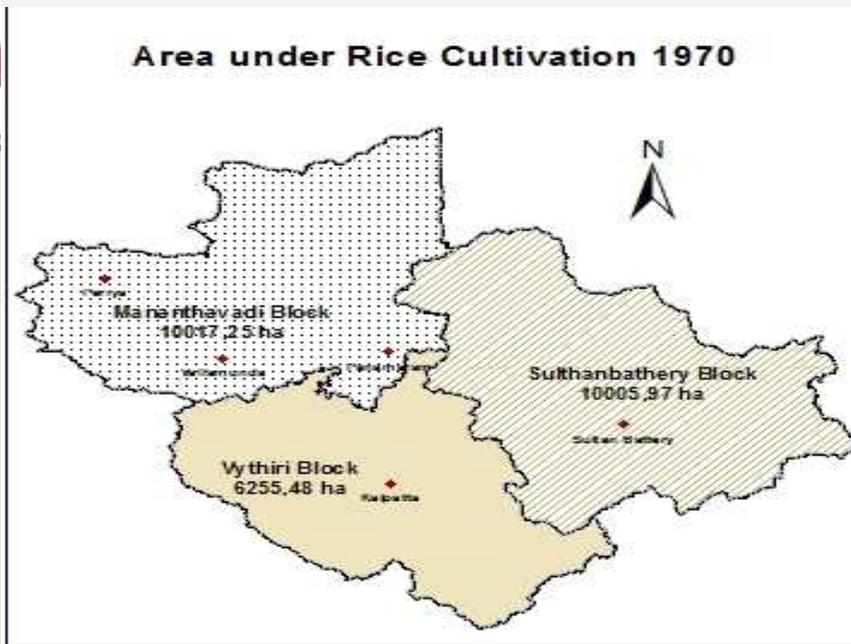


Wayanad surrounds Western Ghats on the west

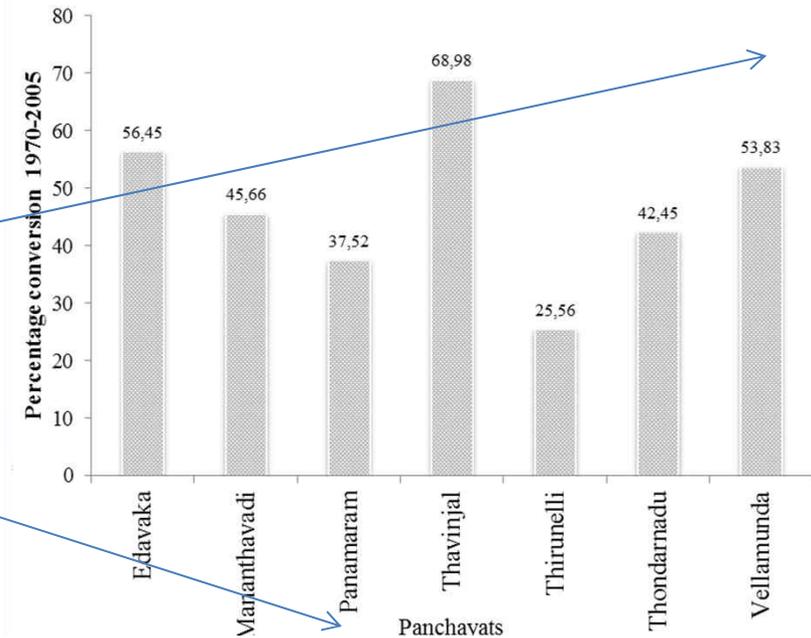


Wayanad District

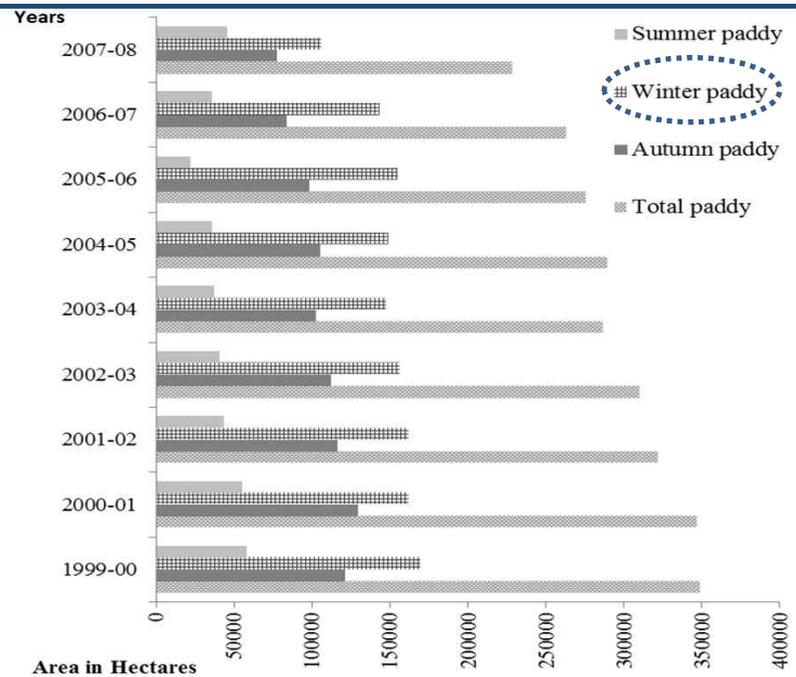
Temporal trend in rice cultivation : what do records say ?



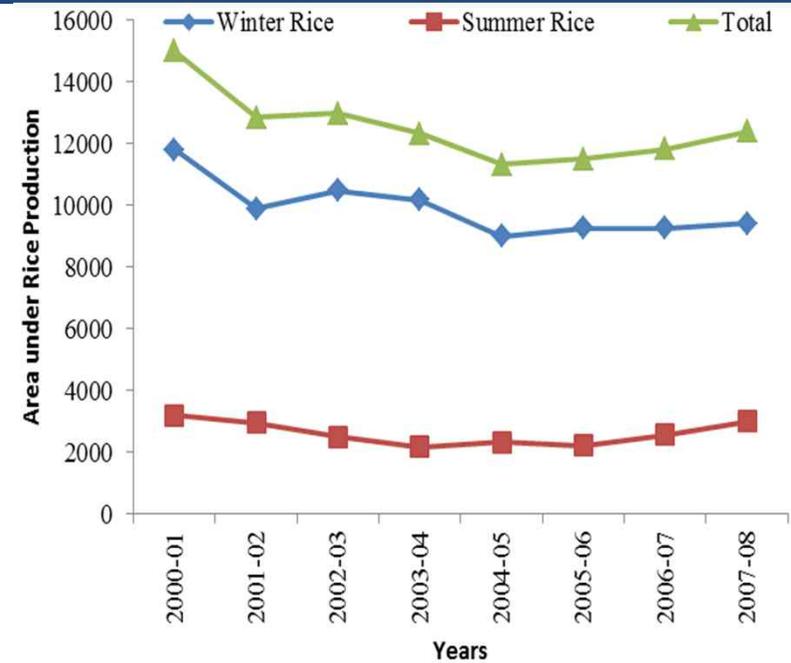
■ % area converted(1970-2005) at Panchayat Level in Manathavadi Block



(rice) Cropping pattern in Kerela and Wayanad



Ten years paddy (rice) distribution trend in Kerala



Paddy (rice) distribution trend in Wayanad

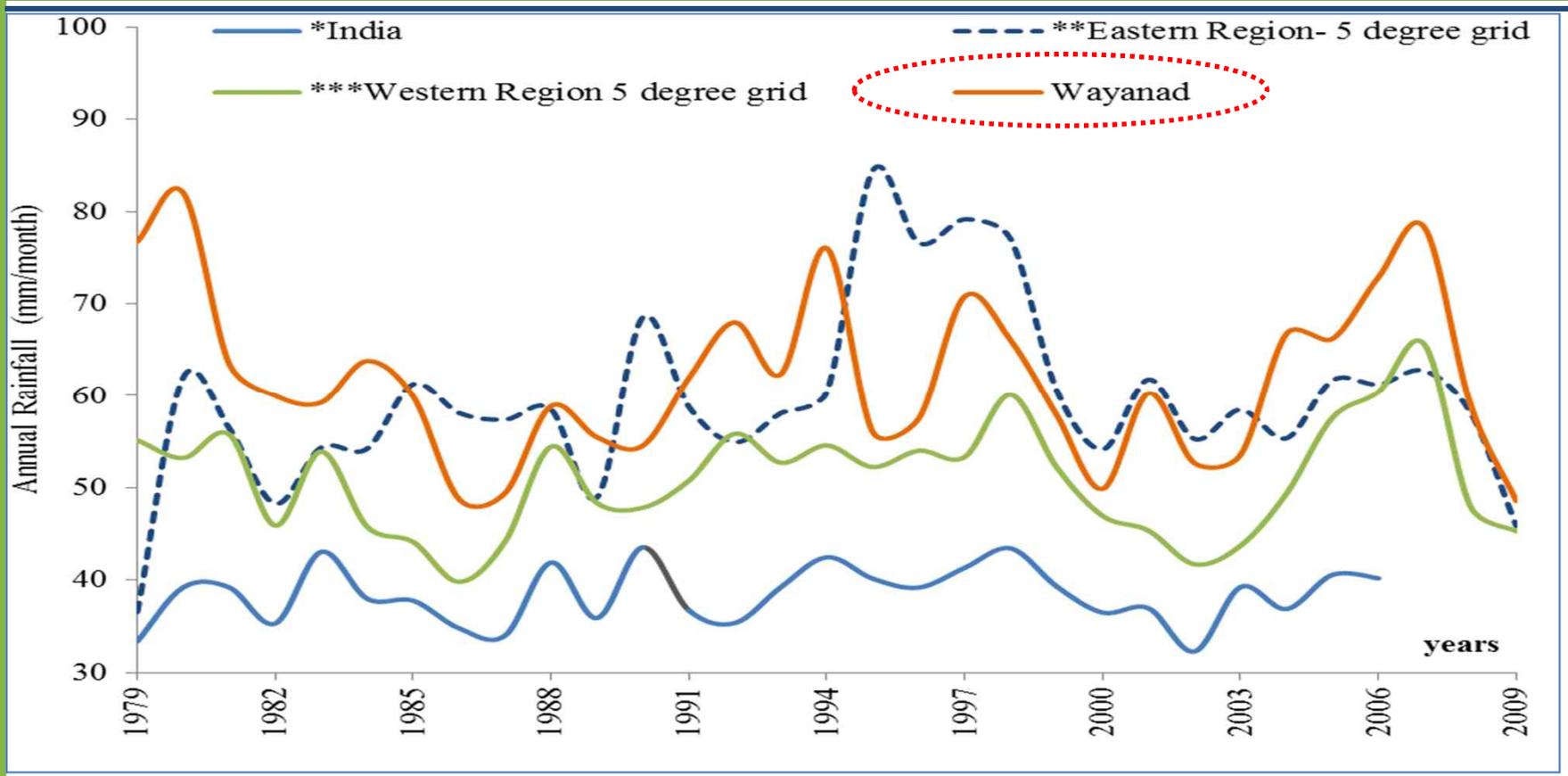
Winter Paddy is main contributor for the total production of rice both at state and district level

We study

- ❖ Local level climatic (rainfall pattern and atmospheric temperature) with temporal trends of rice (area and production)
- ❖ DTR (Diurnal Temperature Range) anomaly employed to comment on the effect of changing pattern of maximum and minimum temperature *vis-à-vis* environment suitability for rice in two seasons [summer (MAM) and winter (DJF)].

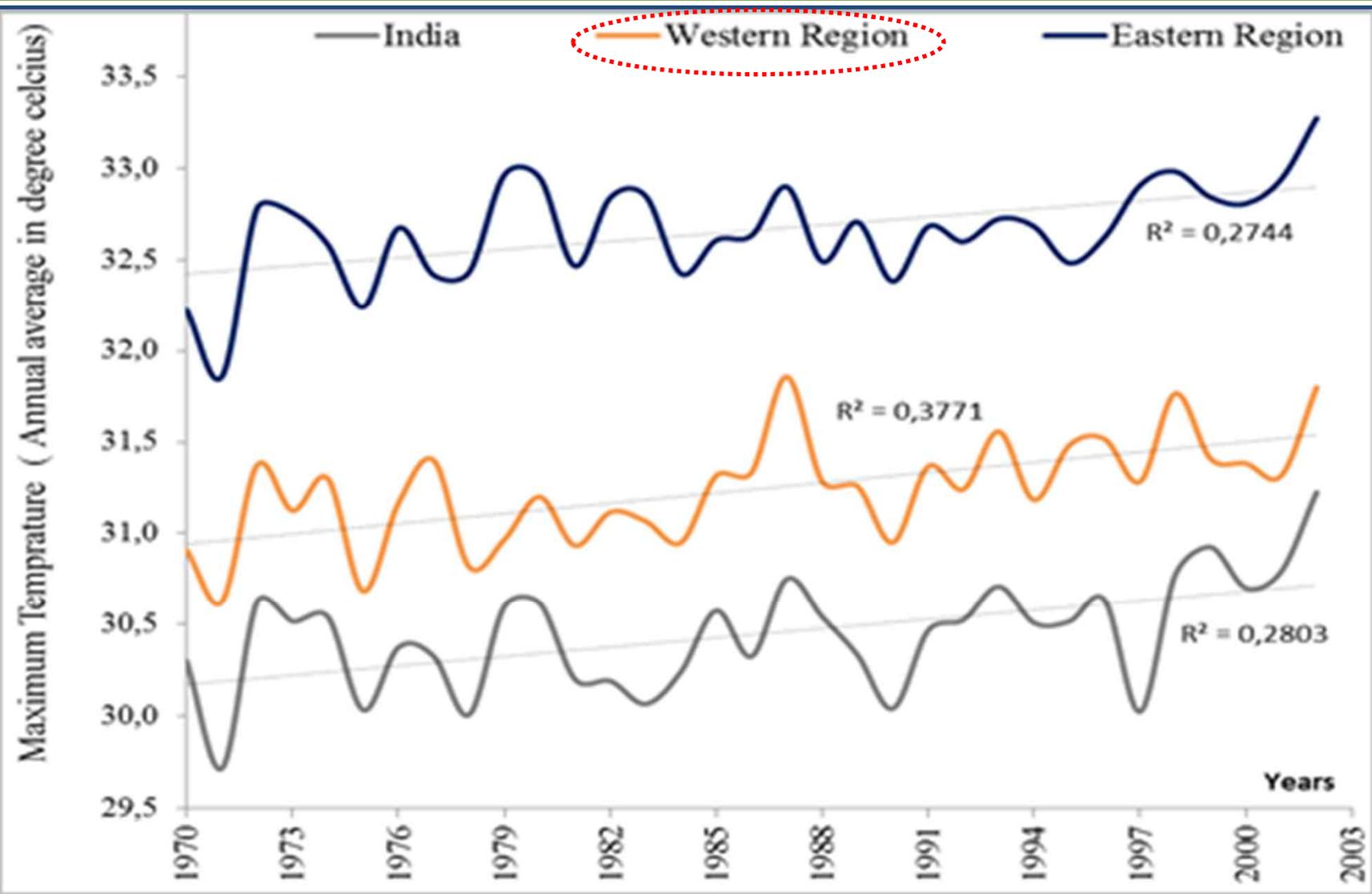


Rainfall Trend (1970's onwards)

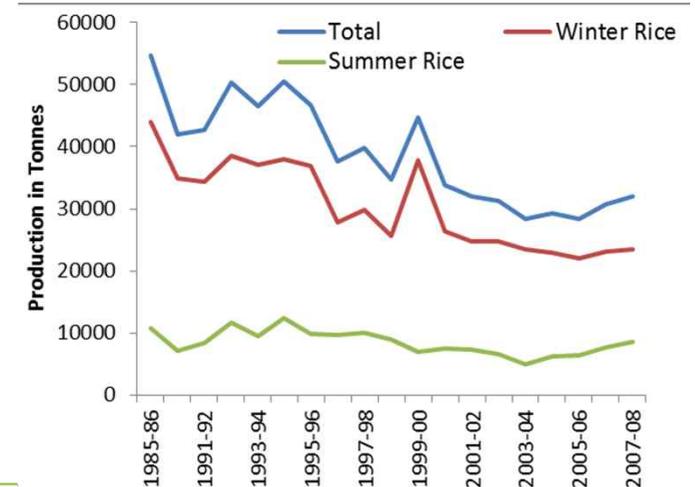
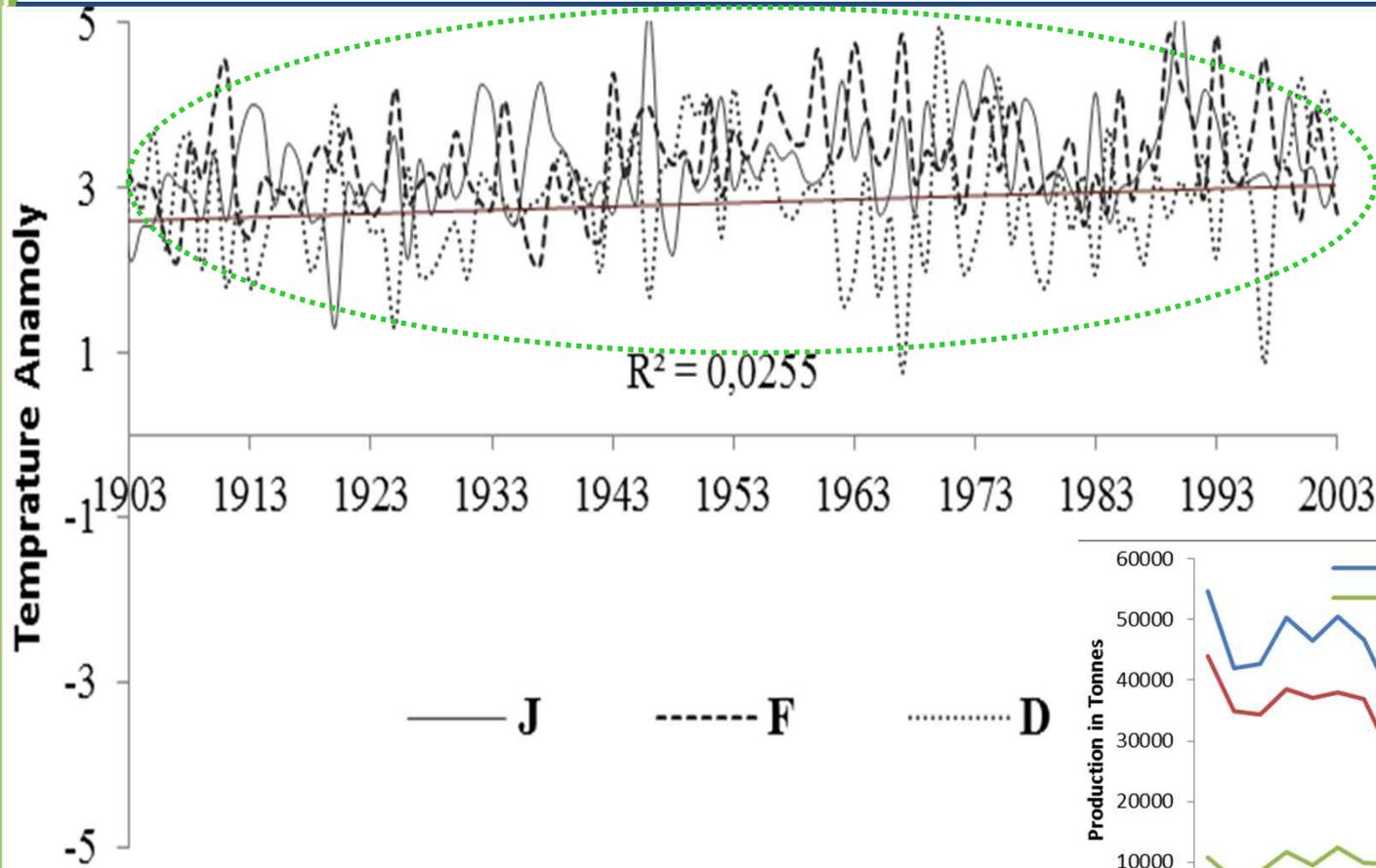


High variation compared to the zonal average

Temperature Trend



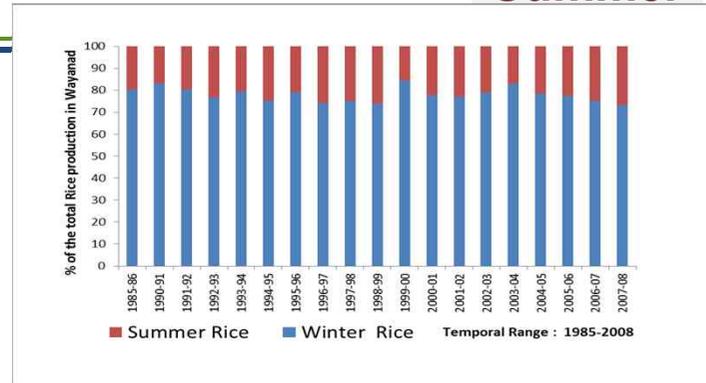
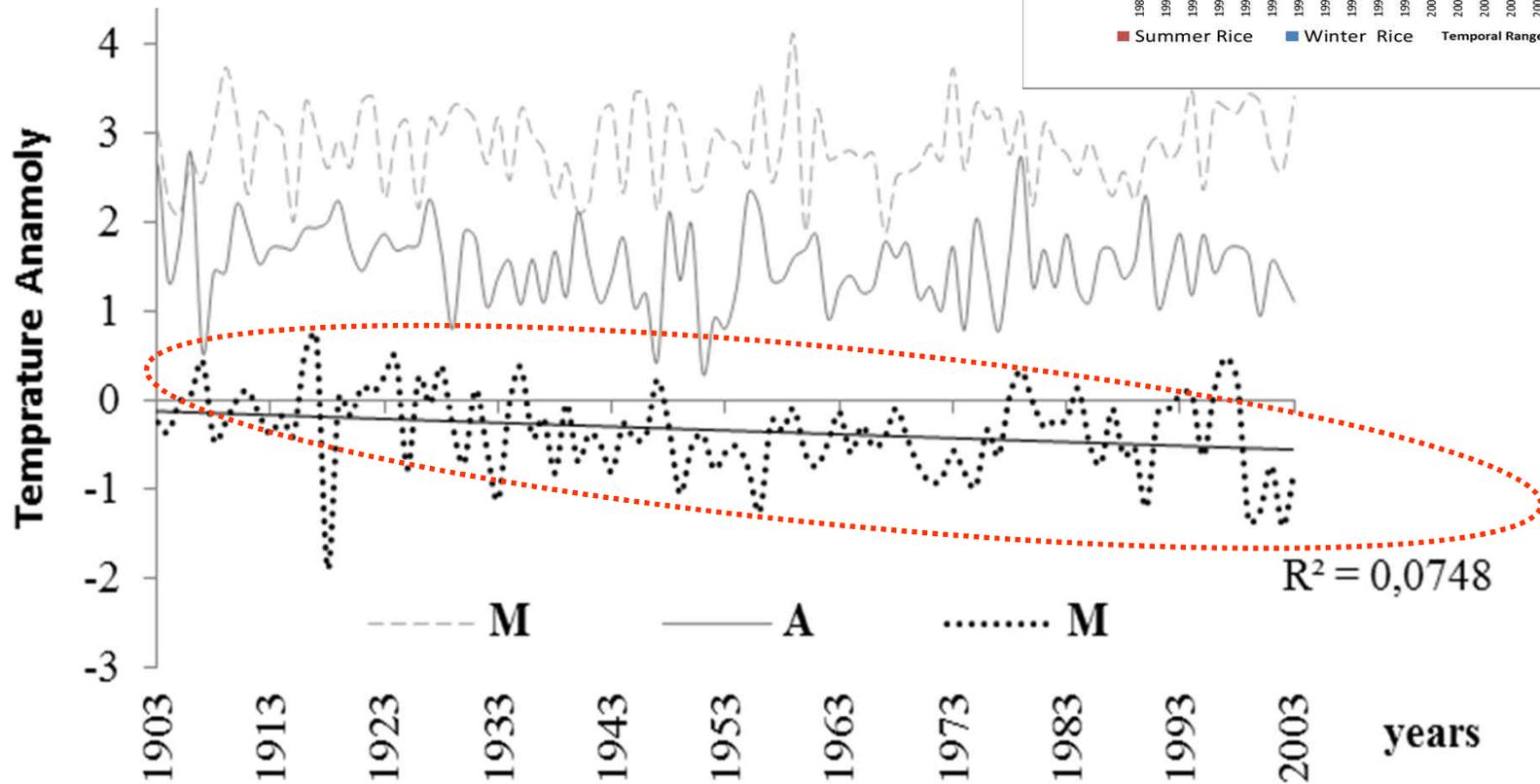
DTR (DTR [Diurnal Temperature Range) : Winter Rice



**Positive DTR value viewed as a reflection of warming effect
To some extent considered fair for crop production.**

DTR [Diurnal Temperature Range) Anomaly

Summer



Warming should not cross the threshold viz. optical/thermal) kinetic range (OKR/OTR)

Local Case Study : inferences

- Temporal variation in rainfall and surface temperature is one of the key determinant for change in land use practices (especially in context of **small-scale** and **rain fed agriculture**).
- Decline in productivity of rice would mean: **shift to other crops; shift to off-farm activities** for livelihoods and income (changing socio-economic profile) [most affected are landless, labor and women]
- Transformation in rice system would also mean loss of genotypic diversity of *Oryza* species along with associated biodiversity

Broad Reflections

- Climate variability is not just a physiological determinant of crop productivity but a defining factor for crop selection (land use)
- Interaction between multi-sectoral experts and transdisciplinary in research is key to address adaptation concerns
- A mix of modeling, projections, seasonality, assessment and observation show potential in addressing uncertainty linked with CC to a fair extent

Acknowledgment

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Moods of Rice

