

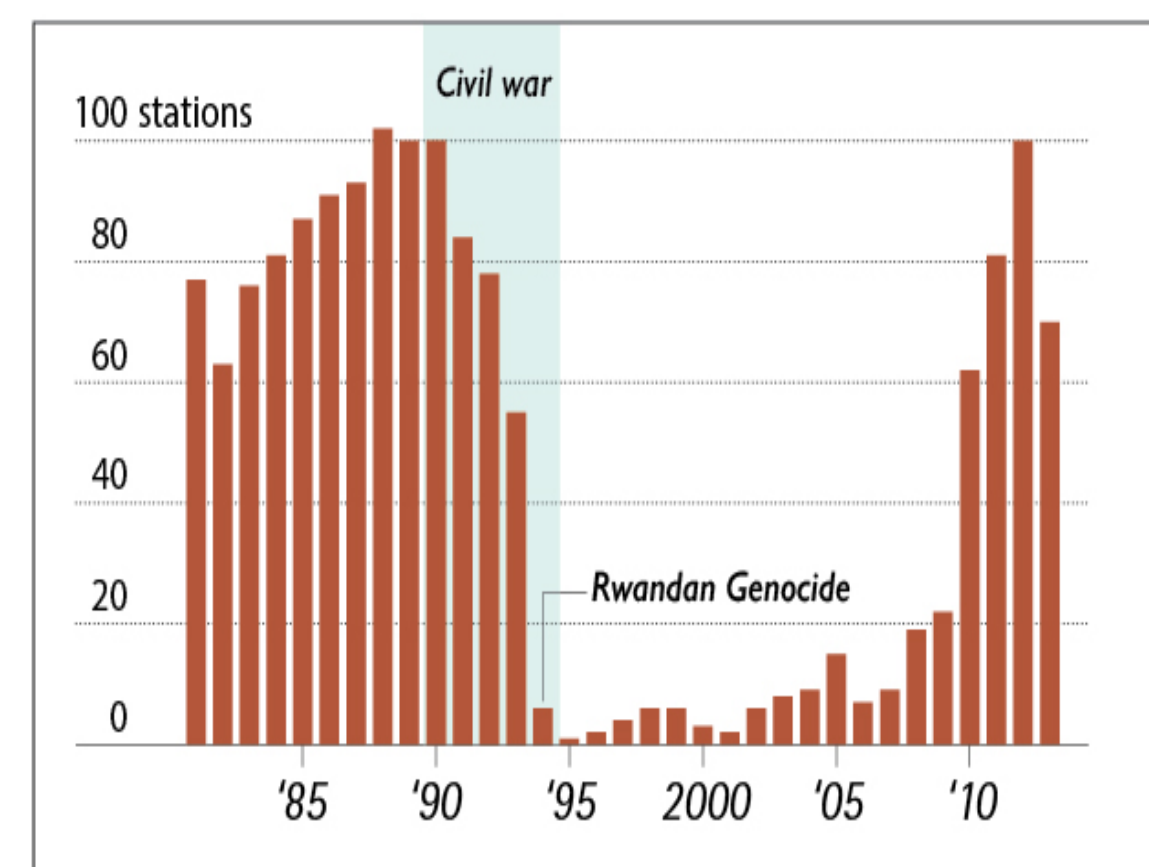
Climatology and Seasonal Forecasting Analysis from a new Multi-Decade High-Resolution Rainfall and Temperature Dataset for Rwanda

Asher Siebert, Tufa Dinku, Floribert Vuguziga, Anthony Twahirwa, Desire Kagabo, Simon Mason, Andrew Robertson, John DelCorral and Rémi Cousin
Rutgers Climate Symposium 2017



Introduction and Overview

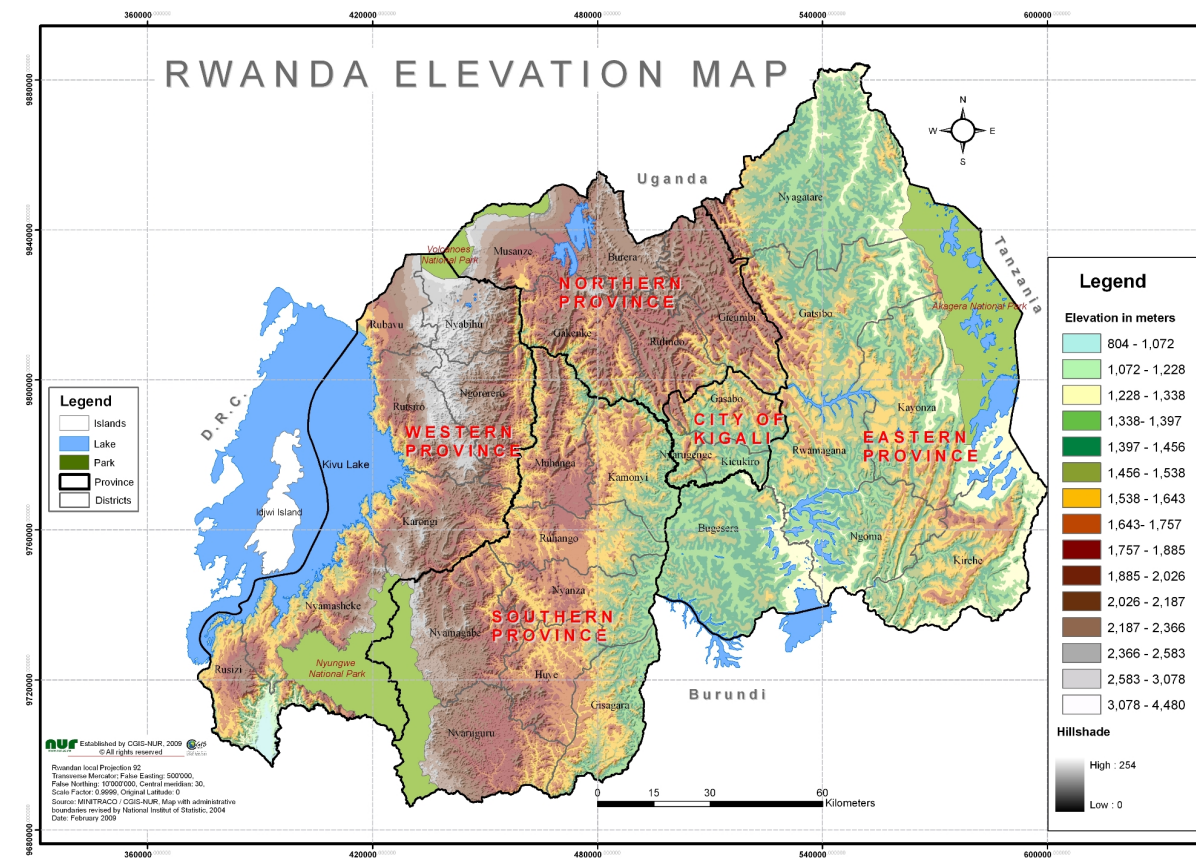
- Climate Change and Food Security (CCAFS) initiative funded by USAID through the Consultative Group on International Agricultural Research (CGIAR)
- Other Project partners include IRI, Rwanda Meteorology Agency, Rwanda Agriculture Board and CIAT (International Center for Tropical Agriculture)
- Four primary project objectives; Climate Services for Farmers, Climate Services for Governmental Planning, Climate Information Provision, National Climate Services Governance
- Over the four year life of the project, the goal is to provide over a million farmers (total population 11 million) with improved climate information, tailor the information to the specific needs of decision makers, strengthen and coordinate information sharing and institutions
- <http://iri.columbia.edu/news/new-climate-services-program-in-rwanda-aims-to-reach-one-million-farmers/>
- <https://ccafs.cgiar.org/building-climate-services-capacity-rwanda>
- Significant decline in meteorological station coverage from the mid-1990s to about 2010 due to the civil war, genocide and aftermath
- ENACTS (Enhancing NATIONAL Climate Services)
- Effort to merge station, satellite rainfall and reanalysis temperature records to offer continuous record at a high resolution (0.04 degree) (led by IRI scientist Tufa Dinku)
- With ENACTS, there is daily, dekad and monthly meteorological data for the country continuously from 1983-present (rainfall) and 1961-present (temperature)
- ENACTS in many other countries in Africa; Ethiopia, Ghana, Madagascar, Mali, Tanzania, Zambia
- <http://iri.columbia.edu/resources/enacts/>



Met station coverage in Rwanda

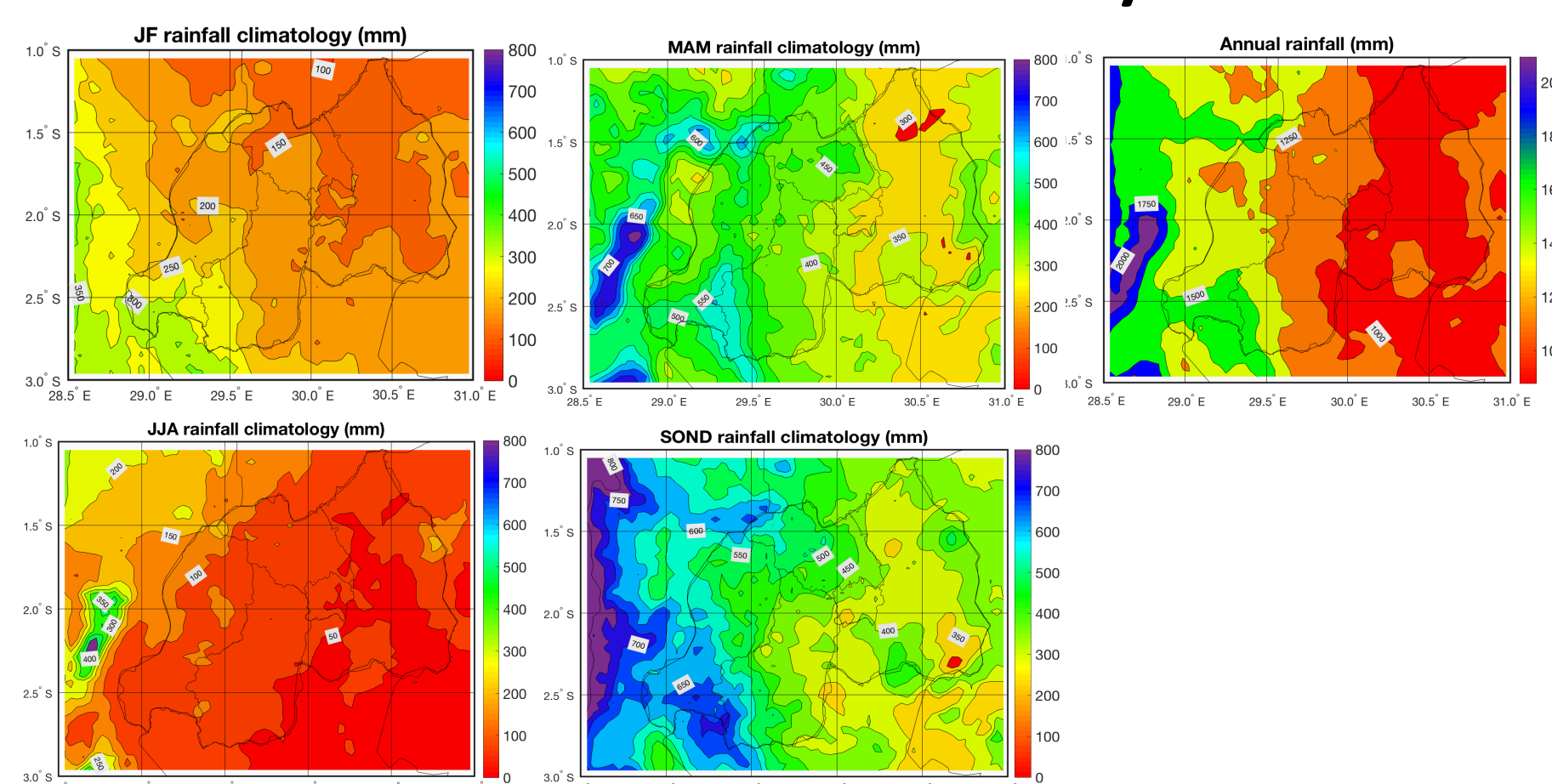
Topography and Climate

- Highly mountainous country in the African Rift Valley – median elevation almost 5,000 ft. above sea level, highest peak almost 15,000 ft. above sea level
- Wetter west than east (orographic enhancement)
- Elevation is a strong control on temperature
- MAM and SOND rainy seasons
- Suppressed rainfall in JF, almost completely dry in June-August
- Meteo-Rwanda Maproom page:
- <http://maproom.meteorwanda.gov.rw/maproom/>
- Training report: <http://hdl.handle.net/10568/89105>



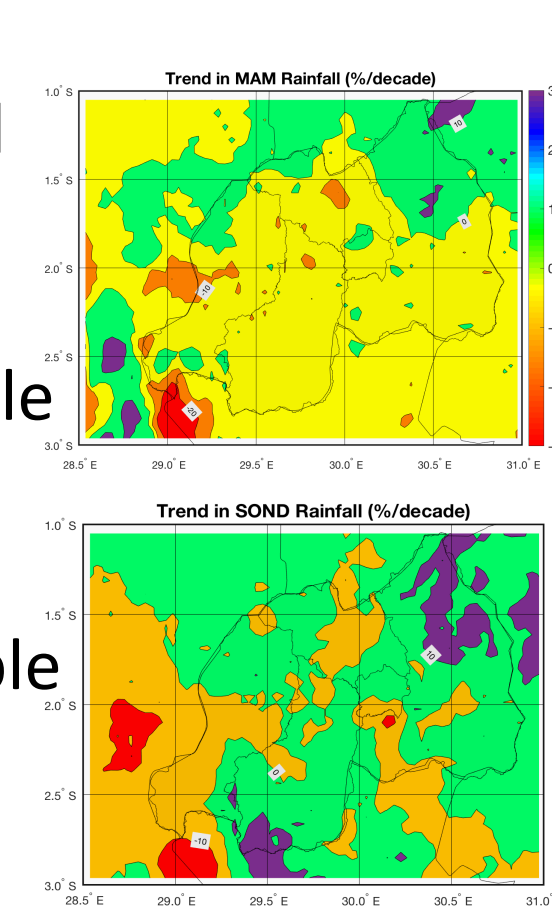
Topographic Map

Rainfall Seasonality

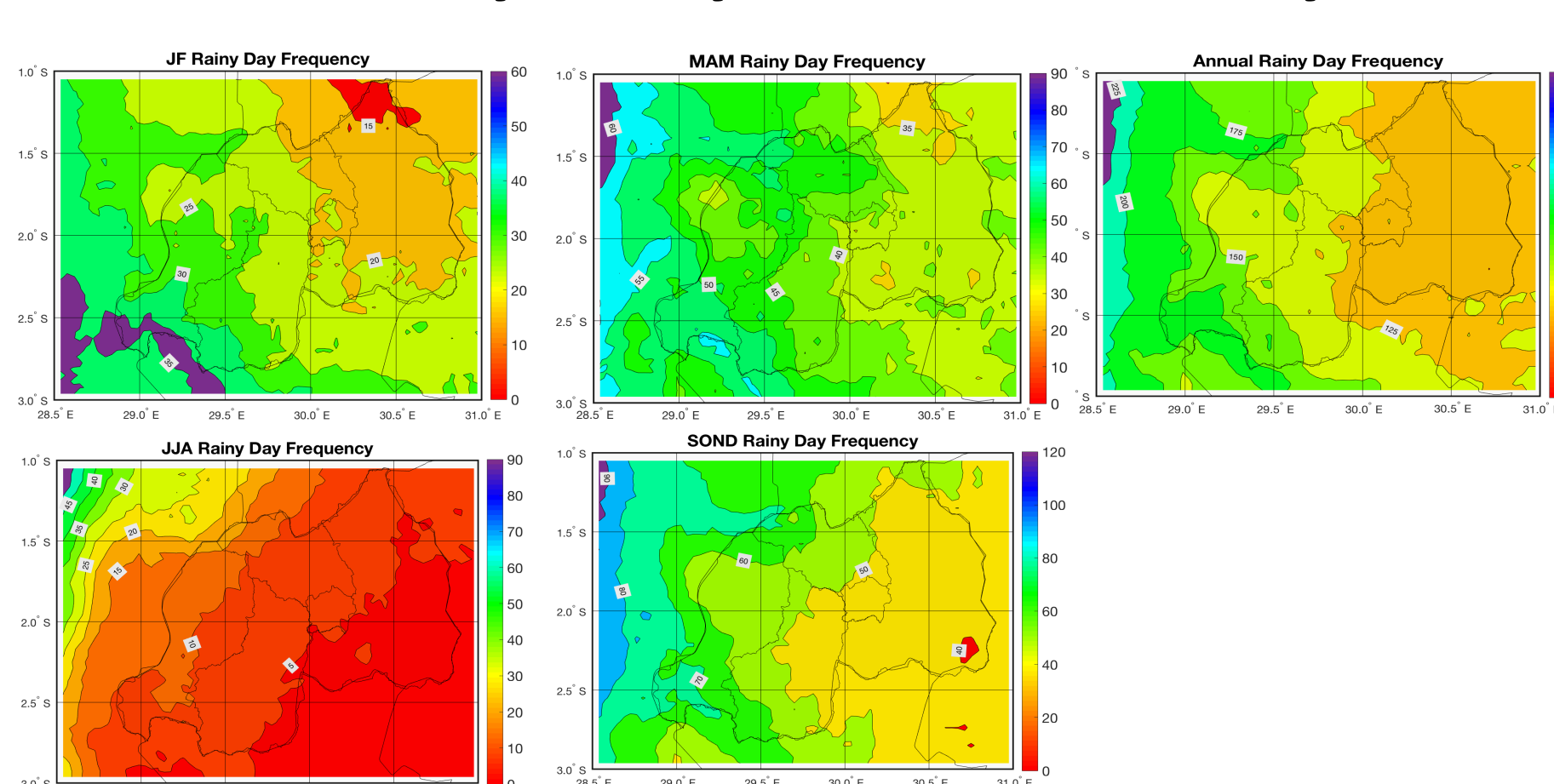


Trends

- Most of the annual rainfall in MAM and SOND
- Trend towards drier conditions in MAM (notable exception in NE)
- Trend towards wetter conditions in SOND (notable exception in SW)

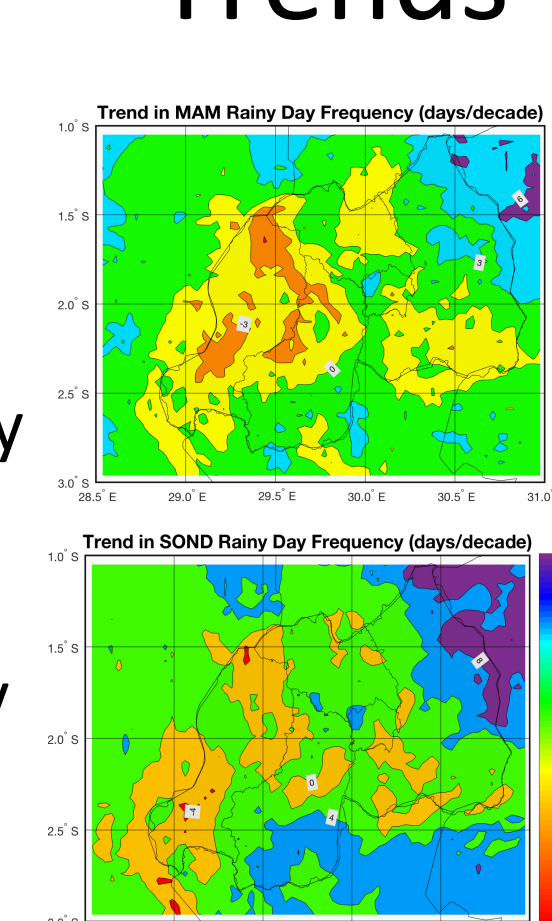


Rainy Day Seasonality

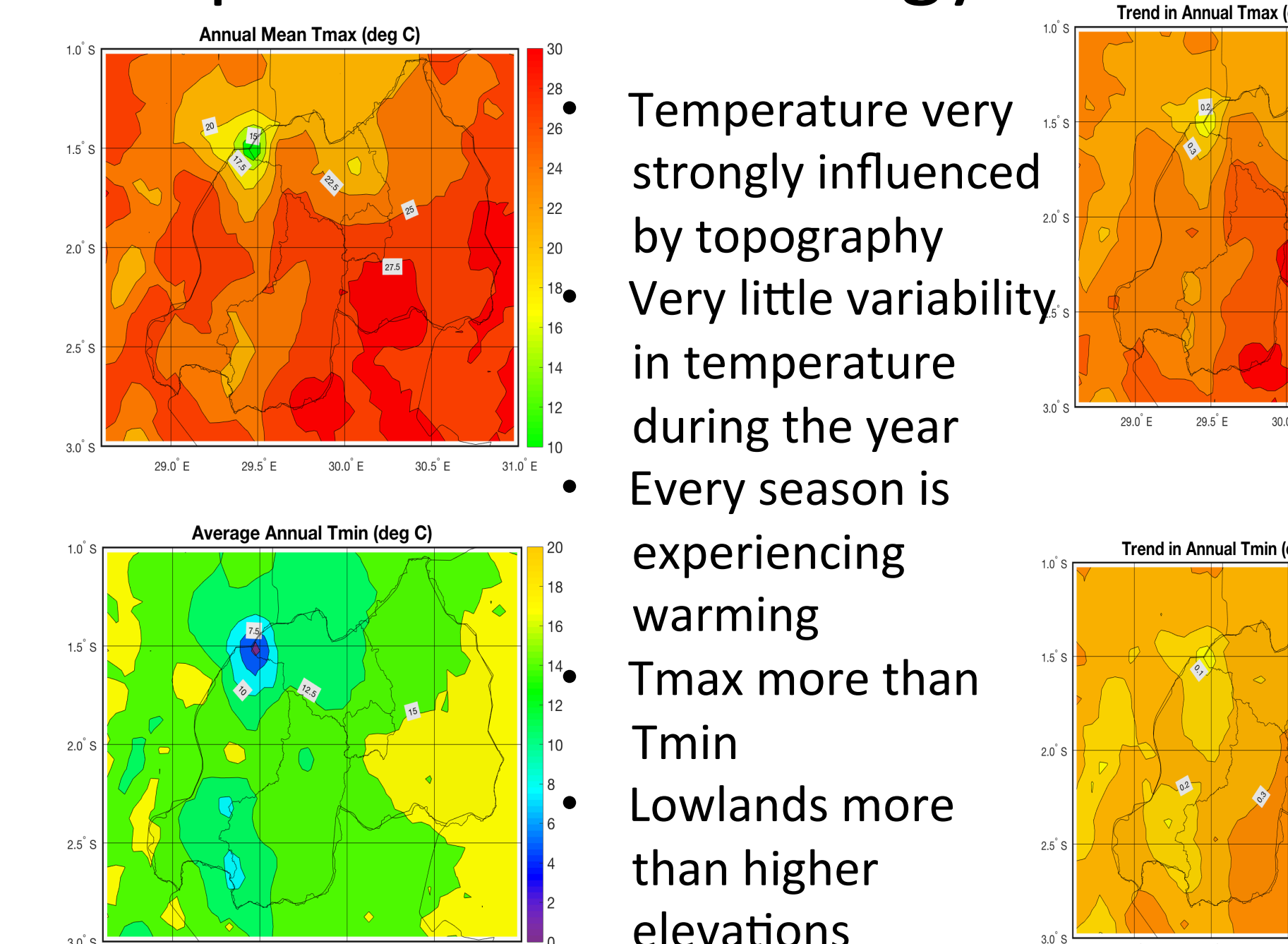


Trends

- Rainy day frequency is closely related to total rainfall patterns
- Trend towards fewer rainy days in MAM (notable exception in NE)
- Trend towards more rainy days in SOND (notable exception in SW)

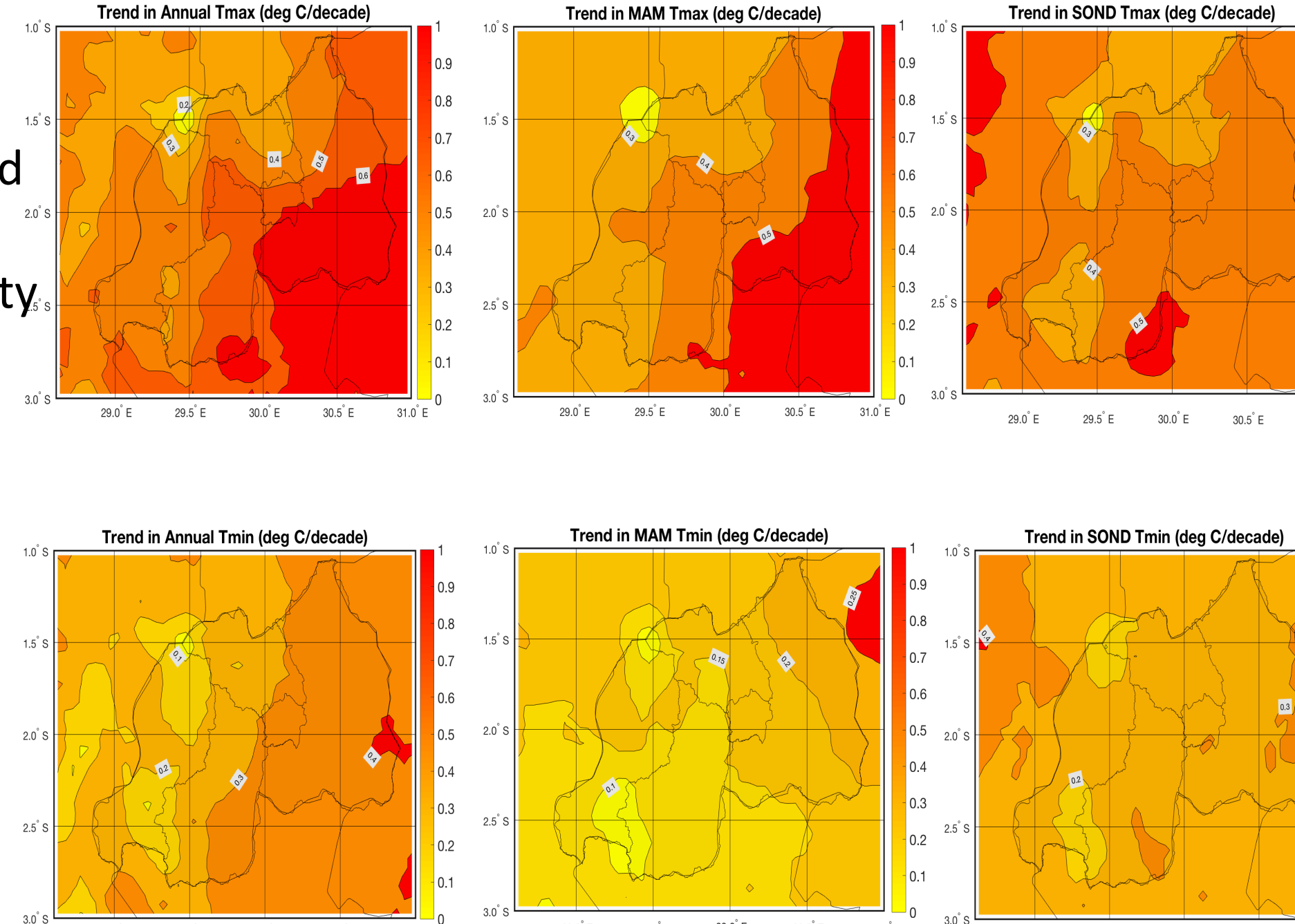


Temperature Climatology



- Temperature very strongly influenced by topography
- Very little variability in temperature during the year
- Every season is experiencing warming
- Tmax more than Tmin
- Lowlands more than higher elevations

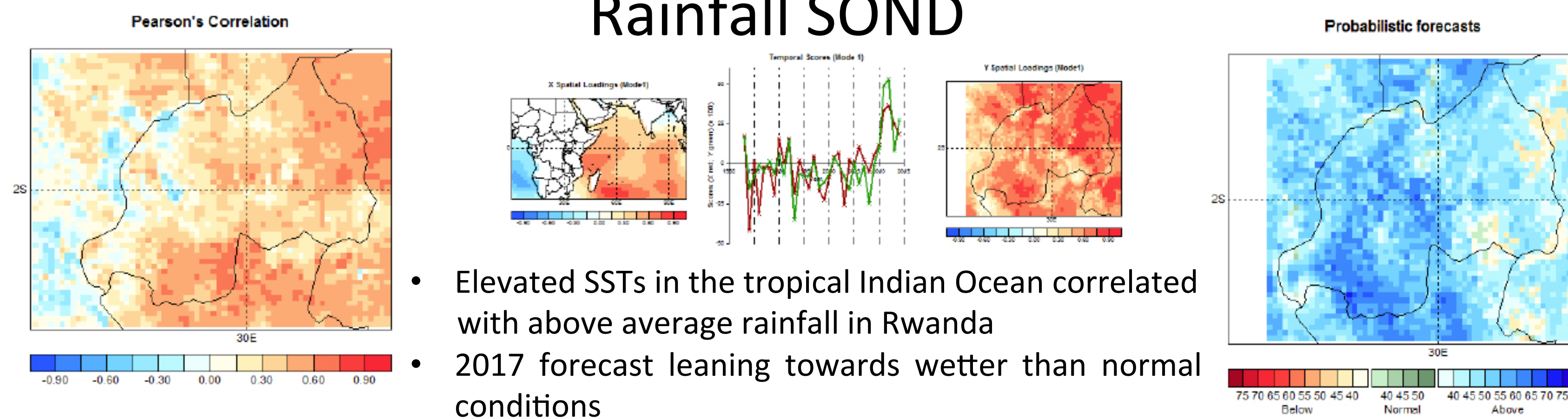
Trends



Seasonal Forecasting

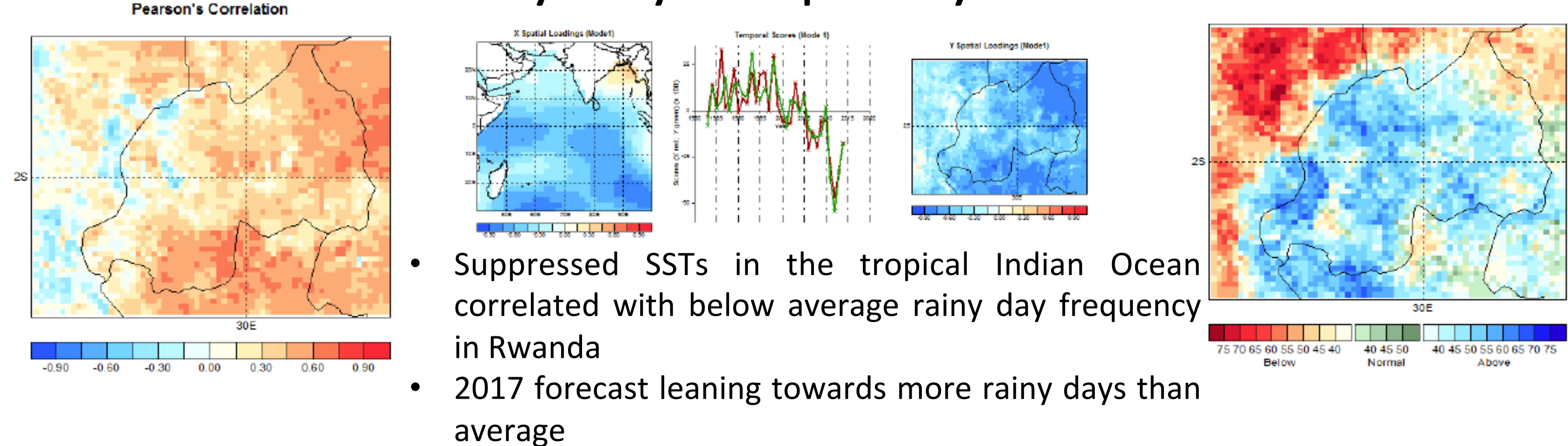
- Main moisture source for most of the country is Indian Ocean
- Similar ENSO and IOD response to the rest of East Africa; warm SSTs in the Western tropical Indian Ocean tend to correspond to wetter conditions in Rwanda, Cool SSTs in the Western Tropical Indian Ocean tend to correspond to drier conditions in Rwanda
- Some moisture advection from the Congo basin during JFMAM (especially February)

Rainfall SOND



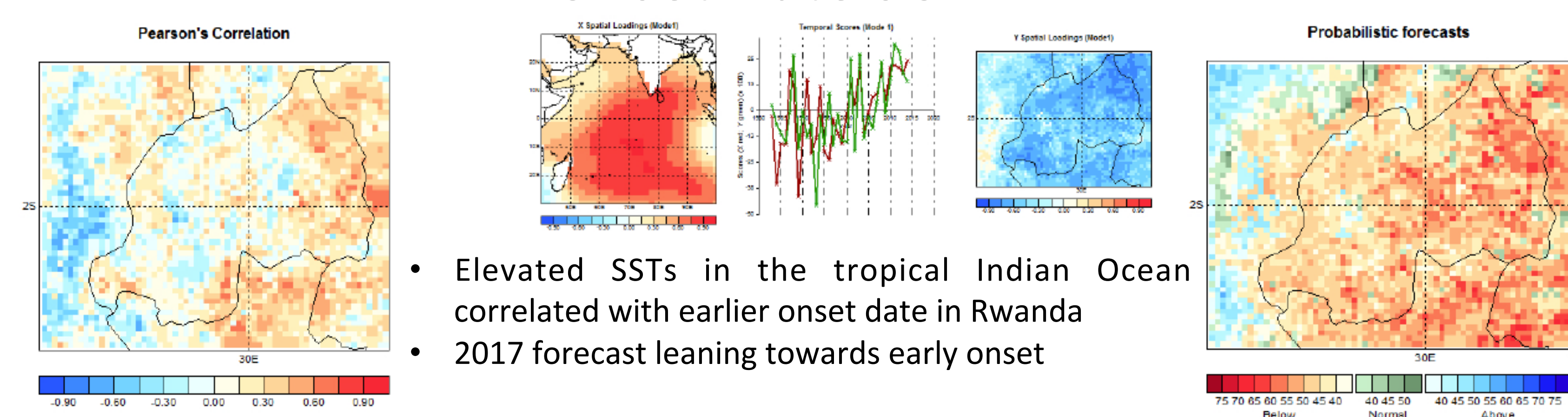
- Elevated SSTs in the tropical Indian Ocean correlated with above average rainfall in Rwanda
- 2017 forecast leaning towards wetter than normal conditions

Rainy Day Frequency SOND



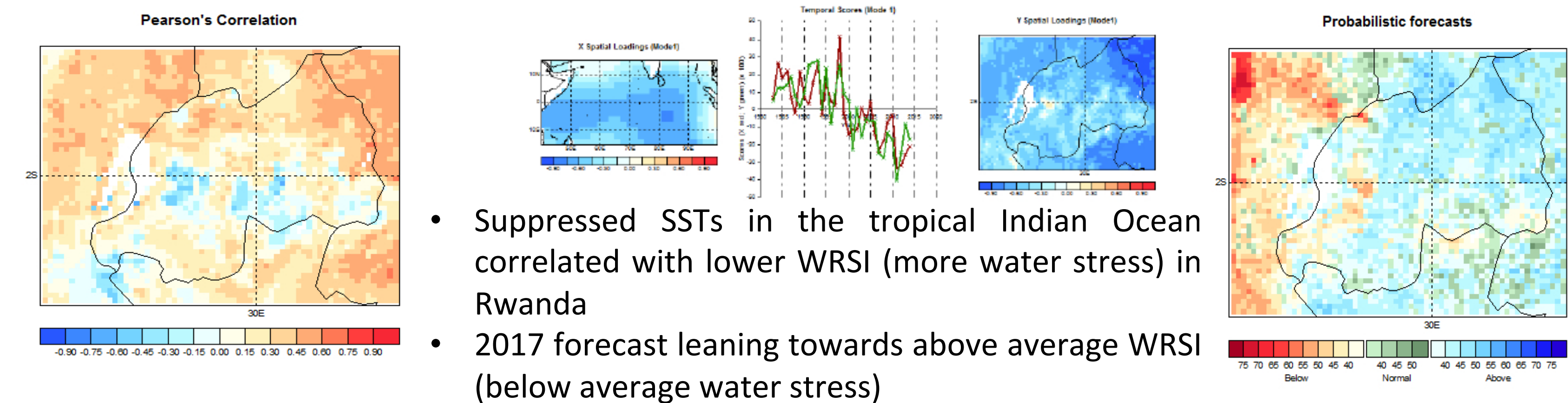
- Suppressed SSTs in the tropical Indian Ocean correlated with below average rainy day frequency in Rwanda
- 2017 forecast leaning towards more rainy days than average

Onset Date SOND



- Elevated SSTs in the tropical Indian Ocean correlated with earlier onset date in Rwanda
- 2017 forecast leaning towards early onset

Bush Beans WRSI SOND



- Suppressed SSTs in the tropical Indian Ocean correlated with lower WRSI (more water stress) in Rwanda
- 2017 forecast leaning towards above average WRSI (below average water stress)

Future/Ongoing Work

- Refine seasonal total rainfall forecasting methodology
- Refine forecasts for other statistics (number of rainy days, dry spell length, onset and cessation dates, etc.), especially for MAM season
- Stay in touch with trainees to hone forecast dissemination and capacity building
- Provide/aid in the provision of forecast information in probability of exceedance format
- Explore role of multi-decadal variability
- Refine crop specific WRSI forecasts
- Continue with work on climatology (peer reviewed publication to be submitted to IJoC, AMS presentation January 2018)
- Study influence of ENSO and IOD in more detail
- Develop more detailed understanding of the dynamics of Rwanda's climate (wind field, moisture advection, etc.) at both seasonal and subseasonal time scales (including the role of the MJO)
- Forecast verification (both meteorological and agro-meteorological)
- Continue connecting meteorological work with agricultural work and water balance assessment
- Evaluate and adapt forecast output to user needs
- Work with regional partners at Kenya's ICPAC

Acknowledgements

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