

# The Influence of Pacific and Indian Ocean sea surface temperatures on monthly rainfall in Mauritius



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# Goal

Quantify rainfall anomalies associated with El Niño Southern Oscillation (ENSO), the Indian Ocean Dipole (IOD) and the Subtropical Indian Ocean Dipole (SIOD) in Mauritius.



# Research questions

- 1) Are individual and combined phases of ENSO, IOD and SIOD associated with significant monthly rainfall anomalies?
- 2) How do these relationships vary across the island?

# Rationale

Once the site-specific relationship is defined, signs of developing events can be incorporated into long range weather forecasts, agricultural strategies, climate risk management plans

# Why Small Island Developing States?



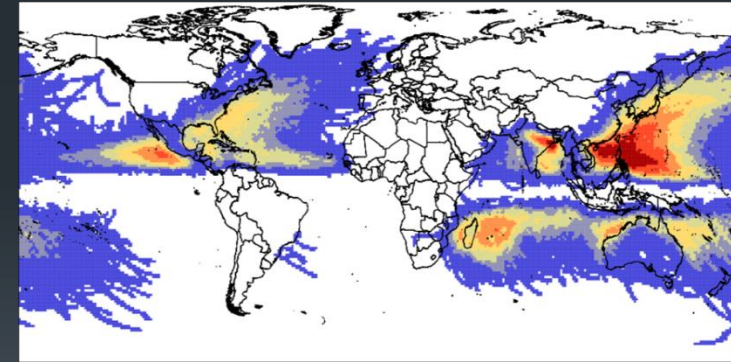
## A need

- Most sensitive to climate change
- High uncertainty in Climate Change projections
- Little political bargaining power



## An Opportunity

- Pre-satellite data on tropical oceans\*
- Sensitivity : “Canary in the coal mine” of Climate Change



<http://www.nytimes.com/interactive/2009/12/05/world/climate-graphic-players.html>

International best track archive for climate stewardship:

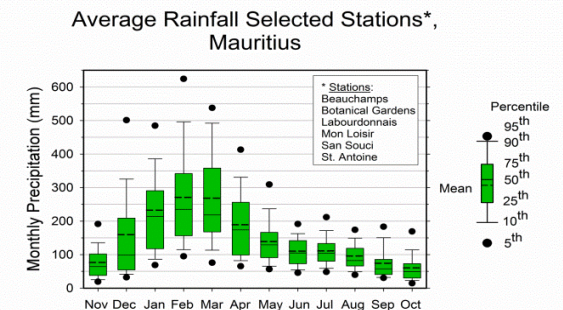
<http://www.katrisk.com/products.html>

# Study Area

- SW Indian Ocean (20.2°S 57.3°E)
- Small
- Densely populated
- Complex topography
- Rainfall seasonal
  - highly variable across space and time



www.operationworld.org



# ENSO, IOD and SIOD

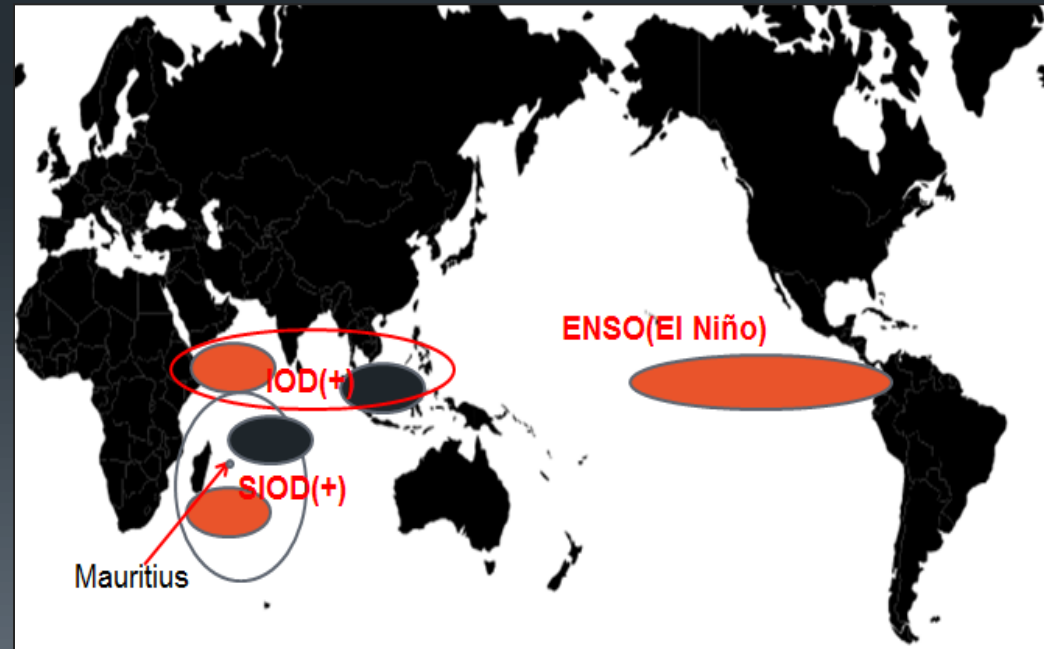


## Similarities

- Responsible for climate variability at the same (temporal) scale
- Phases (warm and cool)
- Periodicity

## Differences

- Influence on IO SST
- Structure
- Center of activity
- Duration
  - Seasonal phase locking (Dipoles)
- Formation mechanism
  - IOD/ENSO vs SIOD



# Methods



## Data and Sources

- Monthly Rainfall totals - 20 rainfall stations 1960-2011 (Monthly Met. Summaries)

## Variables

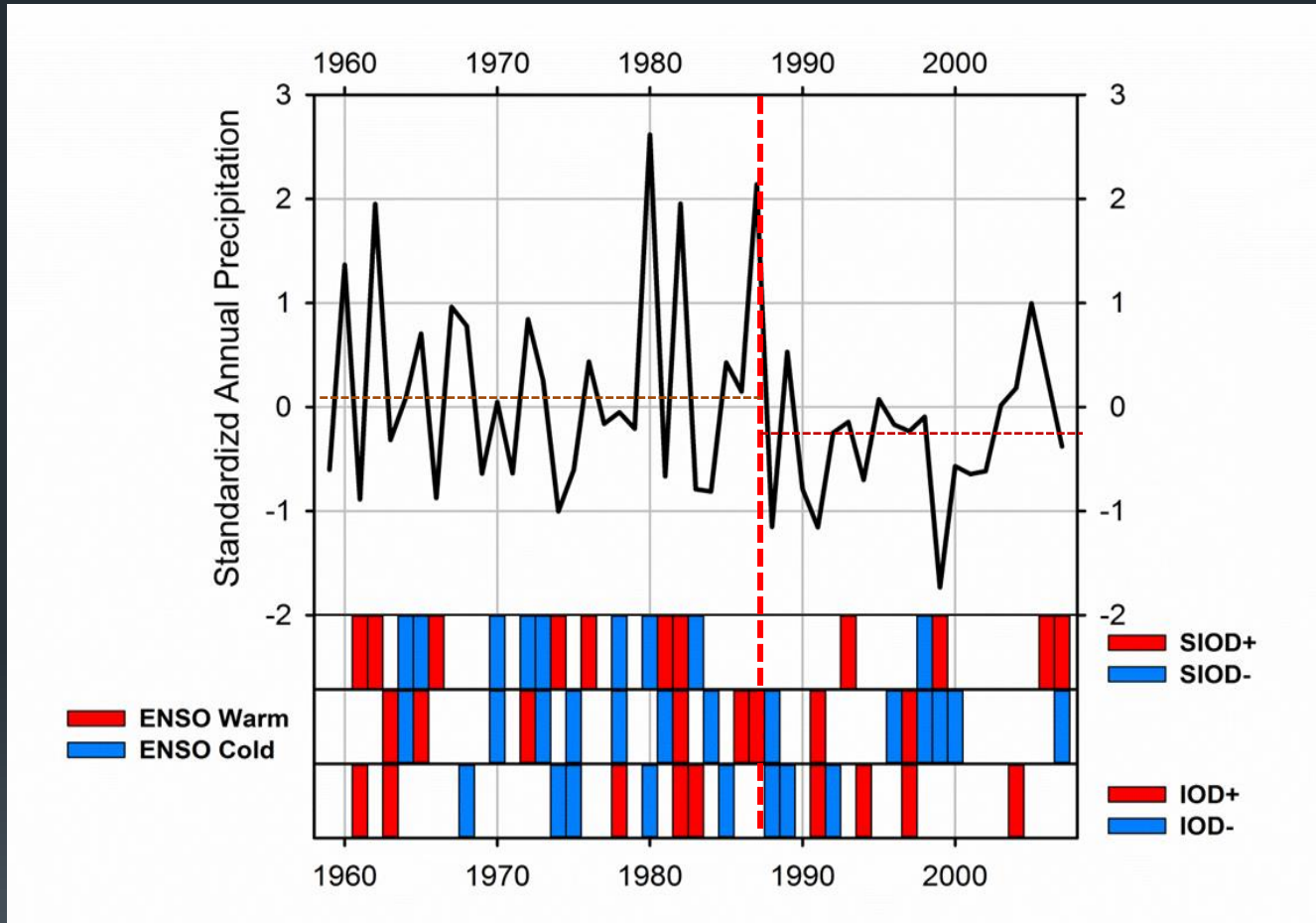
- Monthly anomalies
- Nino3.4, Dipole Mode Index (DMI), Subtropical Dipole Index (SDI)
- Phases - 0/1 Dummy variables

## Analysis

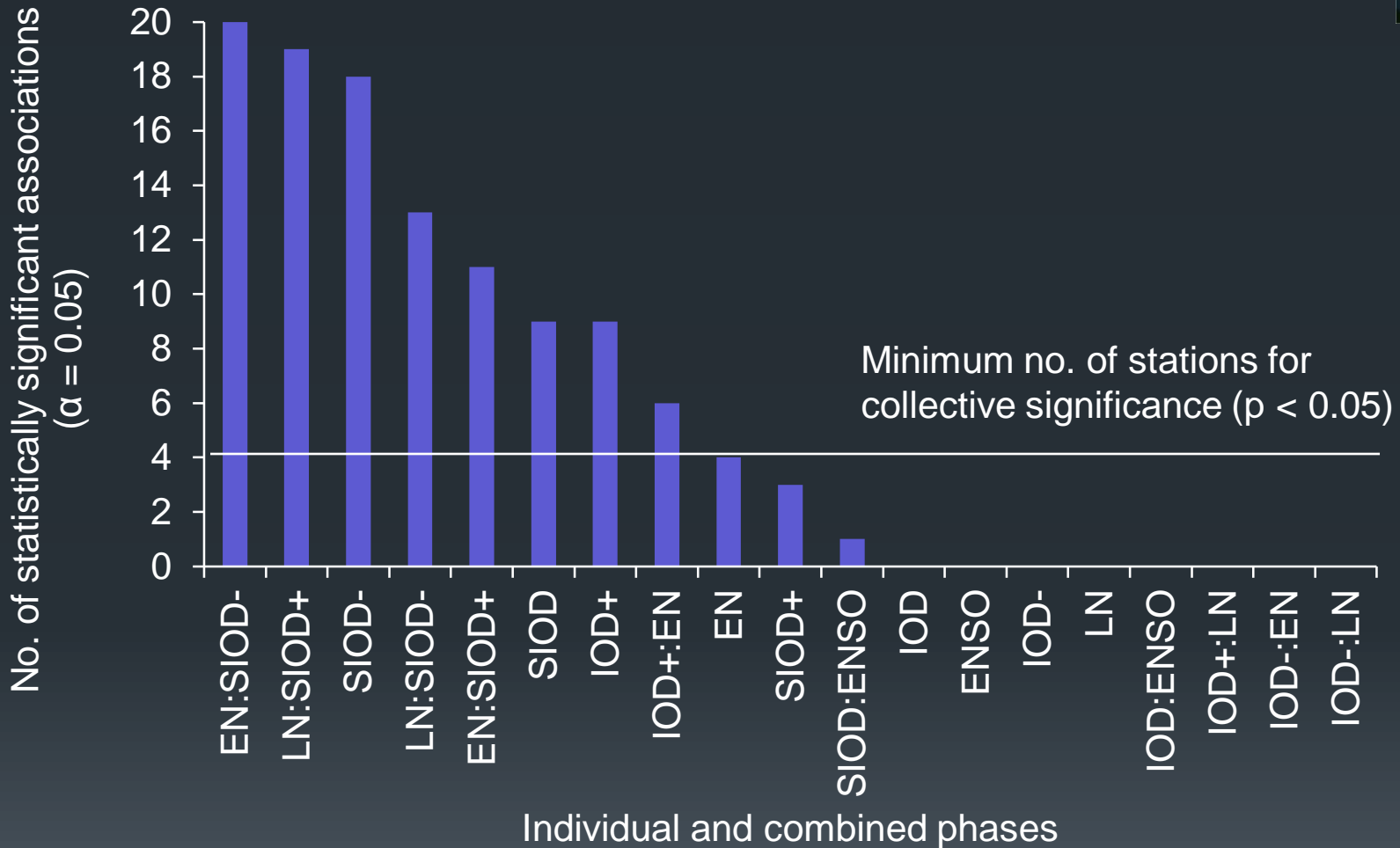
- Break identification + phase frequency distribution
- Relationship with monthly rainfall anomalies
- Collective significance of signal



# Results and discussion



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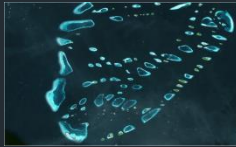


No. of observations = 612, no. of predictors = 19.

Adjusted R Square (average across stations) = 0.036.



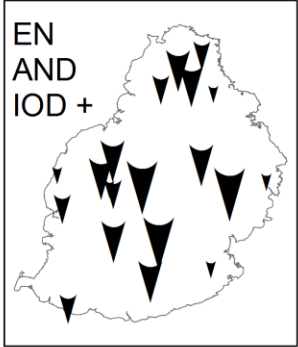
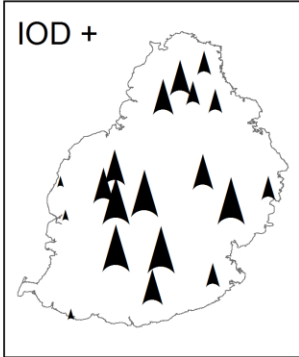
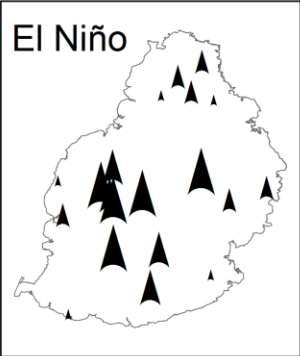
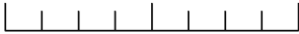
# Results and Discussion



El Niño and Positive IOD forced anomalies on monthly rainfall in Mauritius 1960-2010



0 15 30 60 Kilometers



Coefficient Estimates

- ▲ 42 - 48
- ▲ 34 - 41
- ▲ 25 - 33
- ▲ 17 - 24

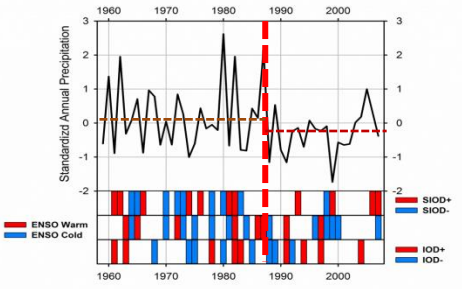
- ▲ 58 - 88
- ▲ 37 - 57
- ▲ 27 - 36
- ▲ 17 - 26

- ▼ -41 - -31
- ▼ -55 - -42
- ▼ -71 - -56
- ▼ -85 - -72

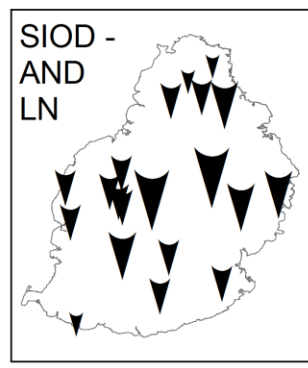
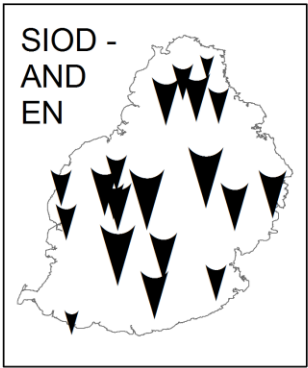
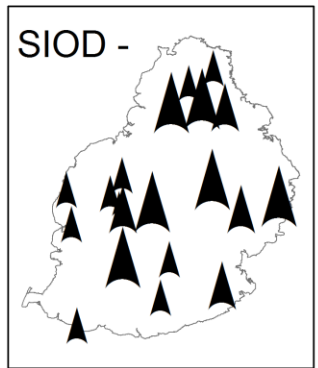
# Results and Discussion



Negative SIOD and ENSO forced anomalies on monthly rainfall in Mauritius 1960-2010



0 15 30 60 Kilometers



- ▲ 122 - 158
- ▲ 96 - 121
- ▲ 49 - 95
- ▲ 48

- Coefficient Estimates
- ▼ -111 - -83
  - ▼ -149 - -112
  - ▼ -191 - -150
  - ▼ -244 - -192

- ▼ -75 - -34
- ▼ -126 - -76
- ▼ -183 - -127
- ▼ -235 - -184

# Contribution so far



- Data accessibility
- Scientific evidence
  - Spatially explicit estimates of rainfall response to ENSO, IOD, and SIOD
  - SIOD-, IOD+ and El Niño associated with anomalously wet years
  - Interacting processes result in severe dry periods
  - Relationships are distinct and different from those observed in S. Africa
  - Fodder for the formulation of new scientific questions

## Soon...

- Break down the science – make it more digestible!
  - Use it to answer plausible “what if” questions
    - Help managers and decision makers solve problems faster

## Funding

- Rufford Small Grants for Nature Conservation
- UF Graduate School
- UF Tropical Conservation and Development Program
- UF Center for African Studies
- Jeanne and Hunt Davis Foundation

## Data and Logistics

- Mauritius Meteorological Services (MMS)
- Mauritius Meteorological Society
- Mauritius Sugar Industry Research Institute (MSIRI)
- Sugar Estates Alteo, Medine, Terra, Omnicane
- Volunteers from the University of Mauritius (UoM)

