Seasonal Variation of Active and Break Spells over the Arabian Sea and the Bay of Bengal

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Outline

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- Analysis
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Introduction

Introduction

- **Intra-seasonal variation** of rainfall is the most important source of weather variability in India
- Intra-seasonal variation of rain spells are of two types **Active spells (excess rainfall) and Break spells (scanty rainfall)**
- Inter-annual variaton of Actve and Break spells are due to global annual cyclic environmental conditions like **El Niño(Dry conditons) and La Niña(Wet conditons)**
- My project is an attempt to study intra-seasonal variation of these spells over the **Arabian Sea and Bay of Bengal during the South West monsoon season during normal, El Niño and La Niña years.**

Data

Data

- The Tropical Rainfall Measuring Mission (**TRMM**) is a joint U.S.-Japan satellite mission to monitor tropical and subtropical precipitation and to estimate its associated latent heating.

- To identify active and break spells, 16 years TRMM Data (3B42 Version 7). (1998-2013). (spatial resolution=0.25^{0} and temporal resolution of 3 h)

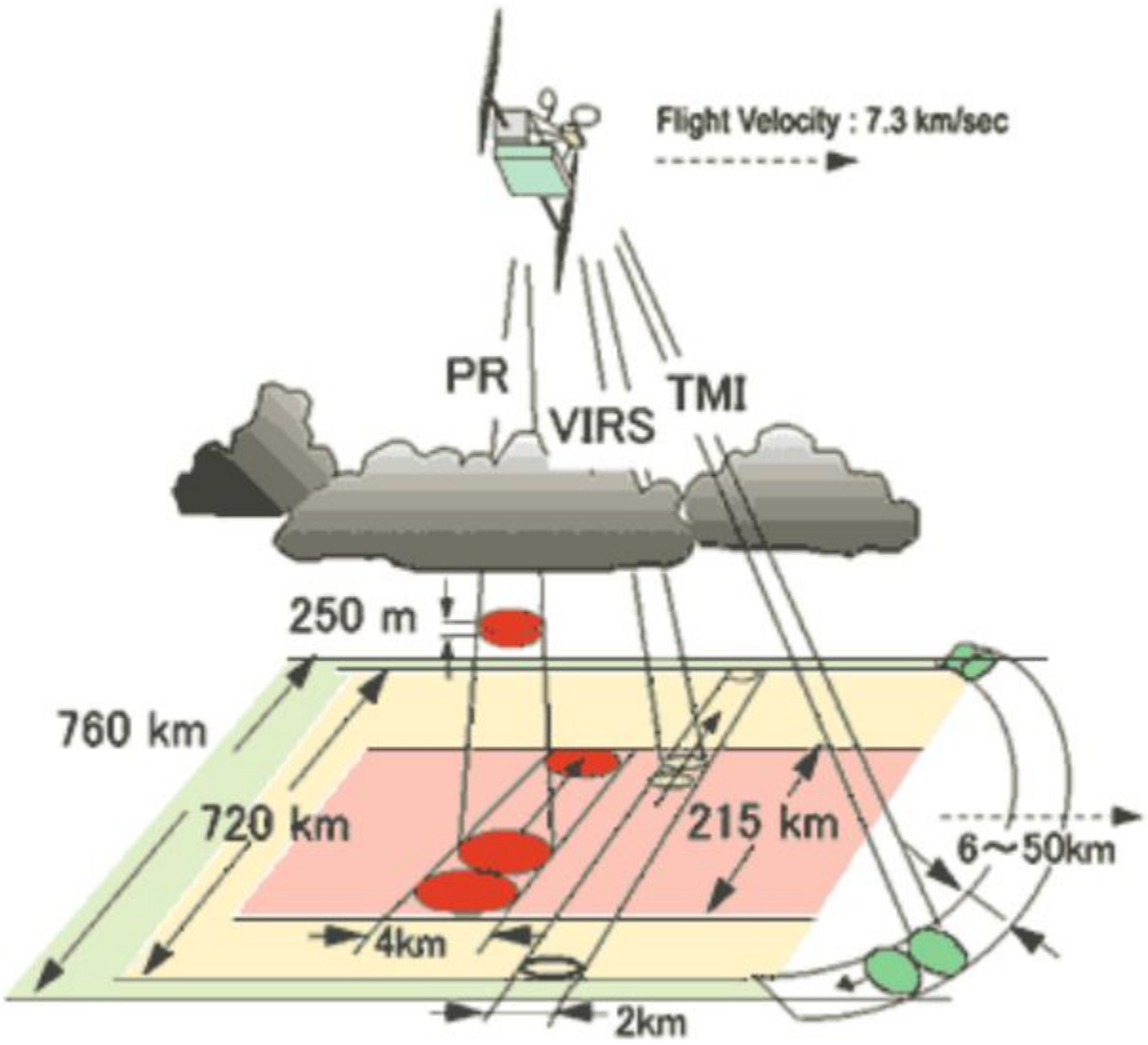
- 1400x400 grids(0-360 ^{0}E, 50^{0}N-S).

Data

- The TRMM Satellite is composed of 3 main instruments to measure rainfall.
- The Visible Infrared Radiometer (VIRS) which
- observes cloud coverage type and temperatures
- The TRMM Microwave Imager(TMI) which records the integrated column precipitaton content rain intensity and type and other rainfall parameters.
- The Precipitaton Radar (PR) which measures the 3D rainfall distributon over both land and ocean and and defnes the layers depth of precipitaton.

Data

- The 3B42 algorithm combines multiple independent precipitation estimates from the TMI and many other satellites
- Advanced Microwave Scanning Radiometer for Earth Observing Systems (AMSR-E)
- Special Sensor Microwave Imager(SSMI)
- Special Sensor Microwave Imager/Sounder (SSMIS)
- Advanced Microwave Sounding Unit (AMSU),
- Microwave Humidity Sounder (MHS)
- Microwave-adjusted merged geo-infrared (IR)


Flight Velocity : 7.3 km/sec
PR
VIRS
TMI
250 m
760 km
720 km
215 km
6~50km
4km
2km

Analysis

Analysis

- **Accumulated Daily Rainfall**
- Accumulated Daily Rainfall (ADR) is the total daily rainfall of concerned area of study(in this case the Arabian see and the Bay of Bengal). It gives us the rainfall per 0.25^0 x0.25^0 grid point per day measured in mm/day which is spatially averaged over the study area.
- **Frequency of spells**
- The number of Active spells, Break spells, and the number of days these spells have occurred for calculated separately
for the Arabian Sea and the Bay of Bengal.
We again compared this between El Niño years and La Niña years.

Standardised Rainfall Anomaly

$$SRA = \frac{r - \mu}{\sigma}$$

SRA = Standardised Rainfall Anomaly

r = Spatially averaged rainfall per day for one year

μ = Mean rainfall spatially and temporally averaged over 16 years

σ = Standard deviation of rainfall spatially and temporally averaged over 16 years

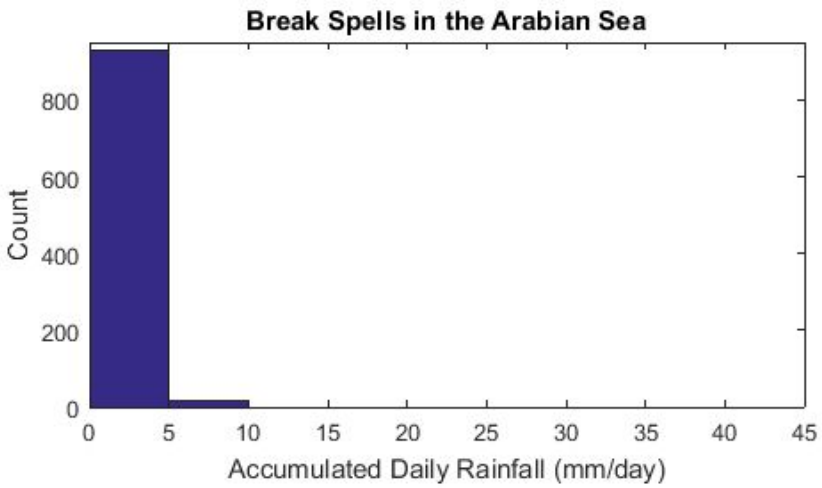
If SRA > 0.5 for 3 consecutive days -> Active Spell

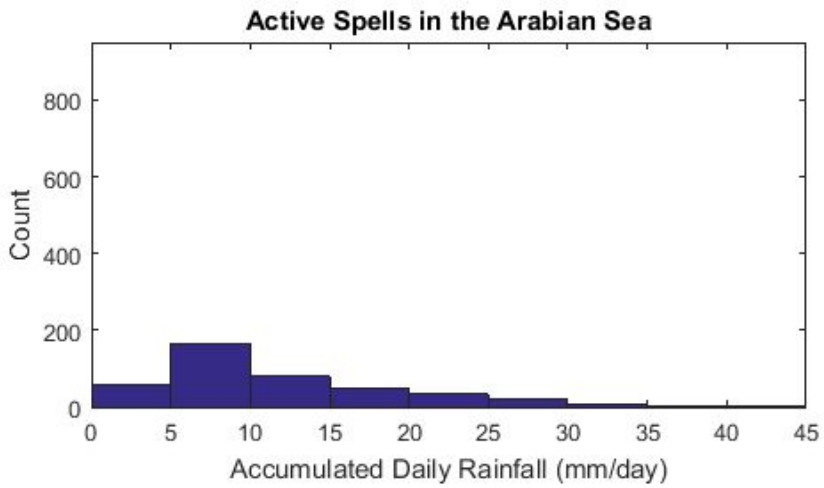
If SRA < 0.5 for 3 consecutive days -> Break Spell

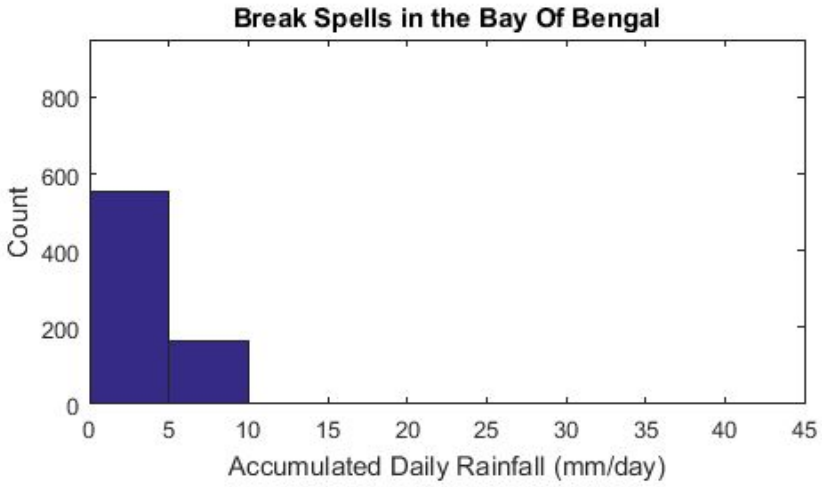
If SRA > 0.25 or SRA < -0.25 for days before after or in between the spells the are added to the Active or Break spells respectively.

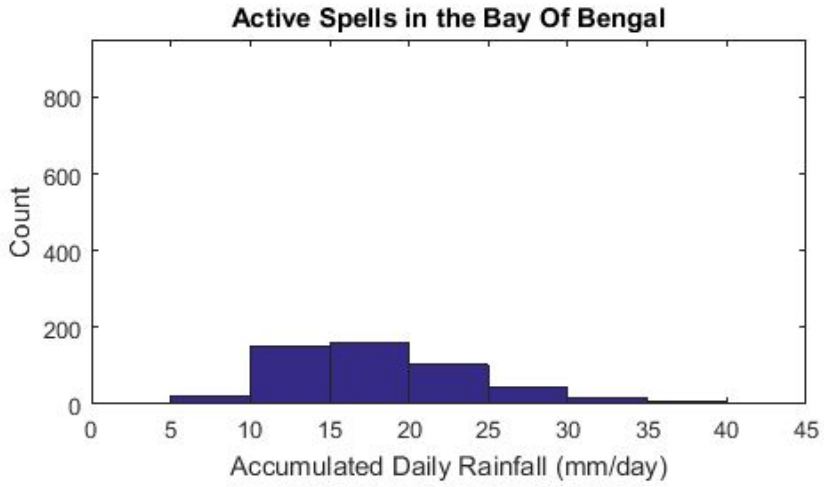
Results

Accumulated Daily Rainfall









Frequency of spells

For all years (1996-2013)

	Arabian Sea	Bay Of Bengal
Number Of Active Spells	73	121
Number Of Break Spells	118	132
Number Of Days of Active Spells	415	384
Number Of Days of Break Spells	945	589

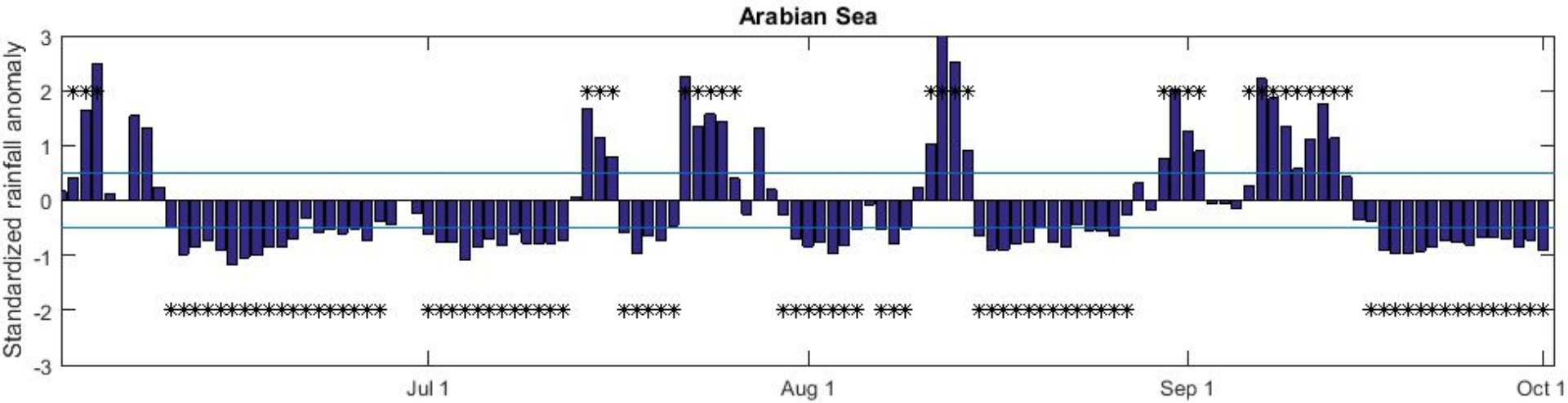
For El Niño years (2002, 2004, 2009)

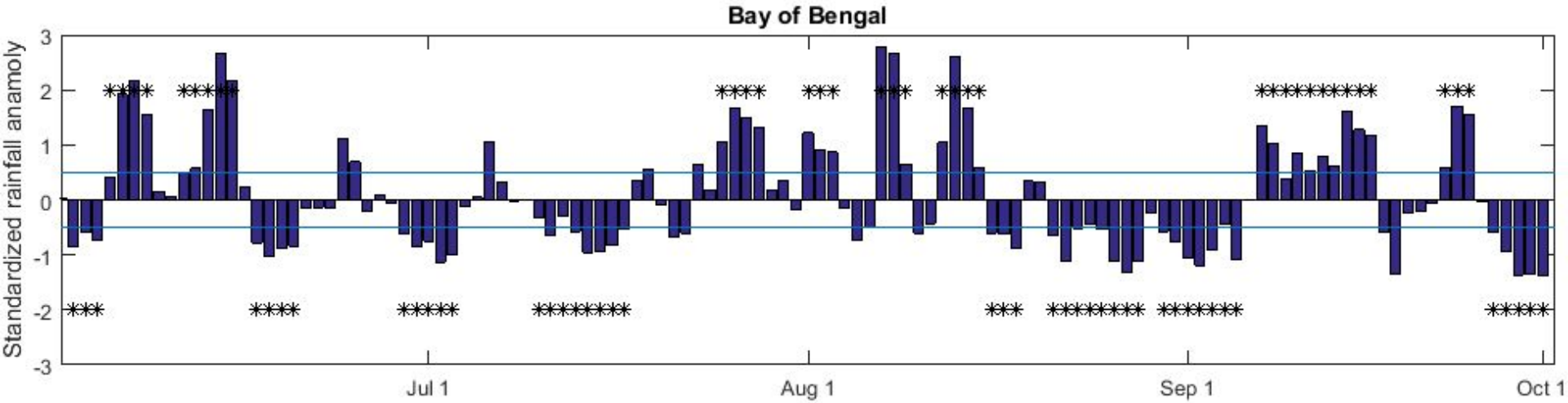
	Arabian Sea	Bay Of Bengal
Number Of Active Spells	9	17
Number Of Break Spells	25	25
Number Of Days of Active Spells	61	66
Number Of Days of Break Spells	187	132

For La Niña years (1998, 1999, 2000, 2007, 2010)

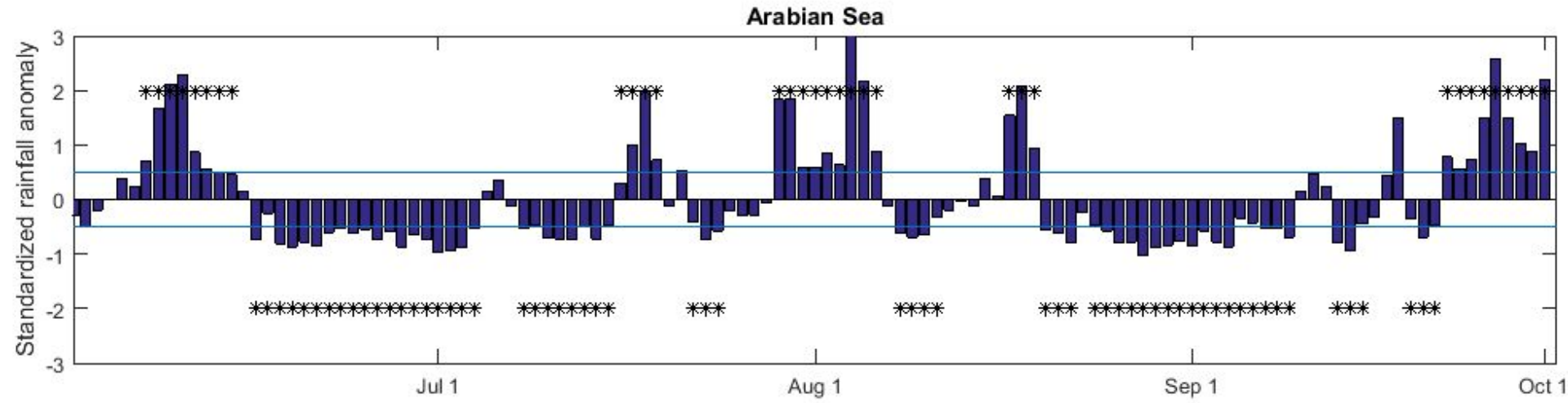
	Arabian Sea	Bay Of Bengal
Number Of Active Spells	28	40
Number Of Break Spells	30	39
Number Of Days of Active Spells	151	139
Number Of Days of Break Spells	283	222

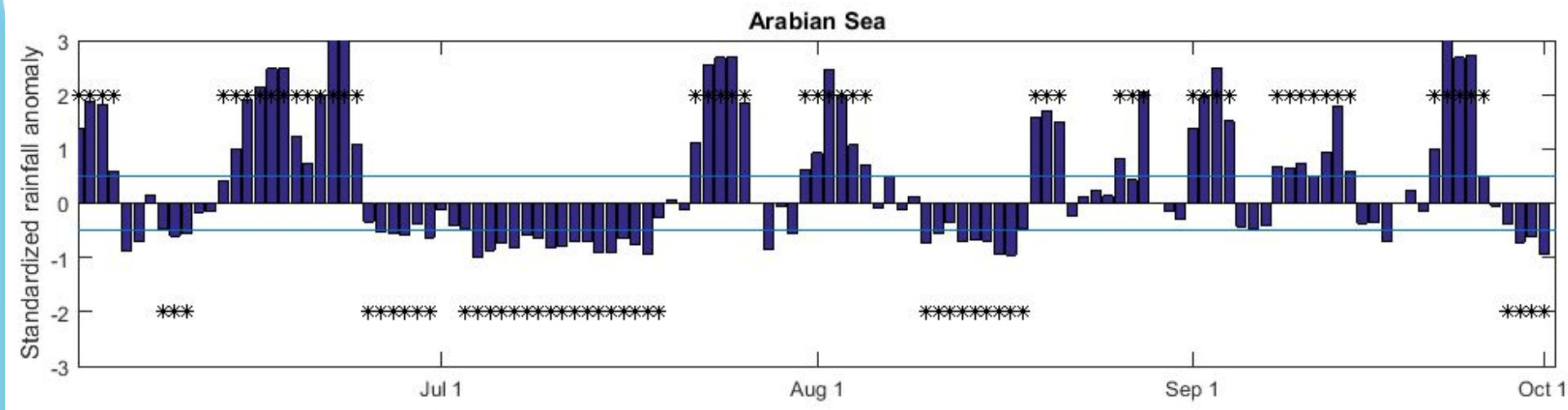
SRA Normal year



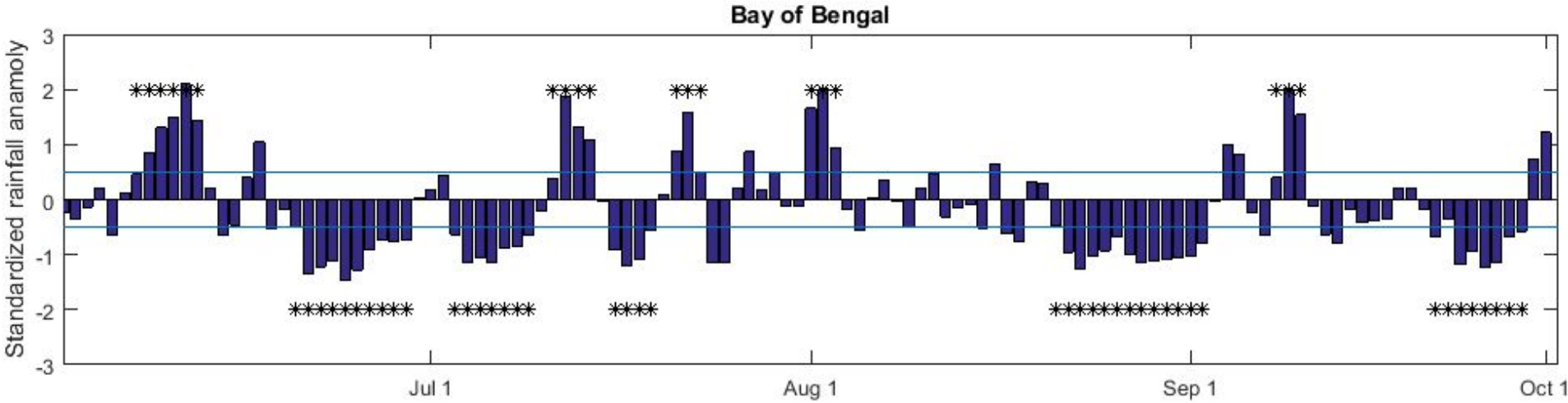


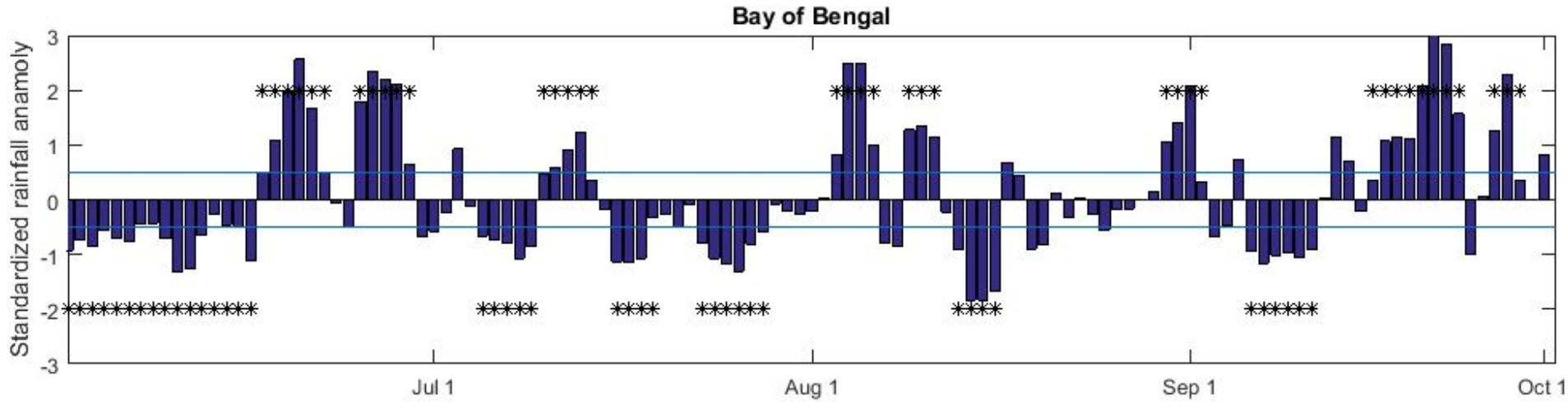
El Niño and La Niña Year

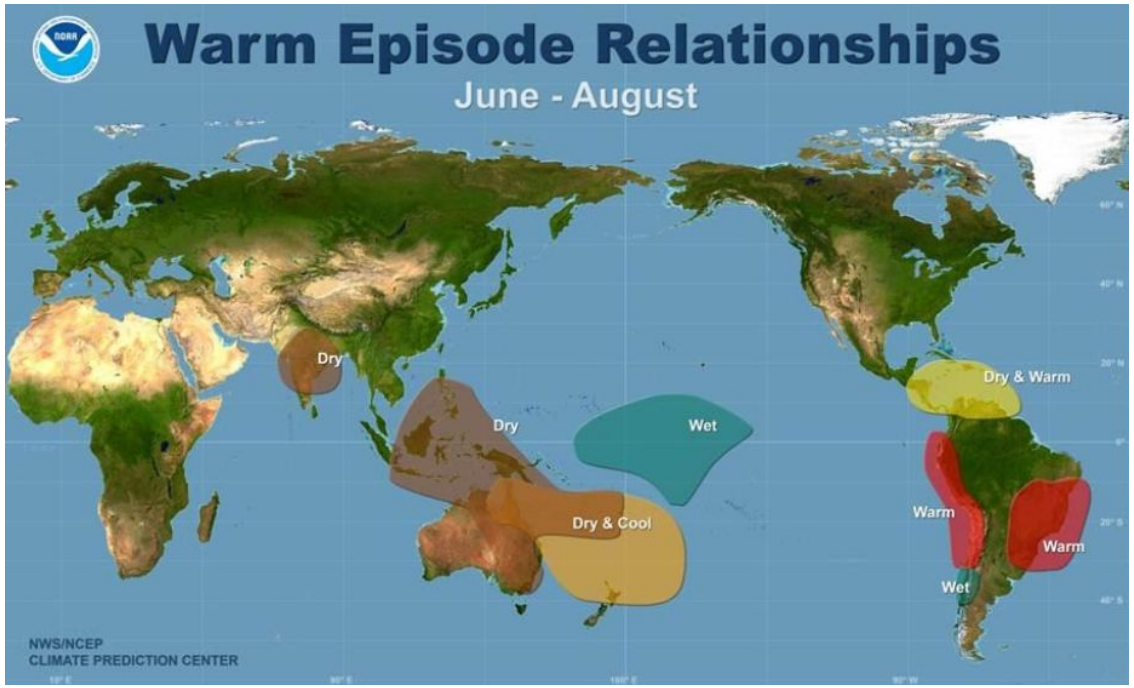




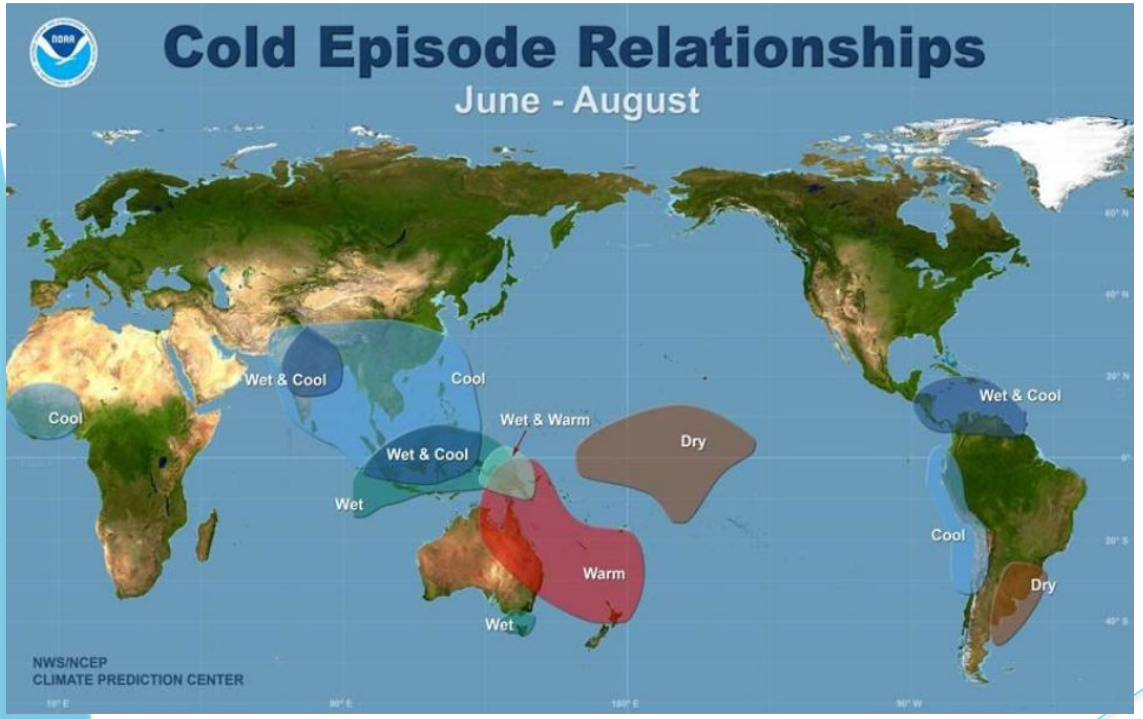
El Niño and La Niña Year







El Niño



La Niña

Discussion and conclusion

Discussion and conclusion

- Actve and Break Spells were classified from the raw TRMM 3B42 data product and the SRA was calculated individually over the Arabian Sea and Bay of Bengal.

- The Active spells have a higher ADR than Break Spells. The Bay of Bengal generally has higher ADR in both Active and Break spells when compared with the Arabian Sea and this is consistent with previous findings

- El Niño years have more break spells and La Niña have more Active spells than the normal. This is due to the SST variations in the Indian ocean during these years.

- For all 16 years we can see that the Bay of Bengal has a higher spell count but the number of spell days is
- more in the Arabian Sea.

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Thank you