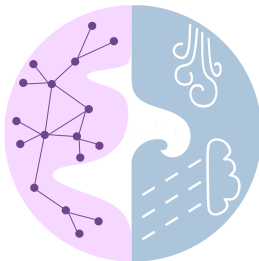


Spatio-temporal organization of extreme rainfalls during the South Asian Summer Monsoon

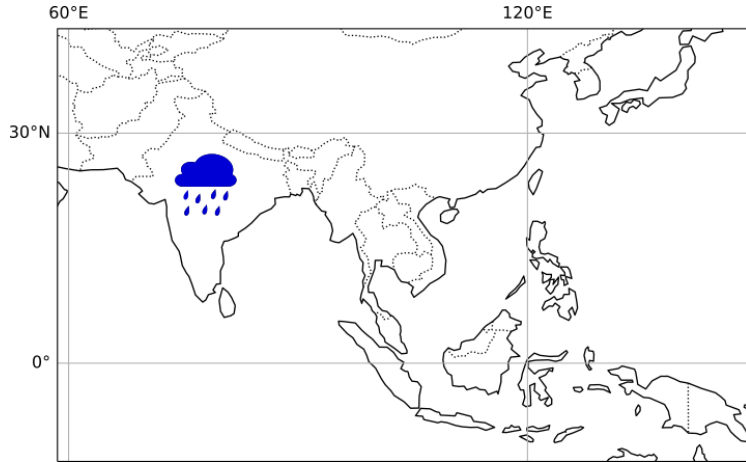


machine learning in climate science

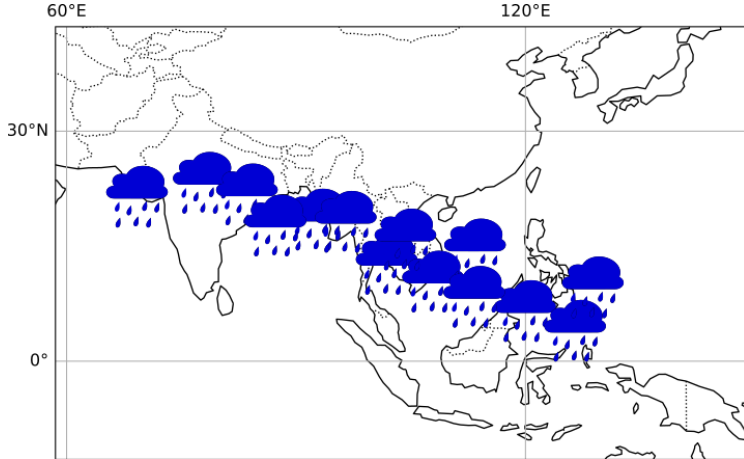
Felix Strnad, Jakob Schlör and Bedartha Goswami

May 23, 2022

Spatio-Temporal Organization of Extreme Rainfalls

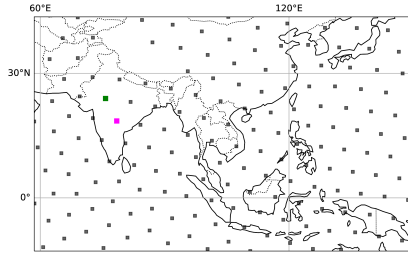


Spatio-Temporal Organization of Extreme Rainfalls

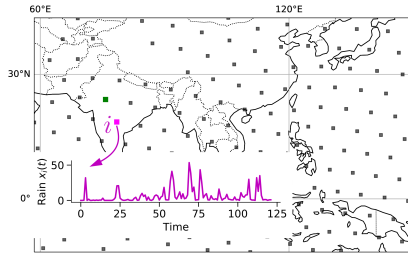


⇒ Can we reveal (and explain) the spatial organization of extreme rainfalls during Summer Monsoon?

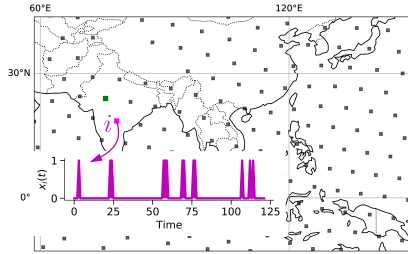
Climate Networks of the South Asian Monsoon



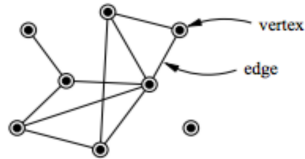
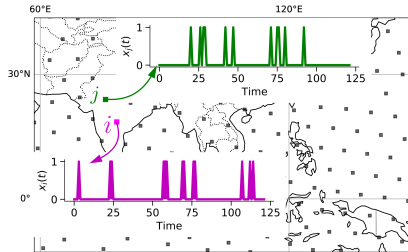
Climate Networks of the South Asian Monsoon



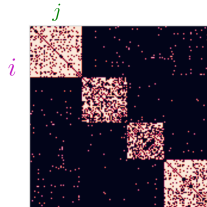
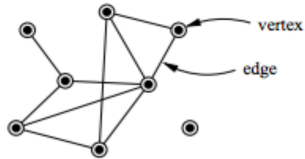
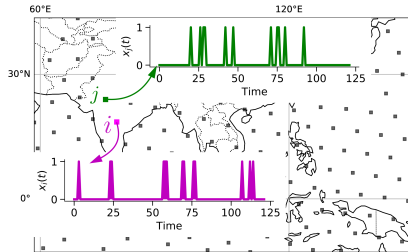
Climate Networks of the South Asian Monsoon



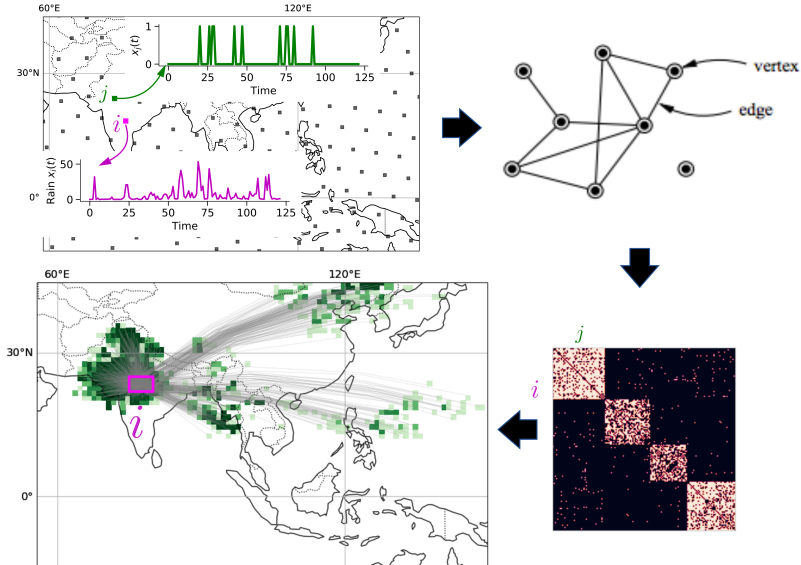
Climate Networks of the South Asian Monsoon



Climate Networks of the South Asian Monsoon

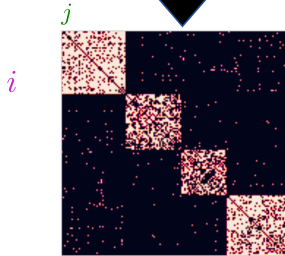
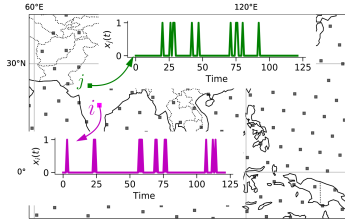


Climate Networks of the South Asian Monsoon



Climate networks highlight:

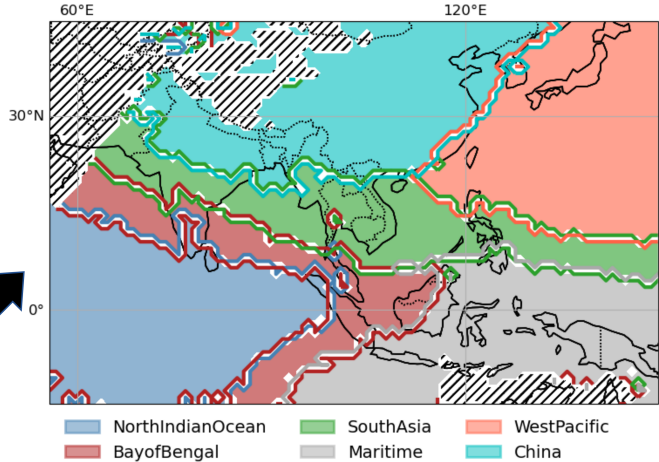
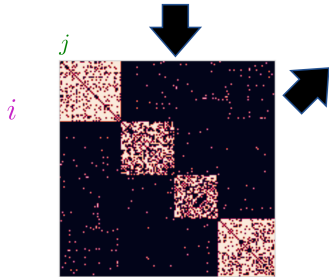
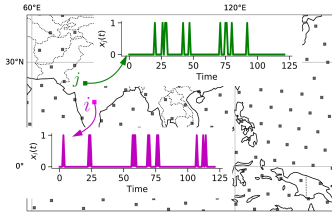
- ✦ Teleconnections
- ✦ ...
- ✦ **Communities**



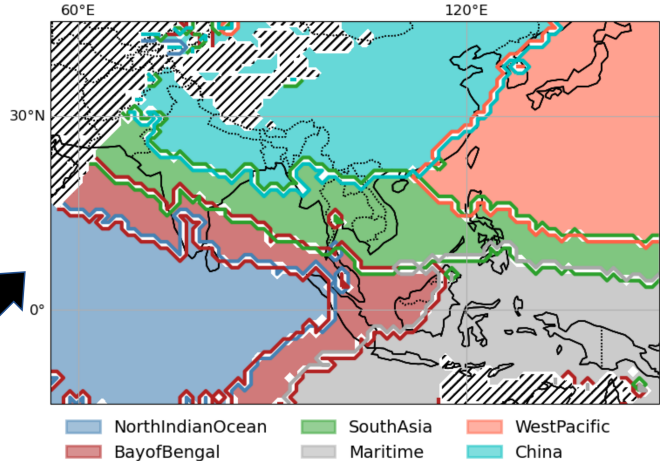
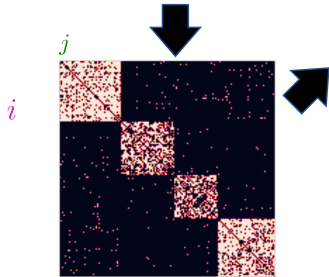
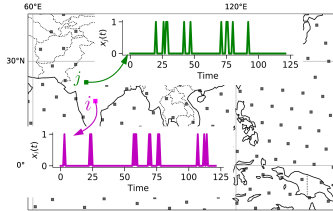
How to identify communities:

- ✦ Inferring blocks in network matrix
- ✦ Using a probabilistic Stochastic Block Model

Spatio-temporal Communities of Extreme Rainfalls

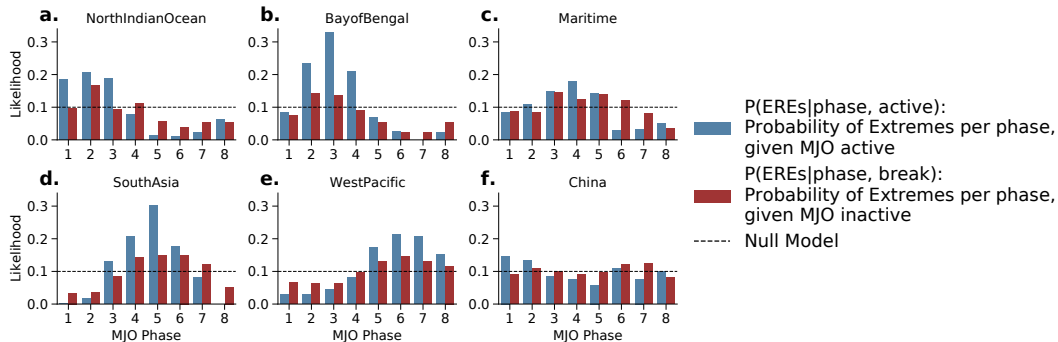


Spatio-temporal Communities of Extreme Rainfalls



⇒ What are the underlying process(es) generating the communities?

MJO defines the spatial organization of EREs



⇒ **MJO drives the spatial organization of extreme rainfalls during South Asian Summer Monsoon!**

Thank you!



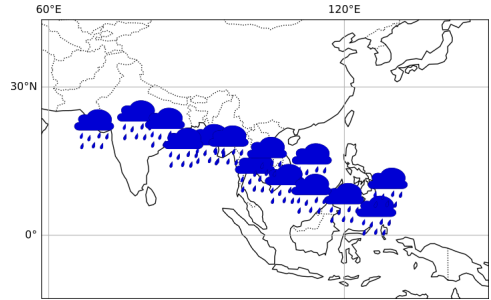
Figure: Felix Strnad, Jakob Schlör, Bedartha Goswami

[felix.strnad@uni-tuebingen.de/](mailto:felix.strnad@uni-tuebingen.de)
<https://machineclimate.de/>
[@MachineClimate](#)



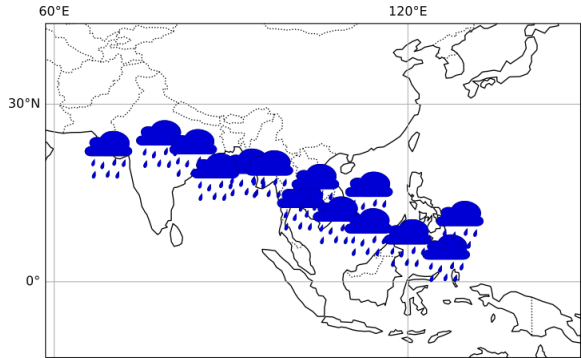
The South Asian Summer Monsoon is a highly complex system:

- ✦ Complex orography
- ✦ Northward shift of the ITCZ
- ✦ Modes of variability (MJO, ENSO, ...)
- ✦ several complex atmospheric processes, eg. enhanced subtropical jets



Rainfall during Monsoon Times:

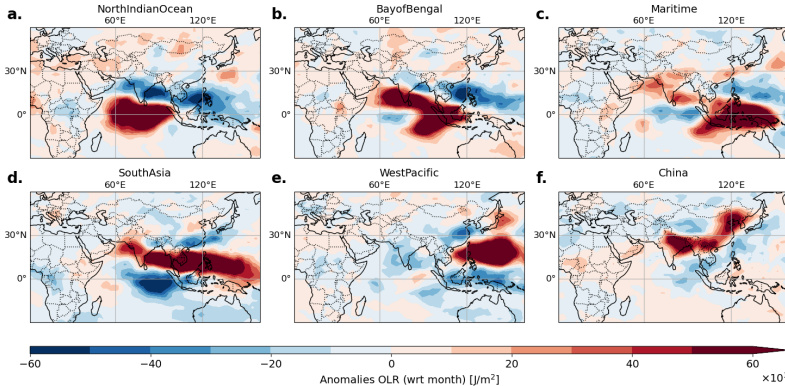
- ✦ Involves small-scale processes
- ✦ Several large-scale complex atmospheric processes (ITCZ, MJO, ...)



⇒ **Can we reveal (and explain) the spatial organization of extreme rainfalls during Summer Monsoon?**

Precipitation composites

Days of maximum synchronization



Anomalies of OLR show:

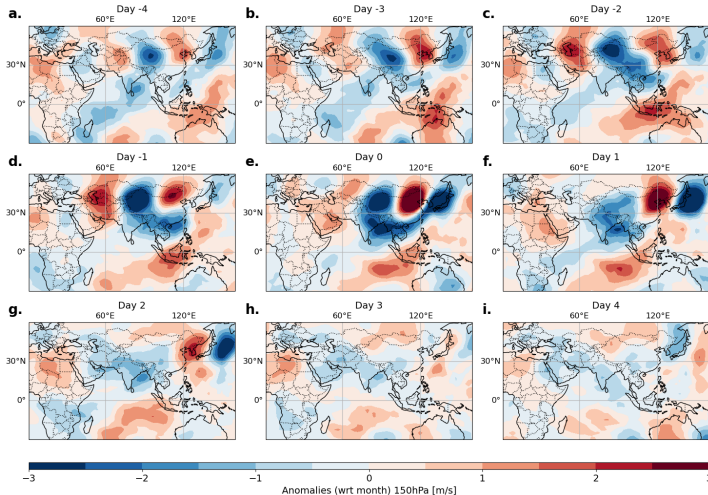
- ✦ Spatially coherent pattern of Extreme Rainfalls
- ✦ North-Eastward movement

⇒ **Extreme Rainfalls occur in spatially extended coherent patterns!**

Indian rainfall extremes teleconnections



Interaction between Indian and East Asian Monsoon



- ✦ Enhanced Silk Road Pattern connects Indian and East Asian rainfall extremes.
- ✦ Pathway gated by the Tibetan Plateau and Himalayan Mountains.
- ✦ During core monsoon season

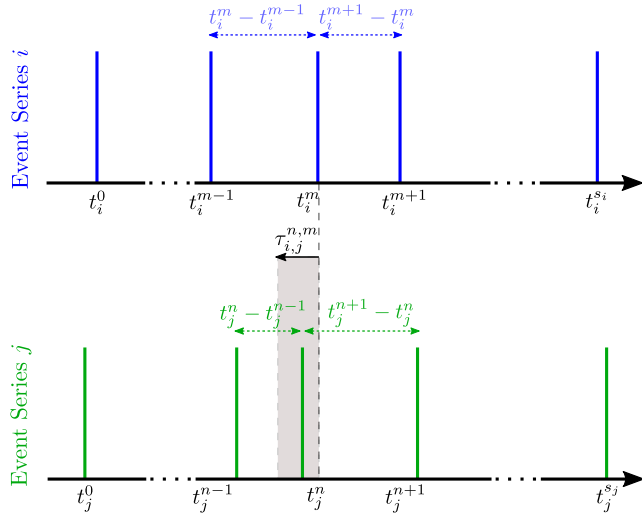


Figure: Event Synchronization for two time series i, j .

Climate networks

The world's climate as a graph

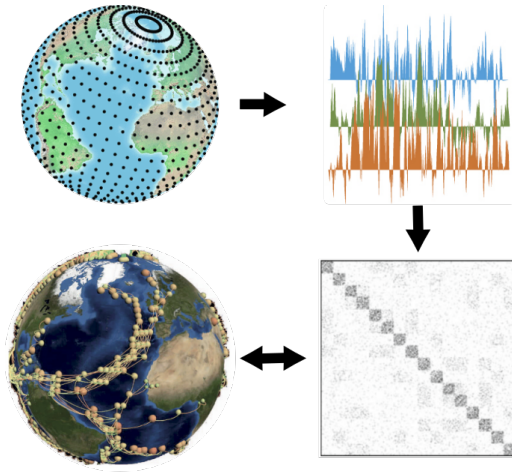
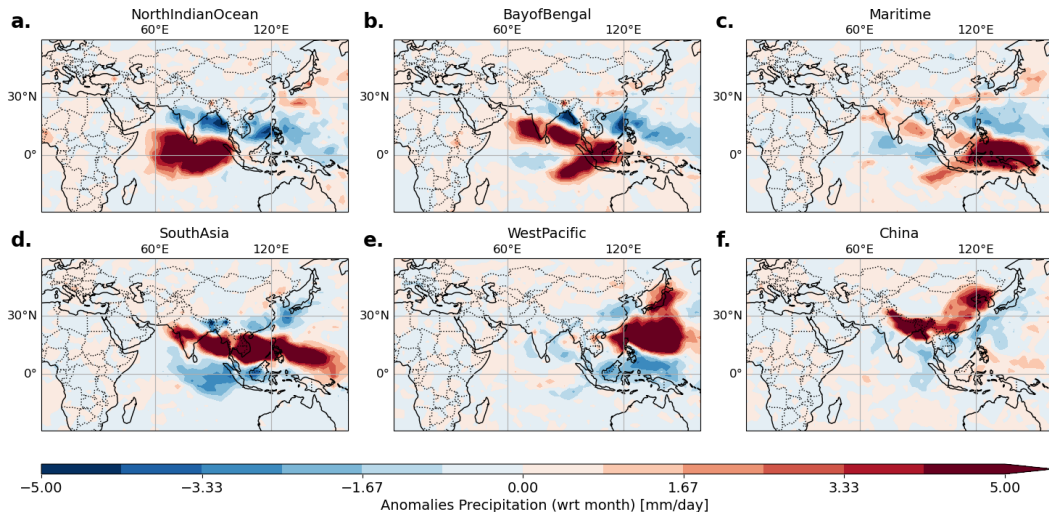


Figure: from Boers, Kurths, and Marwan 2021

Precipitation composites

Days of maximum synchronization



Precipitation composites

Days of maximum synchronization

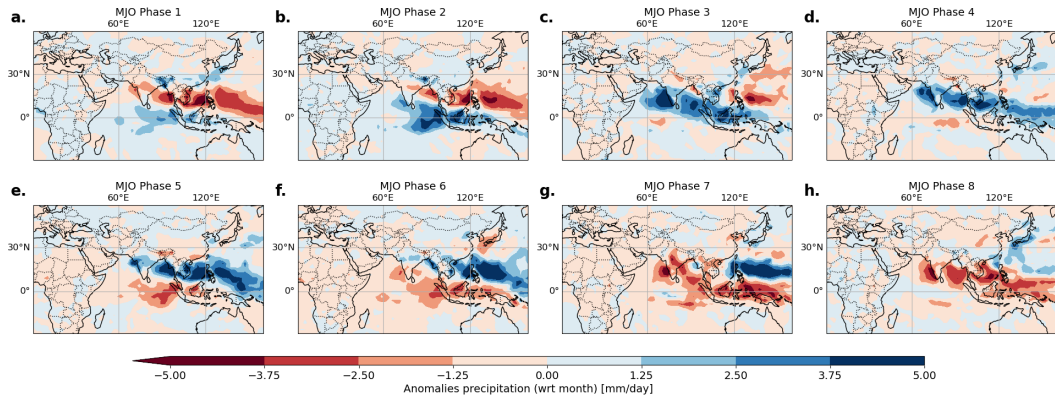


Figure: Precipitation for all MJO phases.