In attempt to get closer to real climate systems and associated with them system of interactions a concept of coupled climate networks was introduced by Donges et al., 2011. Investigating topology of interacting networks conclusions on dominant connectivity "tunnels", spatial and temporal dependences, temporal and spatial connectivity variability of the observed and modeled E/P networks, as well as similarity measures were carried out.

**Motivation:**
- Studying and understanding complex interactions and system of feedbacks between E and P
- Connectivity features of observed E and P from the HOAPS-3 product
- Improvement / validation of the numerical simulation schemes

**Objectives:**
- Analyze topology of single/ coupled precipitation and evaporation networks
- Investigate prominent global teleconnection patterns in the constructed networks
- Identify physical properties within the climate network fields
- Compare observed (HOAPS) and modelled (MPI-ESM) network features

**Method of Complex Networks (CCN):**

The information stored in a node of a climate network reflects the physical state of corresponding spatial grid-point. Thus, depending on the spatial and temporal scale under research the connections or links between these nodes will represent certain (non-) linear interactions between each other. In order to exclude unwanted and insignificant connections between the vertices, a pre-processing of the knowledge data should be done.

- Vertices = grid points
- Edges = (non) linear interactions between vertices
- Criterion = Spearman Rank Correlation (zero lag)
- Fixed Link Density = 0.04

**Observed HOAPS-3 and modelled MPI - ESM Data:**

Construction of any network strictly depends on the knowledge (collected) data to be used. Imperfect retrieval algorithms and data merging of the atmospheric parameters fields cause uncertainties and lower quality of the final product.

**Combined HOAPS-3 and GPCC:**

In order to obtain consistent and representative evaporation and precipitation fields the fully satellite-based HOAPS-3 (Hamburg Ocean Atmosphere Parameters and Fluxes from Satellite Data, (www.hoaps.org) and combined HOAPS-3 / GPCC (Global Precipitation Climatology Center, (www.gpcc.dwd.de)) datasets were used.

**Earth System Model of MPI-M:**

A fully coupled MPI-ESM model is composed of the atmospheric module (ECHAM6, Stevens et al., 2012), ocean (MPIOM, Jungclaus et al., 2012) and land (JSBACH, Raddatz et al., 2007; Brovkin et al., 2009) components.

**Global Teleconnections:**

Area Weighted Connectivity (AWC) fields reveal ENSO and NAO related connectivity patterns and associated teleconnections over western coast of USA, Pakistan, South to Madagascar and the area of NAO+ influence over Greenland.

**North Atlantic Coupled Networks:**

High connectivity areas of the Coupled CCN lie around 20°N and 60°N, and can be partly explained by the NAO variability.

Cross-Connectivity of the Nodes and Super nodes? Where are the areas of high connectivity located? What does degree see? What reveals the mismatch of model and observed networks?

**SVD/ EOF Analysis and Complex Networks:**

The EOF approach investigates the covariance structure of a parameter evolving in time which makes it being similar to the correlation based method of CCN, especially to the Degree. Joint variability of two fields can be assessed using SVD analysis. Potential (dis-)similarities between Coupled Networks and SVD were analyzed.

**Conclusions:**
- E/P Network structure resembles major teleconnection patterns
- High DC area of coupled E/P Networks reveal spatial source-receptor feature
- Uncertainties in E/P variability associated to NAO/ENSO in amp; historical
- (Die-)similarities between SVD and cross DC were investigated

**References:**


