Climatology and Cluster Analysis: Self-Organizing Maps (SOMs)

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Background

- Climatology
  - The study of climate

- Can be modeled visually:
  - Climate Models: CMIP5 ensemble
  - Downside:
    - Tend to have errors when modeling naturally-occurring processes, referred to as biases

- Question
  - How do we obtain more accurate models?
Objectives

- **Broad**
  - To understand climate: how and why it works the way that it does
    - Precipitation
  - To organize large data sets via SOMs

- **Specific**
  - To identify the causes of biases in global climate models
  - Learn more about precipitation patterns in the SPCZ and ITCZ
    - Possible relations that they may have
Self-Organizing Maps

• Novel tool in climatology
  ▫ Requires intuition when considering input and parameters
  ▫ Exploratory approach

• Concept
  ▫ Data is represented as a weighted matrix that is later converted into mapped nodes
    • Weights determined via factors such as precipitation, day, year, etc.
  ▫ Done via MATLAB
Self-Organizing Maps (cont’d)

• Color Example:
  ▫ Colors consist of 3 parameter values: (Red, Blue, Green)
  ▫ Two Nodes:
    • Red = (6,0,0)
    • Green = (0,0,6)
    • Is the color (1,1,6) closer to red or green?
  ▫ Compute Euclidian distance
    • $n$ – the number dimensions in a vector
    • $i$ - the $i^{th}$ component in the vector
References & Acknowledgements

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• SOMs and Climate