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Advanced Climate and Regional Model Validation for Societal Applications

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Spatial Weather Forecast Verification



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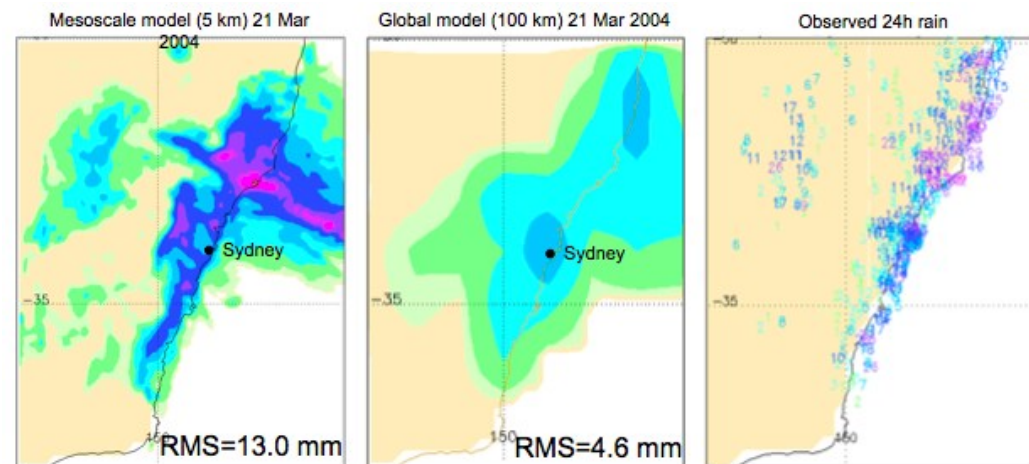
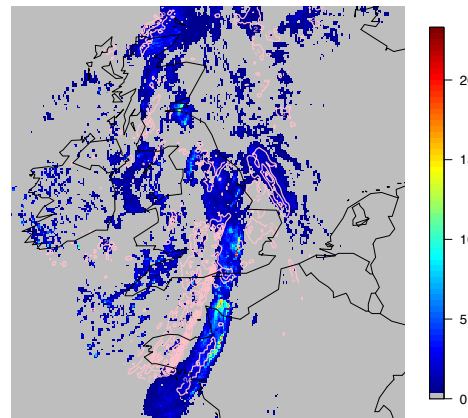
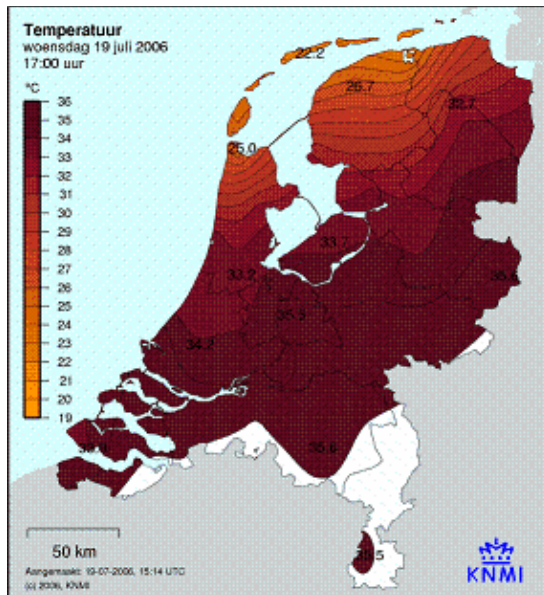


Fig. courtesy of E. E. Ebert

Spatial Methods

SPCT

MODE

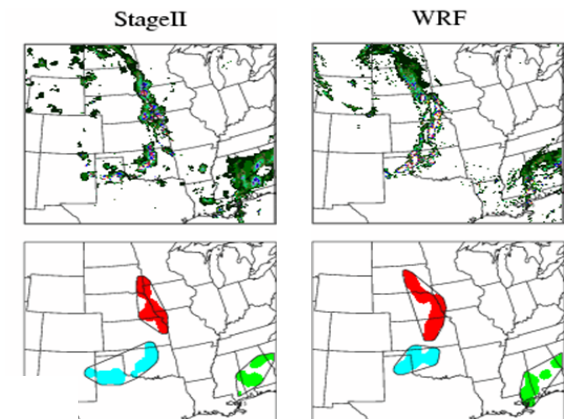
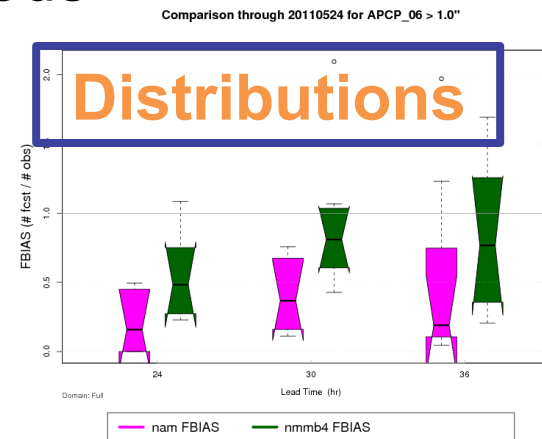
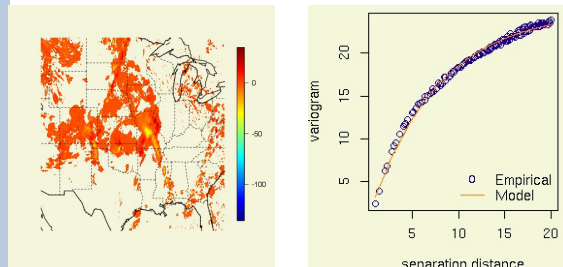
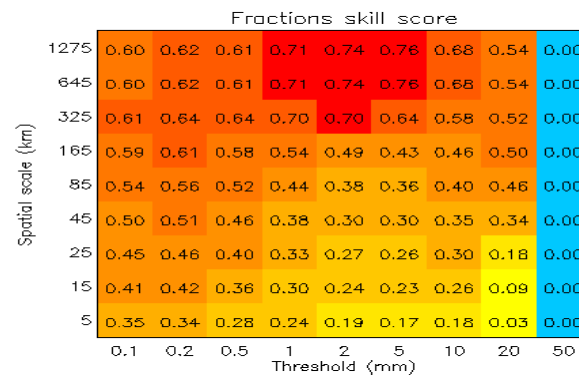


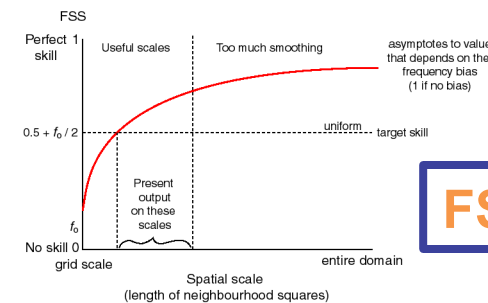
Image Warping



good performance

poor performance

Quilt plots

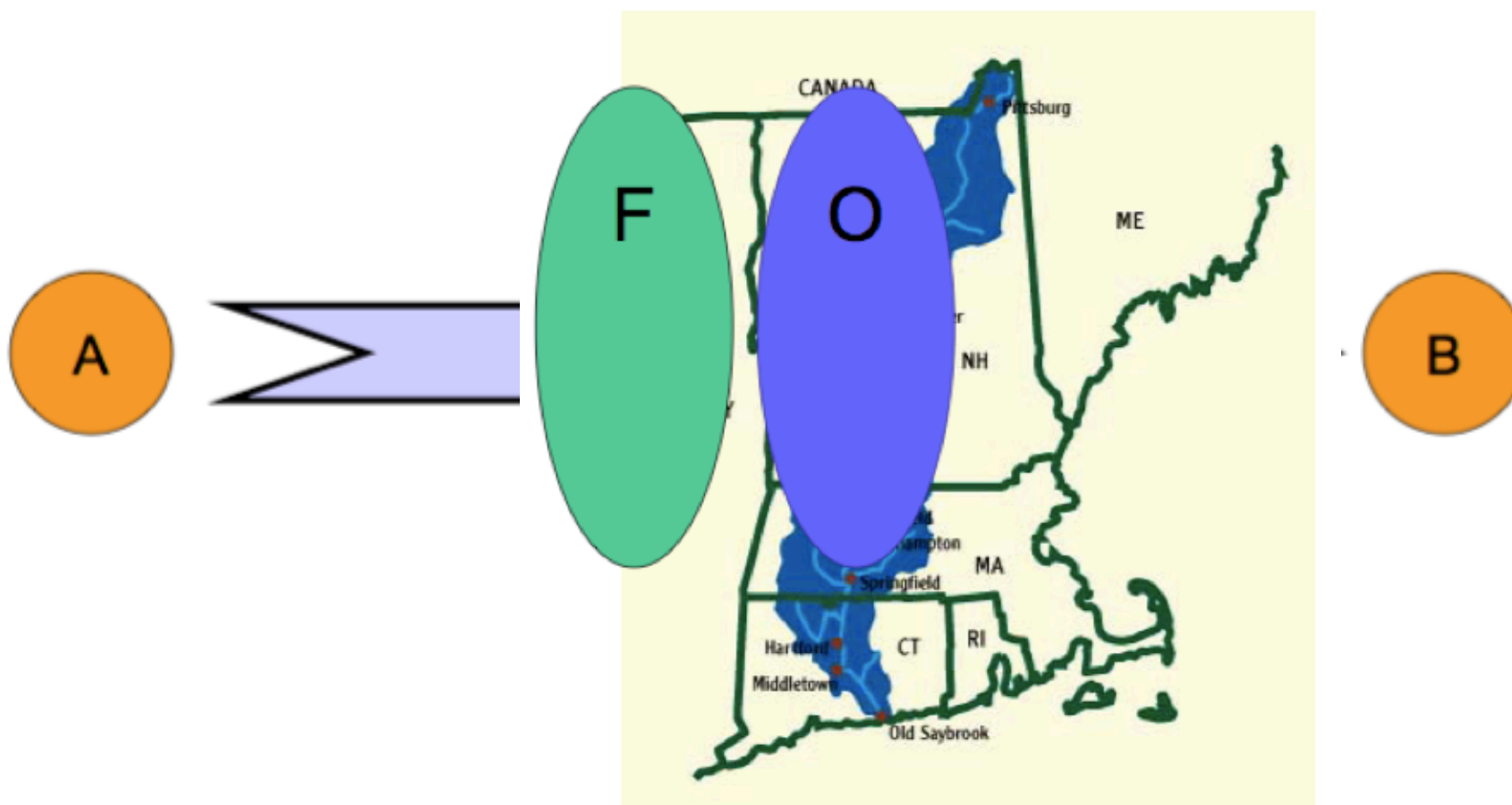


FSS



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User Needs

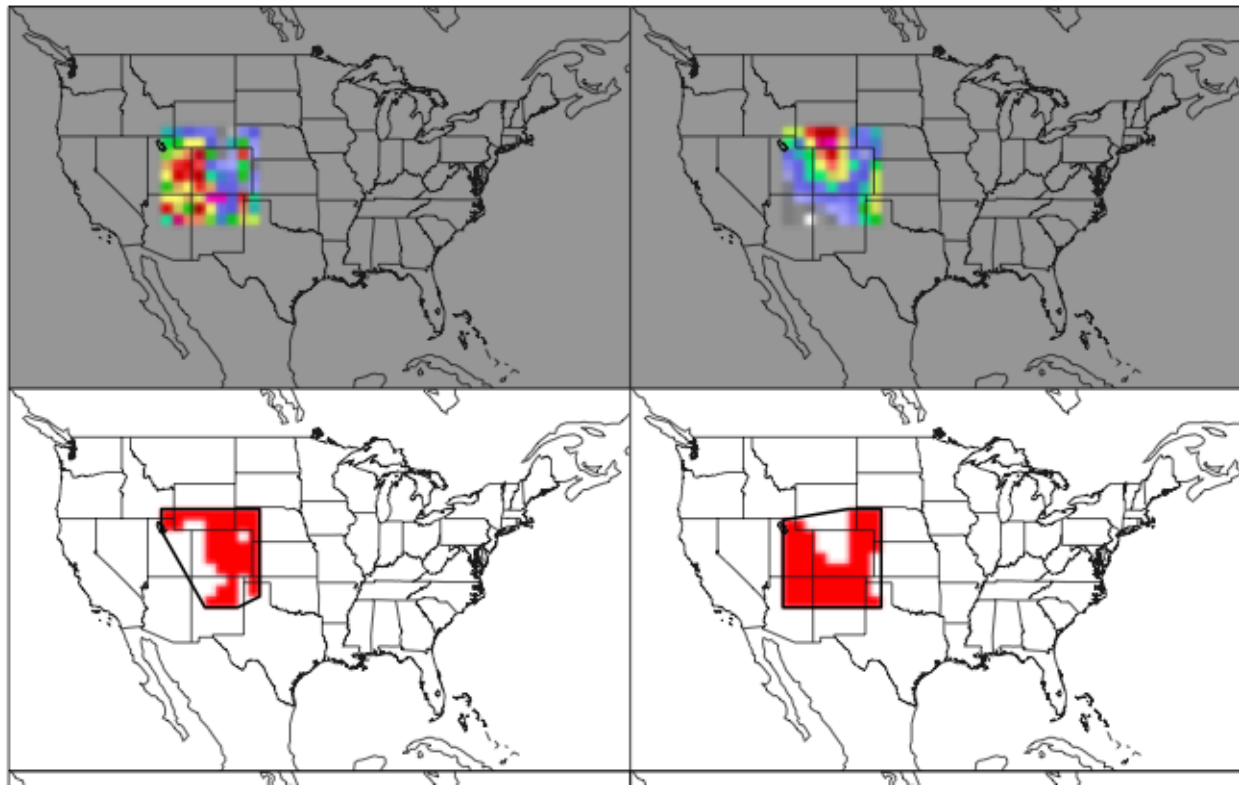


MODE on Drought Indices

Standardized Precipitation Evapotranspiration Index* (SPEI): December 2005

CESM-CAM5LE

CRU3.21


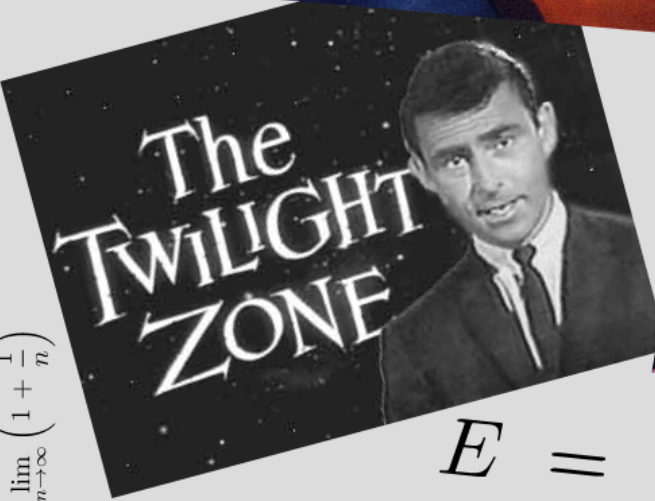
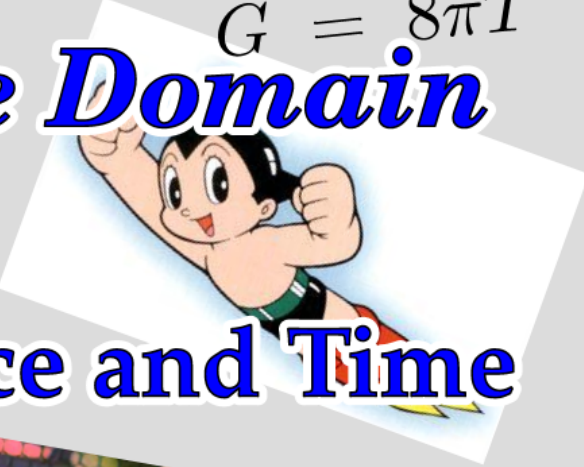



*Vicente-Serrano et al, 2010, J. Climate, 23, 1696 – 1718.



MODE Time Domain

Objects in Space and Time

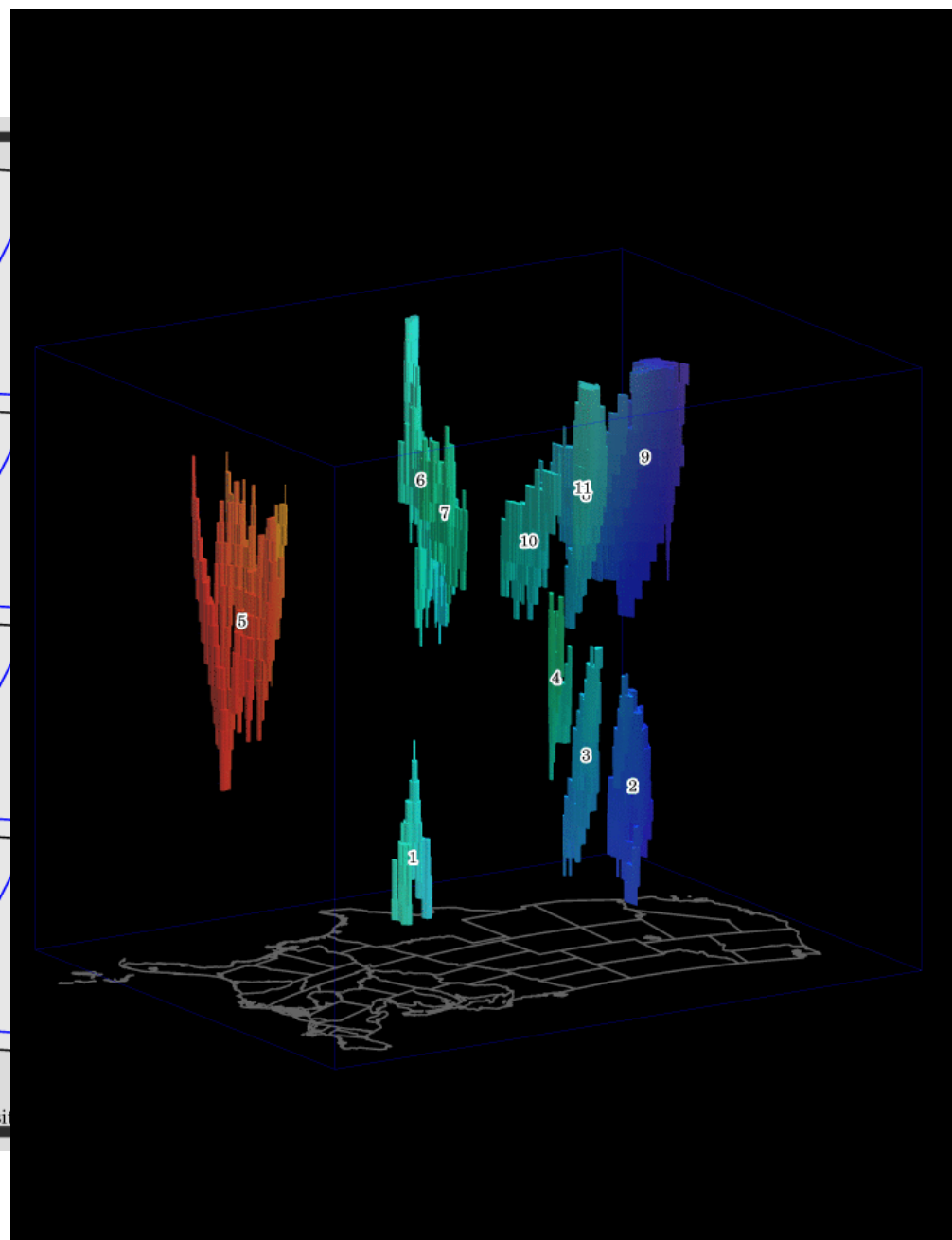


$$G = 8\pi T$$
$$E = mc^2$$
$$\lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n$$

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es
ically

Object

ut

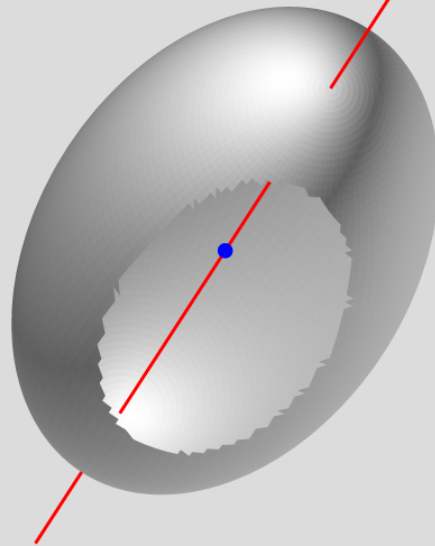
Object

Randy G.
Bullock's
Graphics
package

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MODE Time Domain

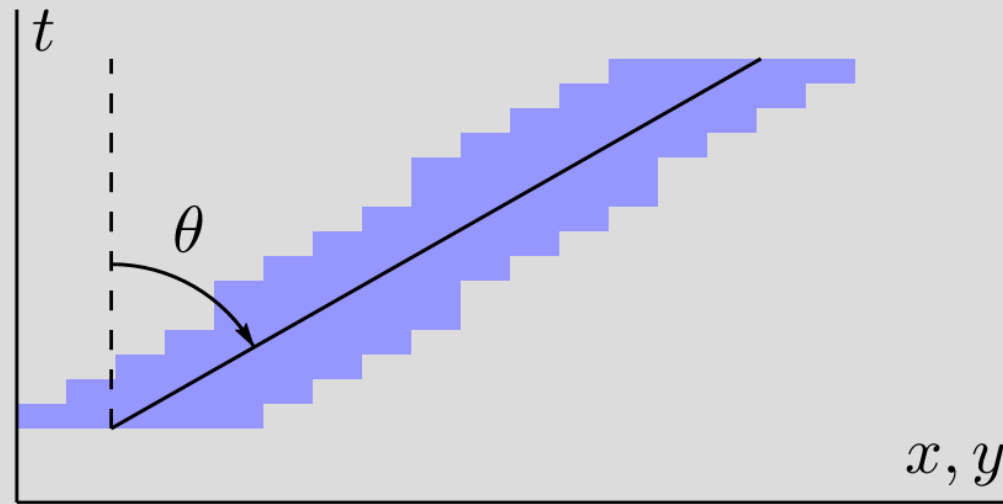
Most attributes for 2D objects
generalize easily to the 3D case



Here we see the centroid
and axis calculated for this
3D ellipsoidal object

MODE Time Domain

Object velocity is related to the tilt angle of the axis



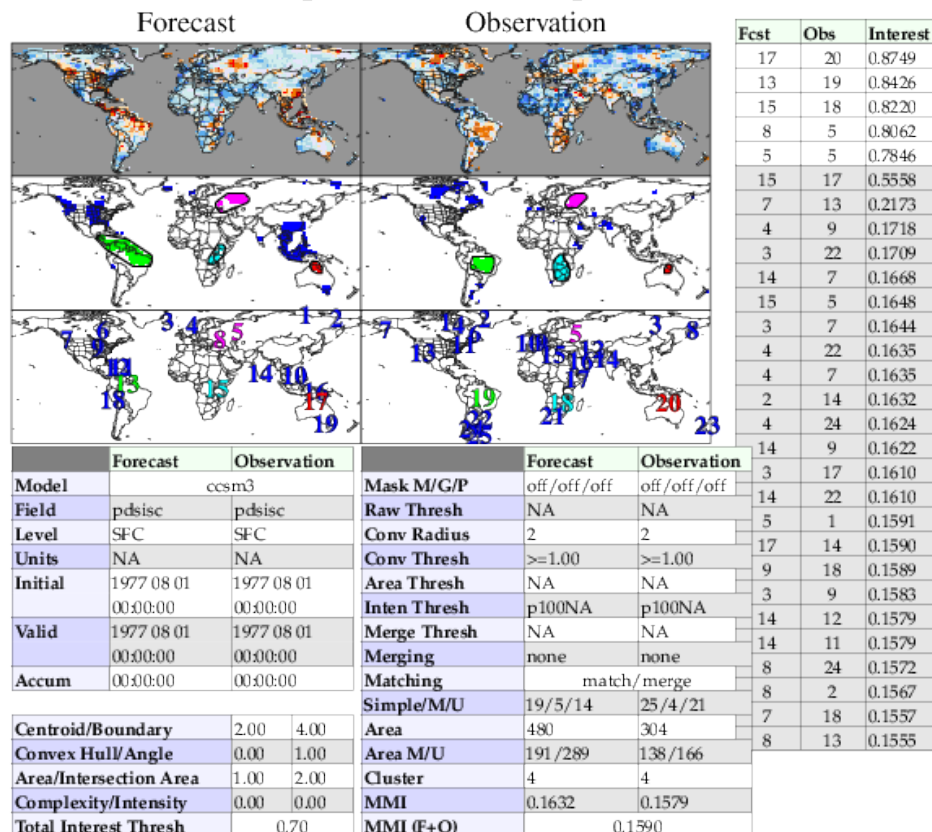
The inclination of the axis from the vertical (time) direction increases with object speed.

MODE Time Domain

Run 2D MODE on
PDSISC.

- Compare CCSM3 to Observed.
- 2.5 degree global lat/lon grid.
- Convolution radius of 2.
- Convolution threshold ≥ 1.0 .
- Run on monthly data from 1950 to 2009.
- 720 runs of MODE.
- Sample case August 1977.

MODE: pdsisc at SFC vs pdsisc at SFC



MODE Time Domain

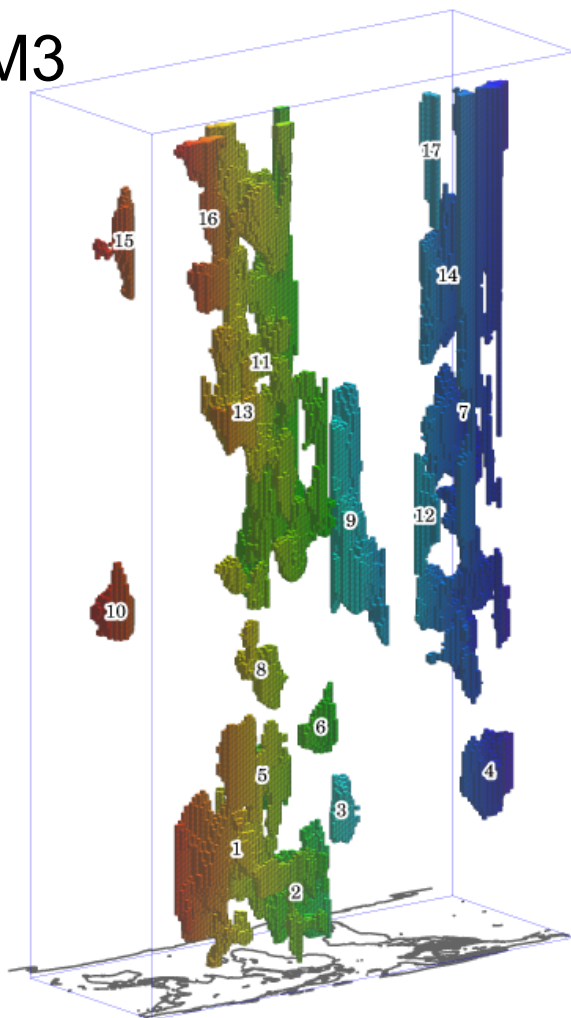
- Run over all 720 months.
- Convolution radius = 2.
- Convolution threshold ≥ 1.0 .
- CCSM3:
 - Resolved 229 space/time objects.
 - 26 with volume > 1000 .
- Observed:
 - Resolved 202 space/time objects.
 - 17 with volume > 1000 .
- Plotting only volumes > 1000 .
- Object tracking through time is easy.

MODE Time Domain



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CCSM3



Obs

