Motivation for Breakout L: Modern approaches to climate and hydrological data analysis and modeling

Efi Foufoula-Georgiou:

1) Regionally-relevant climate model projections

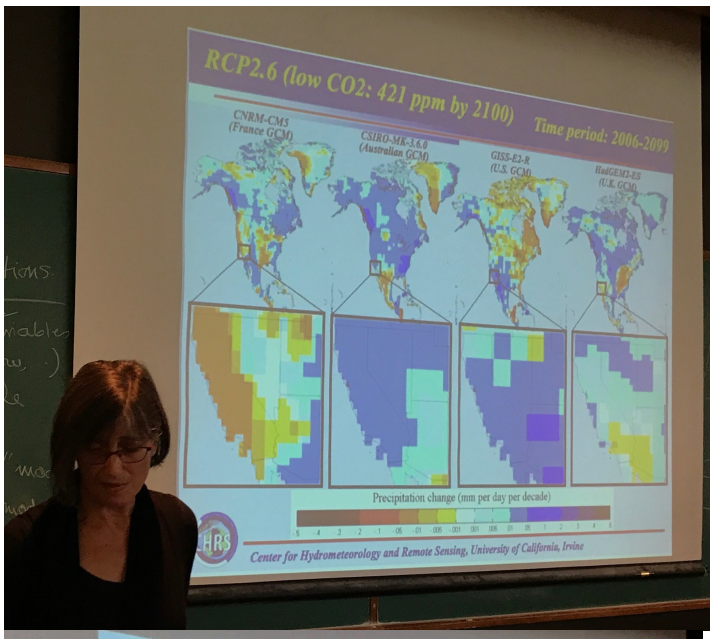
    - Diagnose models for local variables of interest (P, T, snow…) and non-local large-scale dynamics
    - Validate and "down-select" models?
    - Bayesian combinations of models
    - Quantifying uncertainty/risk at a range of space-time scales

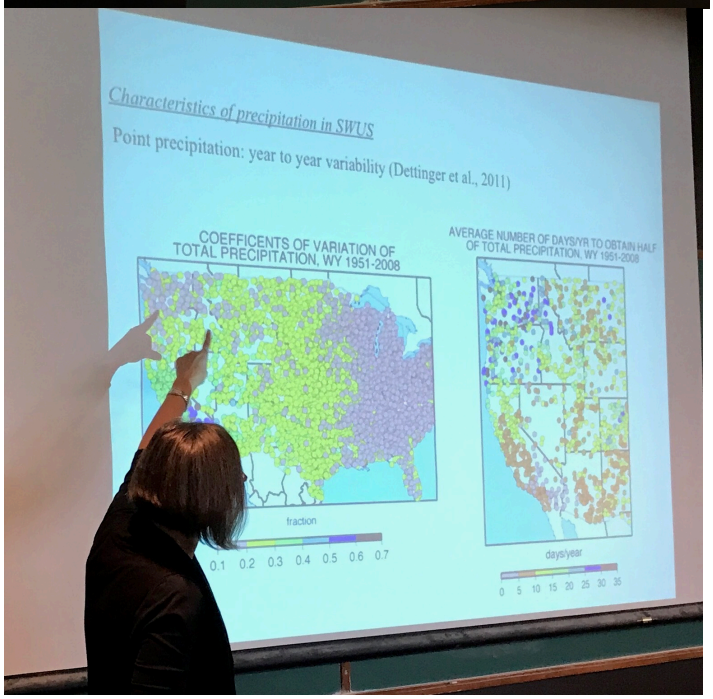
2) Beyond linear statistics

    - There exists organization, emergent properties, cooperative dynamics
    - Climate networks (e.g., for precip in California,
    - Other metrics of dependence. Information-based metrics, etc.
    - Non-linear diffusion; delta h/delta t = K(h) delta^2 h/delta^2 x. Remove the noise, but preserve the edges. Perona-Malik enhances "edges" (Geonet)
    - Non-linearity detection from small datasets; visibility graphs, etc.

3) Metrics for inverse problems with complex space-time dynamics

    - I give you a model that generates two different distributions. Say one is a translation of the observations. Traditional measures, e.g., MSE, may miss this fact.
    - Use OMT (optimal mass transport)
    - L1/L2 regularizations (edges and extremes)


RCP2.6 (low CO2: 421 ppm by 2100)
Time period: 2006-2099
CNRM-CM5 (France GCM)
CSIRO-Mk-3.6.0 (Australian GCM)
GISS-E2-R (U.S. GCM)
HadGEM2-ES (U.K. GCM)
Precipitation change (mm per day per decade)
Center for Hydrometeorology and Remote Sensing, University of California, Irvine


Characteristics of precipitation in SWUS
Point precipitation: year to year variability (Dettinger et al., 2011)
COEFFICENTS OF VARIATION OF TOTAL PRECIPITATION, WY 1951-2008
fraction
0.1 0.2 0.3 0.4 0.5 0.6 0.7
AVERAGE NUMBER OF DAYS/YR TO OBTAIN HALF OF TOTAL PRECIPITATION, WY 1951-2008
days/year
0 5 10 15 20 25 30 35

Sam Shen:

1) Weather history time machine. 4DVD – 4dim visual delivery. NASA and NOAA work

   Need to input data

   - data reconstruction: EOF + GCM => spectral optimal gridding
   - Random forest
   - Compressive sensing or sampling

2) S2s (subseason season) forecasting. 5-days to seasons. NOAA, CPO, AR

   How use Bayesian model to change scales

3) Next generation of GCM – outputs are pdfs. Need to use stochastics dynamics, fractal dimension, similarity. 10^-6 – 10^6 meters.

   Existing methods, Multiscale model framework: 10km -> 1km grid, no suitable.