Statistics Breakout

- What data-handling techniques are relevant (self-organizing maps, composites, etc.) to identify LSMPs?

☞ **RECOMMENDATION: Promote multiple approaches**

- What statistical methods apply to these extreme events?
- What statistical connections are there between extreme events and large-scale phenomena such as ENSO, NAO, etc.?

☞ **RECOMMENDATION: Think globally, not locally**

Statistics Breakout

Gaps in the observing record

- Trends difficult to analyze
- Decadal variability needs better analysis
- Ensure covering multiple phases of PDO, AMO, etc.
- Historical records useful for other communities
- Is first half of 20C relevant for extremes work?
- Behavior in early part of record (1910-1970) differs from post-1970.

Statistics Breakout

Gaps in the observing record

1. Can gaps be filled by statistical modeling (e.g., use GPD?)

2. Is there useful proxy data for extremes? (e.g., tropical cyclone proxies, pluvials)

3. Can our knowledge of seasonal to interdecadal variability help statisticians?

- ☞ **RECOMMENDATION: Promote support for maintaining current observing networks**
- ☞ **RECOMMENDATION: Foster "champions" of co-op observing stations**

Statistics Breakout

Climatology period(s)

- Choice of climatology period affects def. of extremes
- CPC uses 10 yr for T, 15 yr for precip. – for business sectors. (30-yr normals often inadequate for them)

How does an institution serve needs of multiple interest groups?

Statistics Breakout

Multivariate statistical modeling/analysis

- T extremes need to consider intensity *and* duration.
- T + humidity important for heat stress.
- Reveal links between fields during extremes? (e.g., precip + wind, precip + T, links between Rossby waves and extreme T/precip, etc.)

Statistics Breakout

Other

- Appropriate degree of non-stationarity to include in statistical models? (trade-off between precision of fit and comprehension of complexity)
- Define at least some extreme events from an impacts or decision-maker perspective.

Announcement

Short Course on "Statistical Analysis of Weather and Climate Extremes"

AMS Annual Meeting

Atlanta, GA

2 Feb. 2014

- **Organized by Eric Gilleland, NCAR**
- **Hands on training in using software for extremes**
- **For more information, see web page for AMS Annual Meeting**

Statistics

- **What data-handling techniques are relevant --self-organizing maps, composites, etc. -- to identify large scale meteorological patterns (LSMPs)?**

-- Approach (Condition on extreme or on circulation pattern?)

-- Composites, EOFs, SOMs, clustering all useful

-- Machine learning can treat phenomena like atmospheric rivers

-- Desire that LSMPs be predictable

-- Limitation of techniques like composites (Do *not* take into account intensity of extremes)

- **What statistical methods apply to these extreme events?**

-- Methods using extreme value distributions with covariates (e. g., Sillmann et al., J. Climate, 2011)

-- Challenges

(i) Cyclones (path & intensity)

(ii) Multivariate extremes (limitations of extreme value theory)

“Conditional” approach: Gilleland (CAPE & shear)

(iii) Scale mismatch for precipitation (observations versus model output)

Use extreme value methods to devise adjustment

- **What statistical connections are there between extreme event and large-scale phenomena such as low frequency phenomena like ENSO, NAO, etc.?**

-- Can still use extreme value distributions with covariates

-- Issue of whether should assume linearity (e. g., for location parameter of GEV distribution)

Can handle nonlinear relationships (but issue of feasibility for large data sets)

Could study issue via model experiments