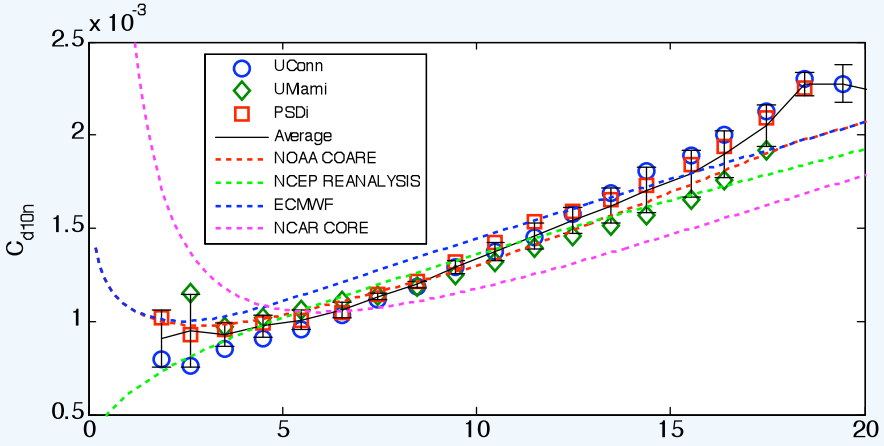
Climate, Weather and Water Science

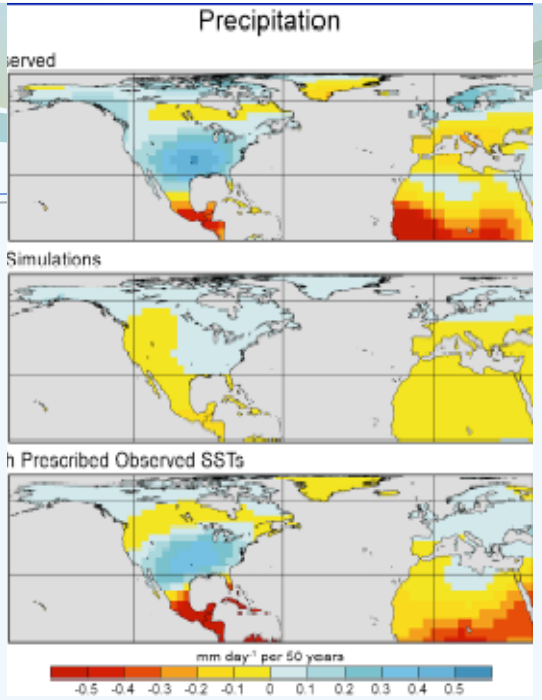
James Wilczak

Summary and Way Forward

Summary

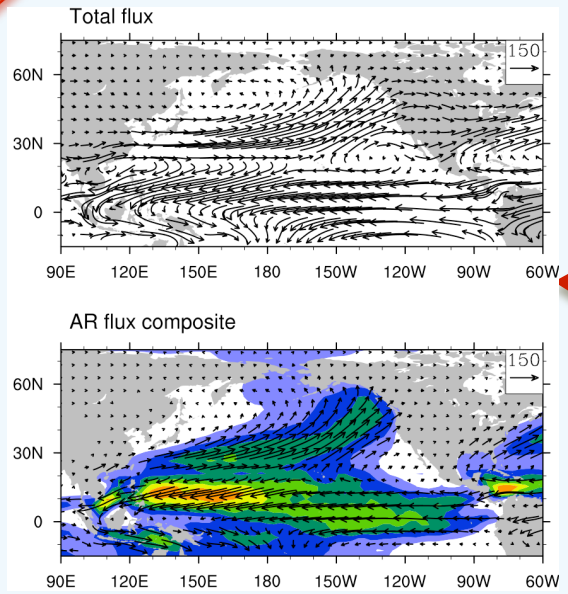


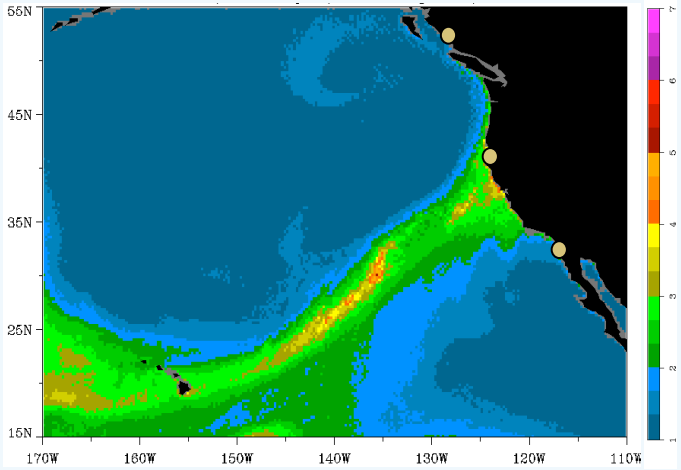
Heat, moisture flux



AR's and climate

SST spatial & temporal var.





Atmospheric Rivers

Science Questions

- What oceanic and atmospheric processes are climate models not getting right?

  (Alexander – P2)

- Can we better predict seasonal climate?

  (Kiladis – P3)

- What controls the intensity of hurricanes?

  (Bao – P6, Voronovich – P7)

- What mechanisms produce extreme weather events? How are they affected by climate drivers such as ENSO?

  (Neiman – P8, Williams – P9)

- What mechanisms are producing the shrinking of the arctic ice sheets?

  (Persson – P10, Spackman – P5)

Products from Research

- COARE air-sea flux algorithm
- Snow level detection
- Boundary layer depth detection
- Reforecasts
- Experimental seasonal forecast
- MJO monitoring and prediction
- Coral bleaching
- Arctic cloud parameters

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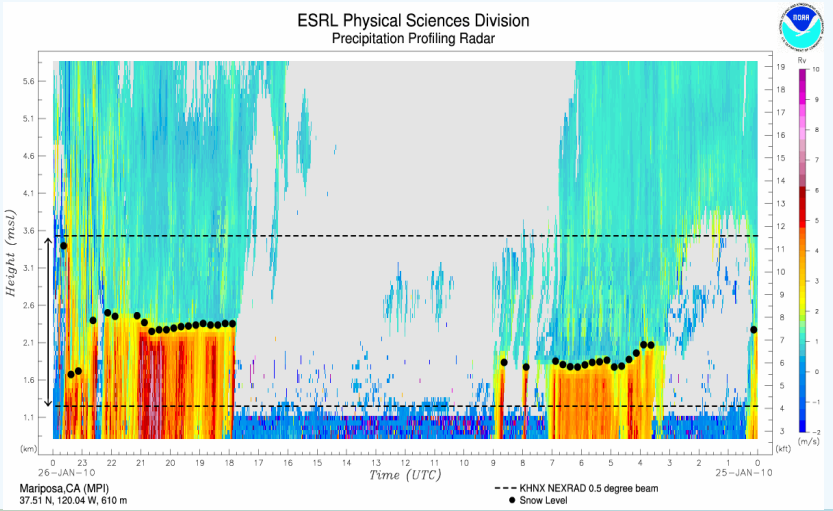

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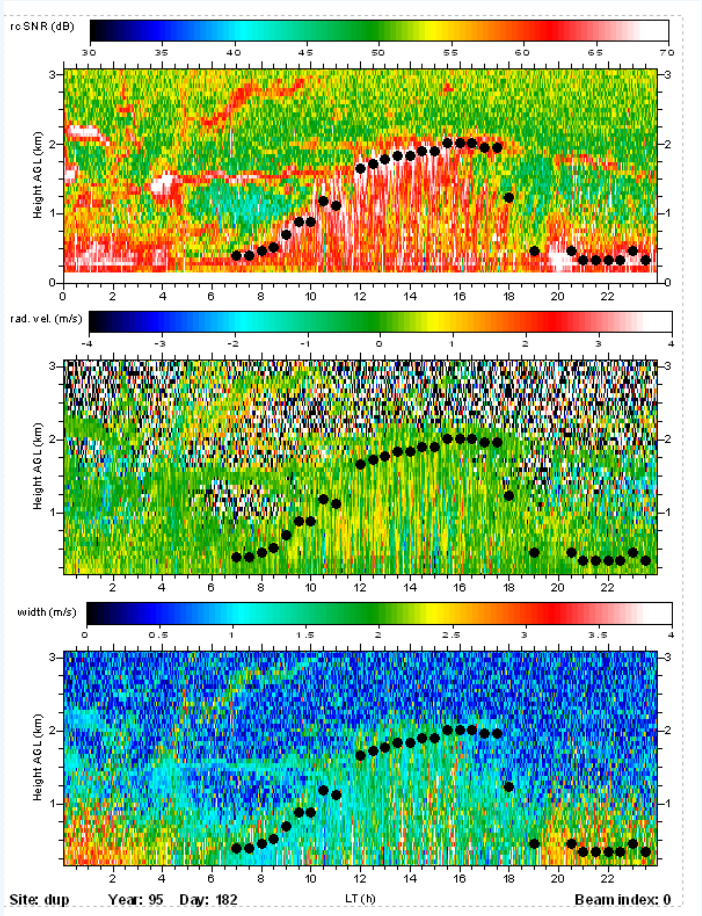

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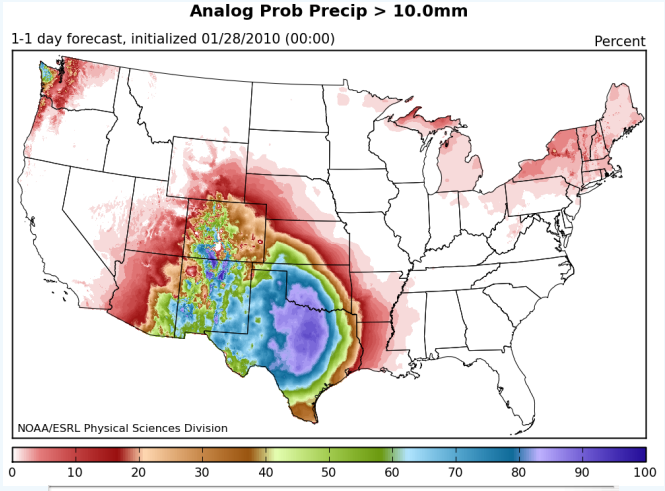

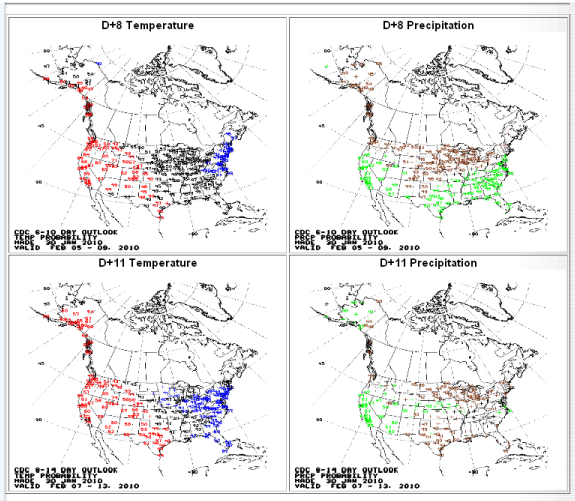

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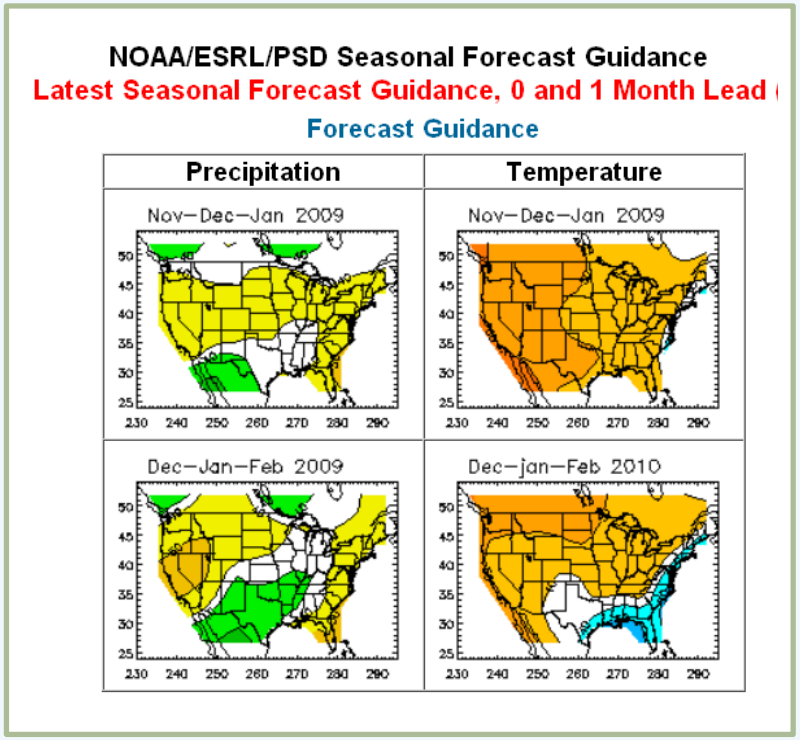

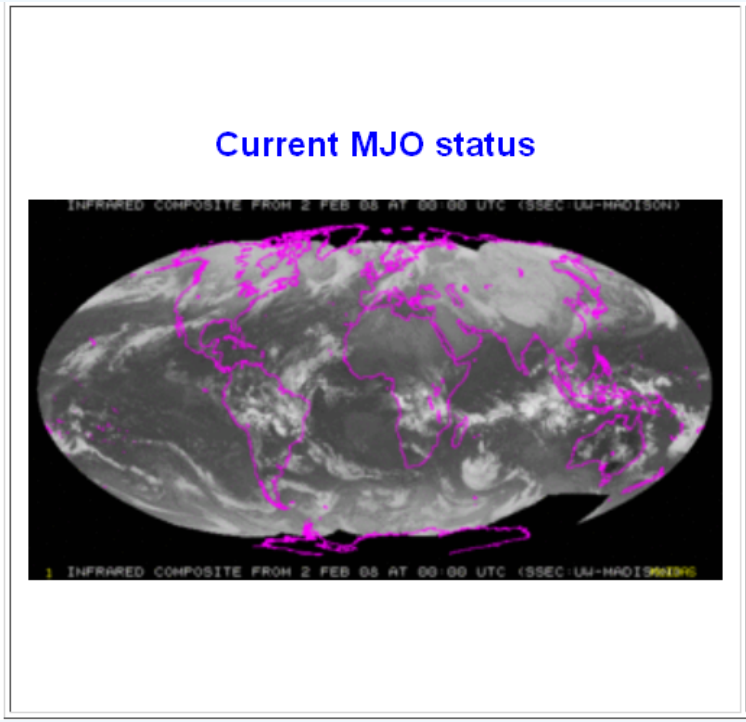

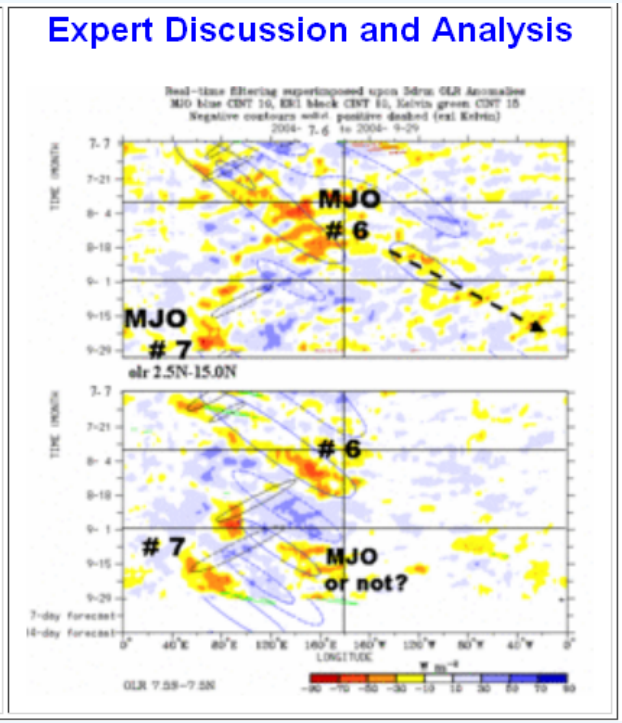

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- Coral bleaching
- Arctic cloud parameters

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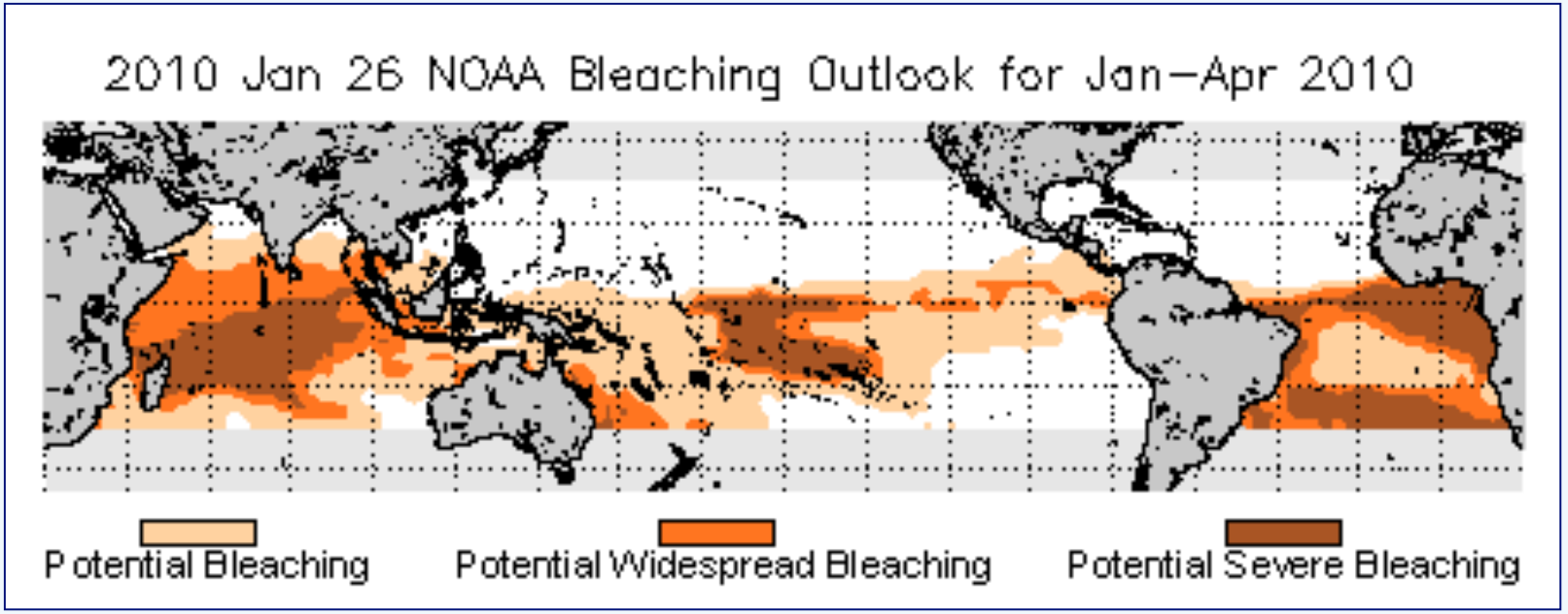

- **Coral bleaching**
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Products from Research

- AR observatory web-based tool
- COARE air-sea flux algorithm
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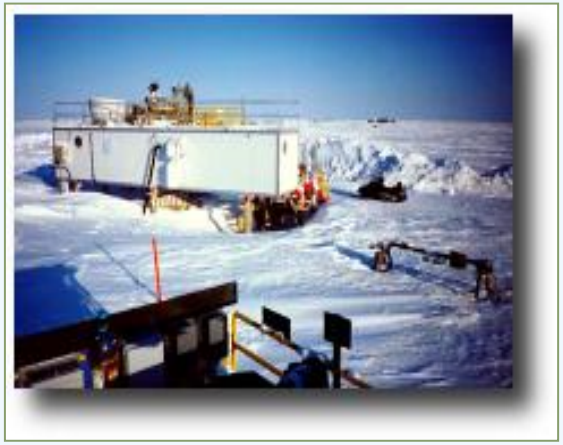
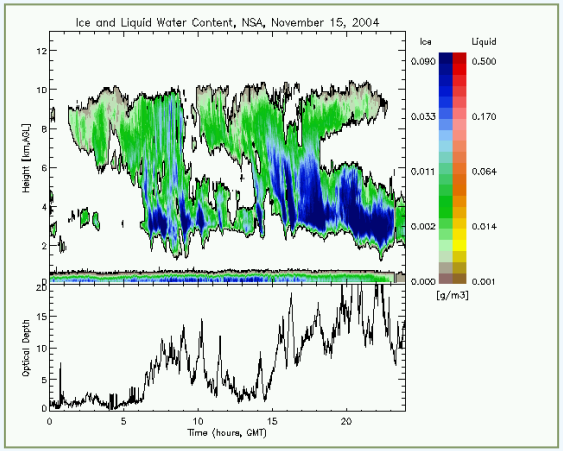
- MJO monitoring
- Coral bleaching
- **Arctic cloud parameters**





Products from Research

These examples of PSD products connect:

- Atmosphere and ocean
- Weather and climate
- Global and local

Future Directions

- Extreme Precipitation (and drought) processes in a changing climate
- Regional Climate – modeling and downscaling
- Connection between Climate and Ecosystems
- Polar Processes
- Hurricanes/High Wind Speed Fluxes/Sea Spray
- MJO
- Decadal Predictions
- Advanced Observing Systems (BL Wind profiler, P-3, Ship)
- Renewable Energy

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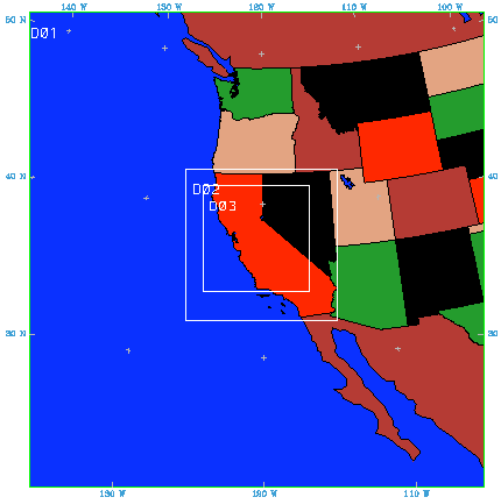

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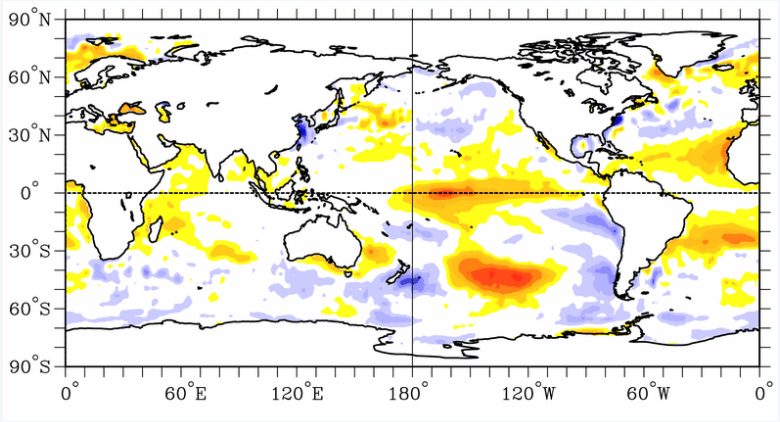

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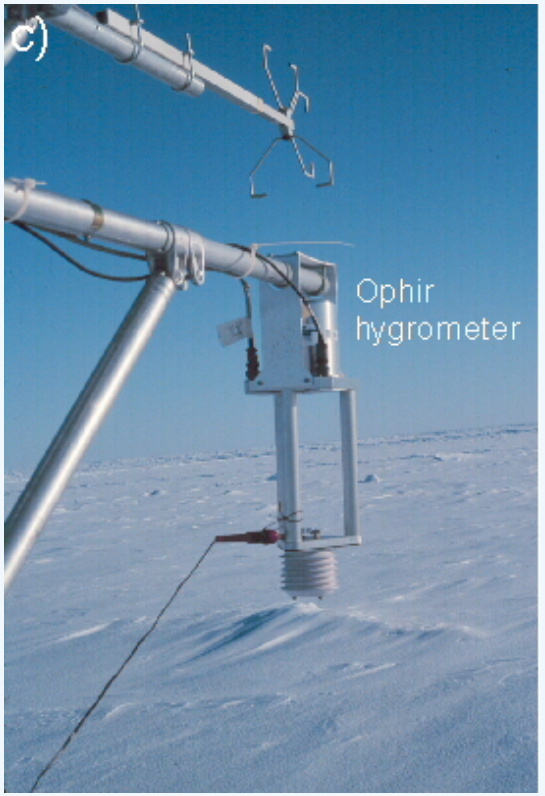

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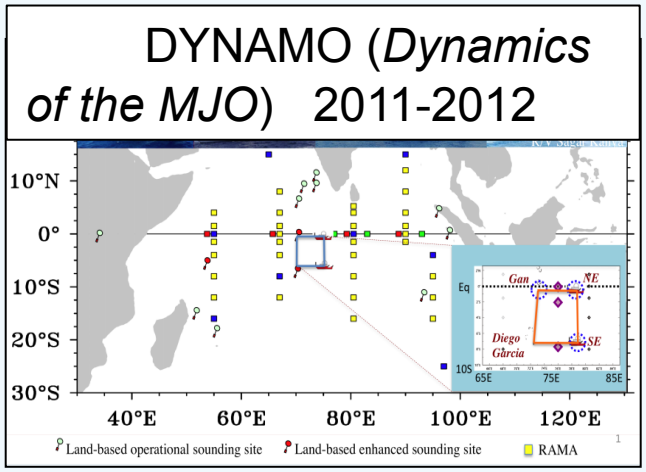

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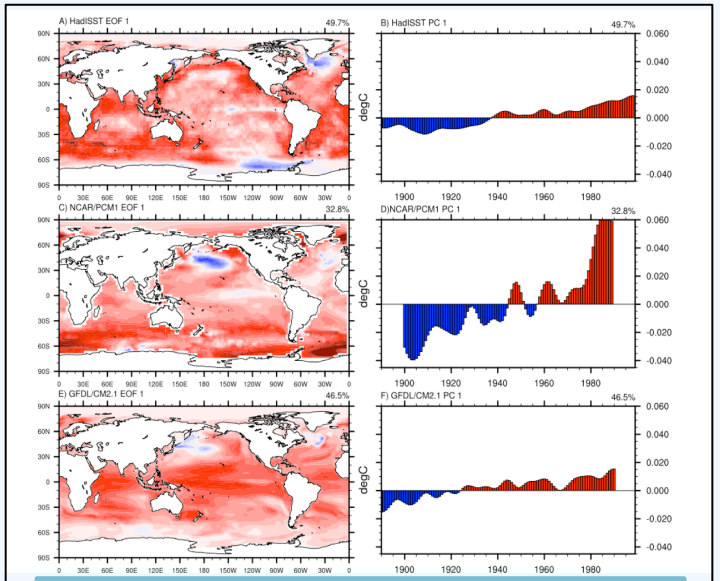

First EOF and associated time series of 10-year low-pass annual mean sea surface temperature from observations and two 20th Century simulations for years 1890-1999. (A,B) HadISST (C,D) NCAR/PCM1 (E,F) GFDL/CM2.1 (G,H). From Solomon et al. (2010).

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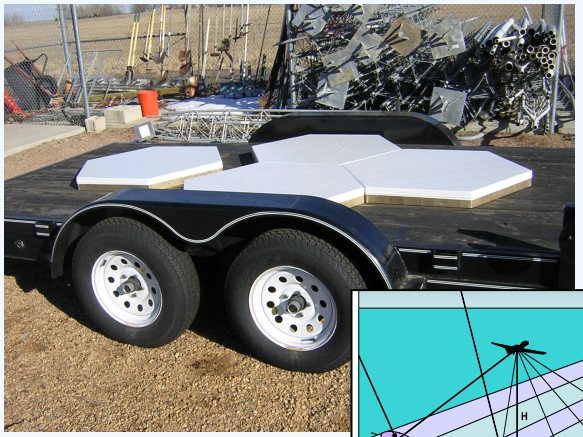

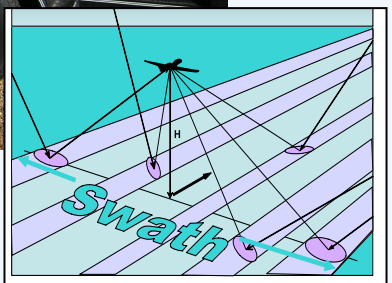

- Scanning Radar Altimeter
- Doppler Sea Spray Radar
- Breaking-Wave Imaging System
- GPS Bistatic Scatterometer

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Renewable Energy

Information and knowledge about weather-driven renewable resources (wind, solar, waves, currents) will be critical for the US energy system.

"The Smart Grid cannot be smart without accurate weather forecasts built into it."
- Dr. Henry Kelly, DOE Principal Assistant Secretary

"Private RE forecasting companies are dependent on the observations and large-scale weather forecasts provided by NOAA, and both of these are insufficient. Until NOAA is able to improve its' observational and forecasting services, private forecasters will not be able to meet the needs of utilities and electric grid operators."
- Jim Blatchford, Senior Policy Rep., Cal ISO

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DOE and NOAA Collaboration

Climate
- wind, solar, hydro co-variability
- dependence on climate drivers (e.g. ENSO)
- seasonal resource forecasts
- climate change impacts on resources
- impacts on local climate

Weather
- Observations required to improve forecasts
- HRRR forecasts w/data assimilation
- Improved PBL physics parameterizations

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