Theme 3: Modeling the Physical System

Improving Model Processes - Overview

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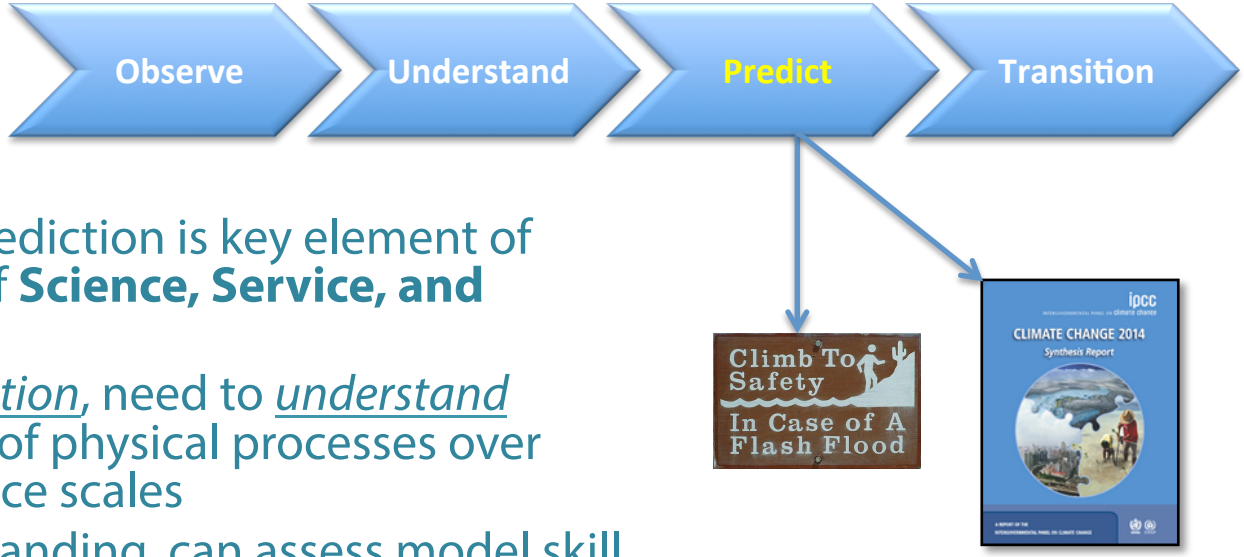
Improving Model Processes

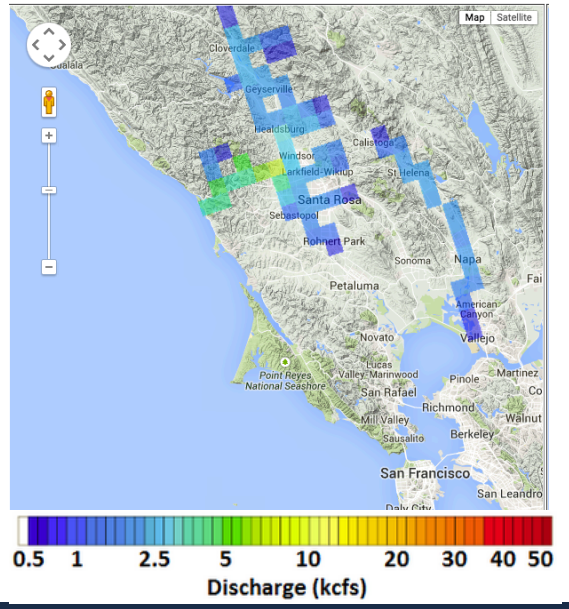


- Environmental prediction is key element of NOAA's mission of **Science, Service, and Stewardship**
- To improve *prediction*, need to *understand* model treatment of physical processes over range of time-space scales
- From this understanding, can assess model skill – develop process better representations
  - Better predictions lead to more reliable actionable intelligence for decision makers
- PSD research spans the weather-climate continuum to understand and *improve model processes*
  - minutes to multiple decades ; local to global

Research to inform actions ranging from issuing weather/flood warnings to future climate projections

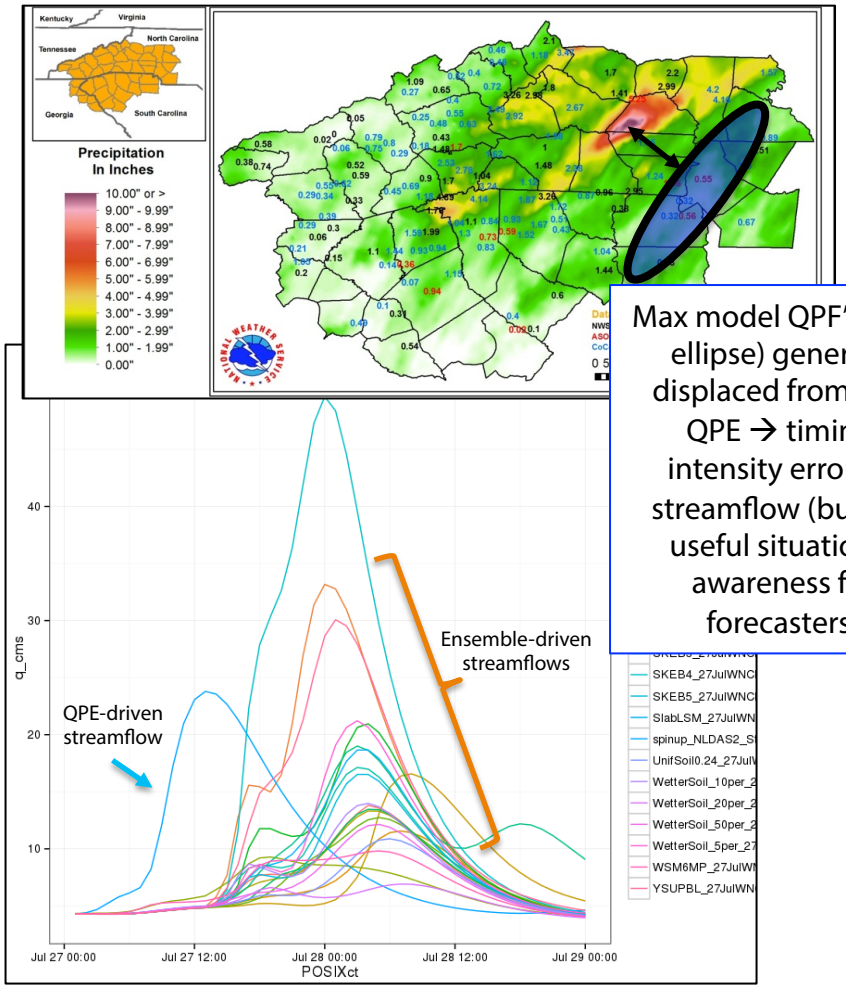
Example of Improving Model Processes to Support Stakeholder Needs: Streamflow Forecasting

- Russian River has some of the most severe flood damage in California
- Small tributaries especially flood-prone
  - Flows are not forecast by NWS
- PSD prototyping distributed hydrologic models to provide streamflow estimates everywhere in the basin
  - Assess sensitivity to precipitation forcing
- Part of a national effort by NWS
  - Determine how distributed modeling can be used to support flash flood services



Example of Improving Model Processes to Support Stakeholder Needs: Streamflow Forecasting

- PSD modeling research to inform flood risk management for extreme events
  - WRF-Hydro modeling framework
  - Impact of soil moisture and QPE on initial conditions *(see poster by R. Zamora)*
  - Propagation of forecast uncertainty from precipitation to streamflow *(see poster by M. Scheurer)*



Max model QPF's (blue ellipse) generally displaced from max QPE → timing, intensity errors in streamflow (but still useful situational awareness for forecasters)

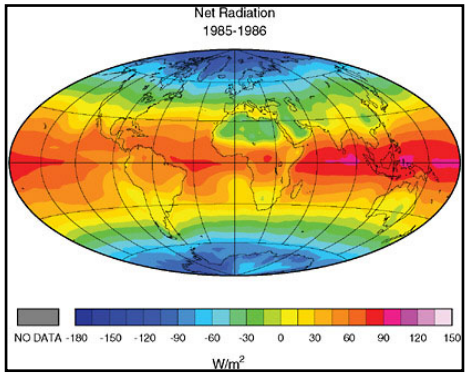
Strategic Context

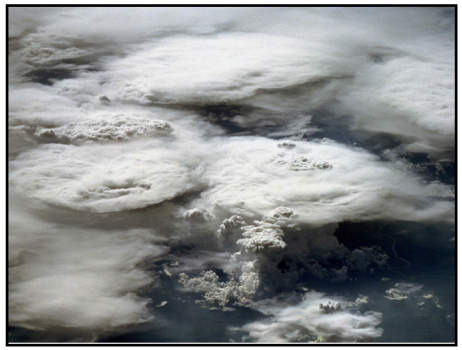
- NOAA Strategic Goal(s) Addressed:
  - Weather Ready Nation
  - Climate Adaptation and Mitigation
- NOAA Strategic Objective(s) Addressed:
  - Improved scientific understanding of the changing climate system and its impacts
  - Reduced loss of life, property, and disruption from high impact events
- NOAA 5-Year Plan Objective(s) Addressed:
  - Improved predictive guidance
- OAR Science Question(s) Addressed:
  - How can we improve forecasts, warnings, and decision support for high-impact weather events?
  - What causes climate variability and change on global to regional scales?
- PSD Strategic Goal Addressed:
  - Understand, attribute, and predict extremes in a variable and changing climate

Improving model processes strongly supports goals and objectives at all NOAA levels

What You Will Hear: Use-Inspired Research to Improve Model Processes Across the Weather-Climate Continuum

- Robert Pincus: *Radiative Forcing in CMIP6*
  - **Future climate projections:** In providing reliable projections of future climate, including extreme events, do we understand model error characteristics?
- Jian-Wen Bao: *Evaluation of Microphysics Schemes for Numerical Weather Prediction*
  - **Precipitation forecasts**: How much complexity is required to accurately represent microphysical processes in weather forecast models?





What You Will Hear: Use-Inspired Research to Improve Model Processes Across the Weather-Climate Continuum

- Stefan Tulich: *Improving Weather and Climate Prediction Models Through the Super-Parameterization Approach*
  - **Innovation:** What key processes must be represented to capture extreme events?
- Kelly Mahoney: *High Resolution Modeling to Understand Flood Risk and Hail Impacts in Future Climates*
  - **Inform decision-makers :** How can high-resolution modeling better inform future flood risk management applications ?