Theme 3: Modeling the Physical System

Modeling the Climate System - Summary

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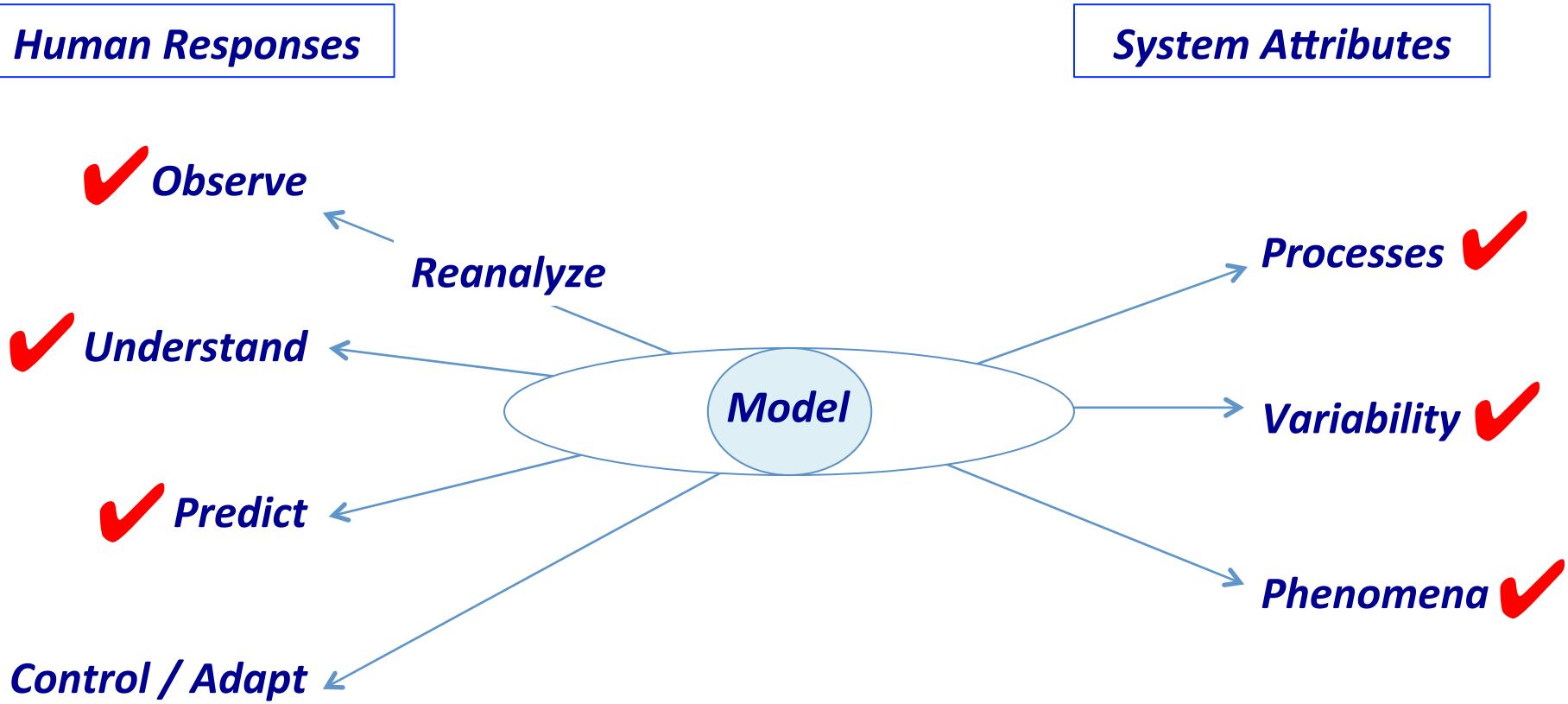
PSD is using models to generate better human responses to the chaotic climate system



Science Questions Addressed

From the PSD Strategic Plan:

- **What is the state of the climate system** and how is it evolving?
- **What causes climate variability and change** on global to regional scales?
- **What improvements** in global and regional climate predictions are possible?
- **How does climate affect** seasonal weather and extreme weather events?
- **How can we best use** current and emerging environmental data ?

Some Notable Scientific Successes of the last 5 years

- **Extending atmospheric reanalysis datasets** back into the mid-19th century.
- **Establishing the critical role of tropical SST patterns** in global climate variability and trends, and how current climate models misrepresent such patterns.
- **Developing a cleaner modeling and diagnostic framework** for understanding climate variability and predictability from weekly to decadal scales.
- **Developing stricter LIM-based benchmarks** for sub-seasonal to decadal predictions made using comprehensive models.
- **Introducing a new class of probability distributions** called *Stochastically Generated Skewed ("SGS") distributions* for characterizing and understanding weather and climate extremes.

Some Future Directions

PSD will continue to both run and analyze GCMs developed elsewhere to :

- *Diagnose the causes of weather and climate variations and extremes*
- *Identify regions of relatively large sensitivity and predictability*
- *Perform focused dynamical and physical process studies*
- *Help extend the climate record back to 1850 through Reanalysis*
- *Identify simulation and prediction errors that are systematic across models*

PSD will additionally continue to develop and use Linear Inverse Models (LIMs) for many of the above (and several other) purposes.

PSD will also develop physically based "Probability Models" of extreme anomalies as an attractive alternative to expensive ensemble GCM integrations.

What you heard in this Session

1. Cécile Penland : The Stochastic Framework for Understanding Climate
   A magical mystery tour of stochastics.
   How knowledge of the stochastic forcing can illuminate loss of predictability in general, and of forecast derailment in particular cases.

2. Prashant Sardeshmukh : Challenges in modeling extremes
   Tails of the Unexpected, and how they can be muddled
   Even the sign of changes in extremes cannot generally be deduced from the mean shift alone.

3. Amy Solomon: Filling conceptual gaps in Arctic Cloud Processes with focused model studies
   Clearing up some cloudy Arctic issues
   Model misrepresentation of simple features such as humidity inversions can have serious implications.

4. Gil Compo: The 20th Century Reanalysis project version 2c (1851-2011)
   How to Reanalyze it all. Again.
   It's currently the only game in town for characterizing atmospheric variability and trends over the full 150-yr historical period of record. The new Version 2c is better than the widely used Version 2b.