Self Introduction
AMSC/CMSC 663-664 Fall 2016

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Associate Professor

Department of Atmospheric and Oceanic Science
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Institute for Physical Science and Technology
Earth System Science Interdisciplinary Center

Applied Mathematics, Statistics, and Scientific Computation Program

RIT: Weather-Chaos Research Group

Professional Training

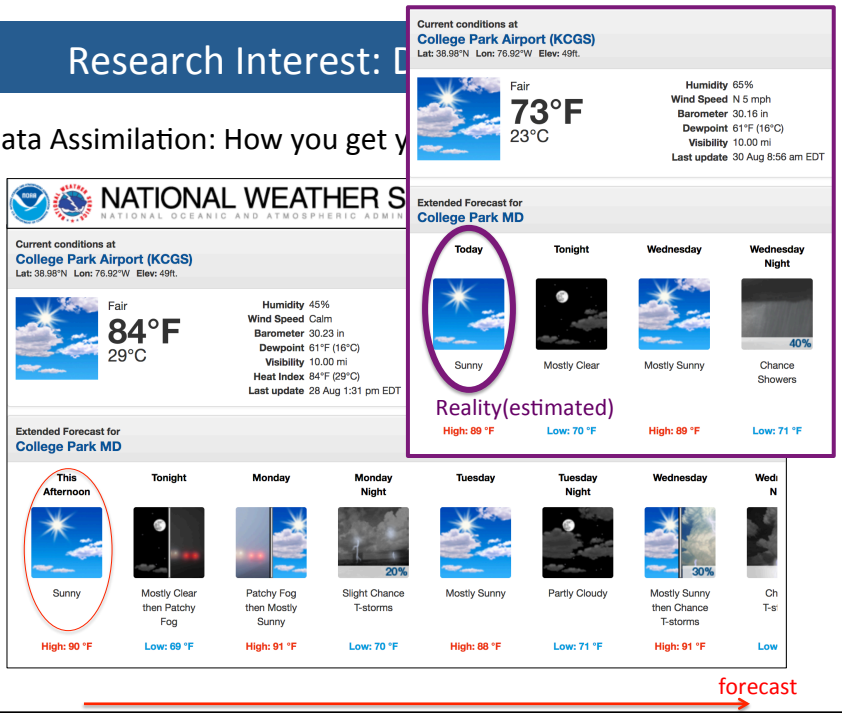
- Education
  - BS in Aeronautical Engineering, Nagoya University, Japan
  - MS in Aeronautics, California Institute of Technology
  - PhD in Aeronautics, California Institute of Technology
- Training
  - Theoretical (/computational) fluid dynamics
  - Applied Mathematics
  - Geophysical fluid dynamics
  - Interdisciplinary research
- UMD since 2008

Current Research Interests

- Bottom line
  - Applications of mathematical and engineering techniques (dynamical systems, control, statistics, system design…)
- In particular
  - Data assimilation = scientific prediction
    - from theory to operational applications
  - Lagrangian analysis = dynamical systems approach to fluid dynamics

Research Interest: D

- Data Assimilation: How you get y



Research Interest: D

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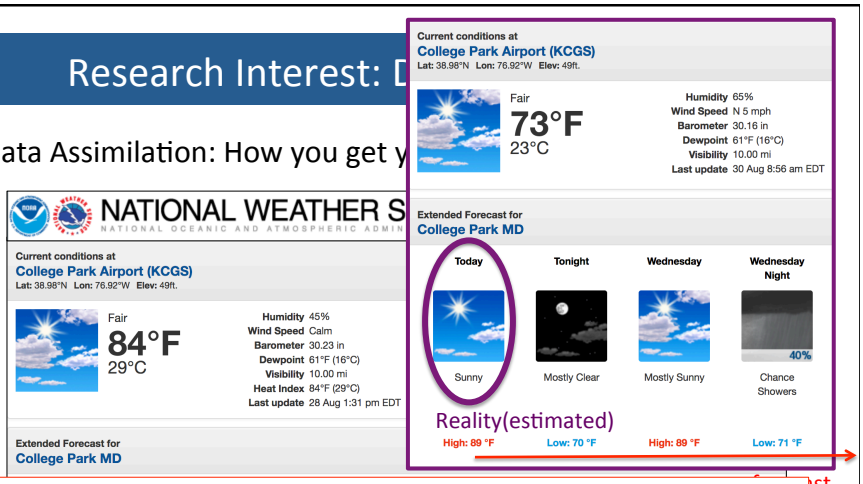
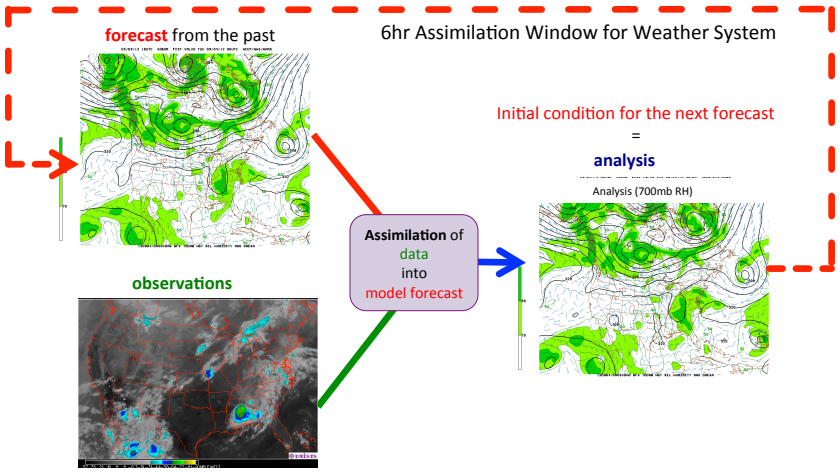


- Weather forecasting is an iterative process
- My research is Numerical weather prediction (NWP)= Scientific prediction using
  - ✓ Computational model to generate synthetic reality using realistic initial/current conditions
  - ✓ Observations of the real system

Research Interest

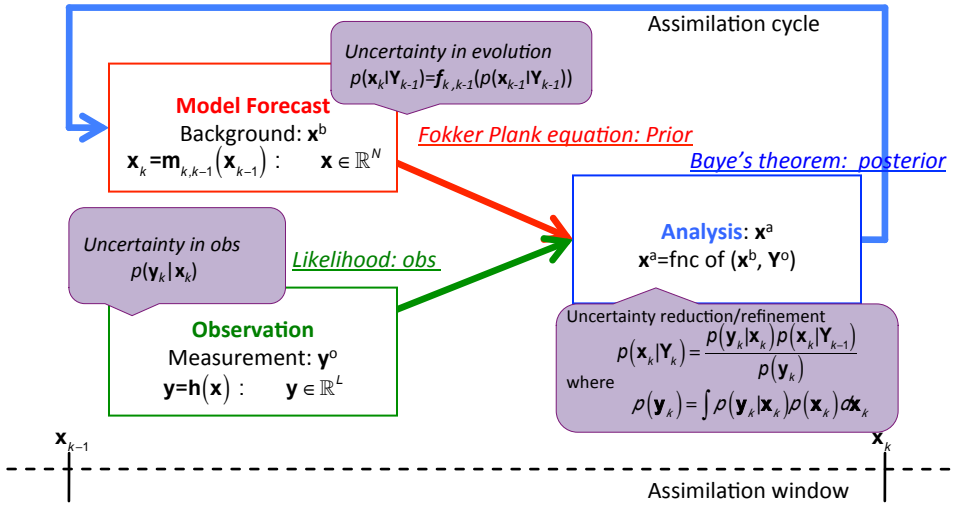
- Data assimilation is an iterative method that attempts to make best use of the model and the observations

  by incorporating *uncertainties* in model forecast & observations



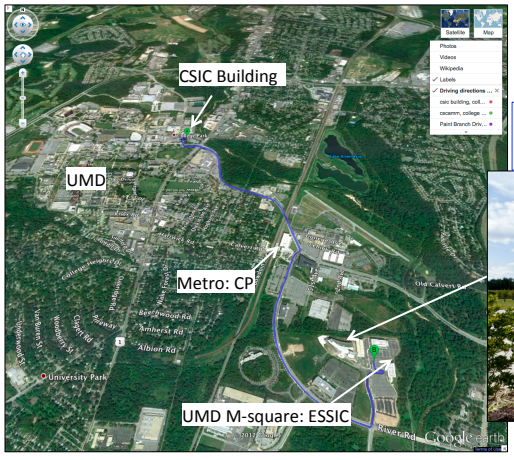
Data Assimilation as Probabilistic Approach

- Data assimilation is a scientific prediction problem, involving applied math, statistics, engineering, even social sciences

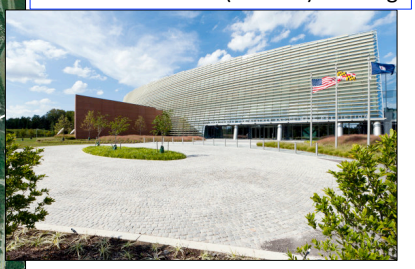


Digression: Who Issues Weather Forecasts

- National Oceanic and Atmospheric Administration
  - National Weather Service
  - National Environmental Satellite, Data, and Information Service

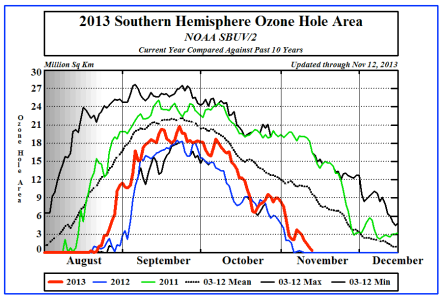


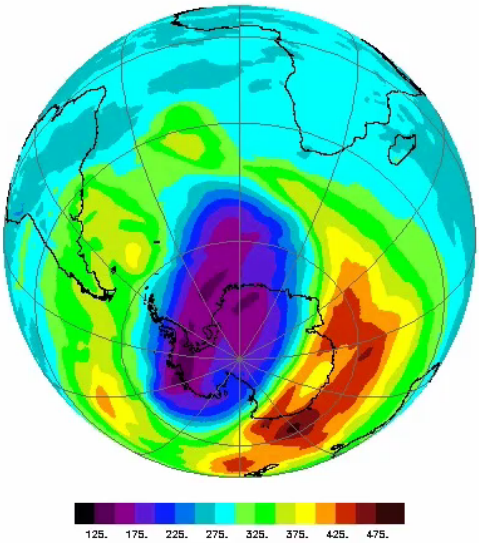
National Centers for Weather and Climate Prediction (NCWCP) Building



Ozone Hole

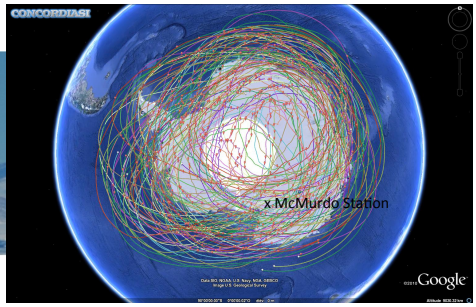
- Lagrangian coherent structures ← Dynamical systems theory
  - What's the boundary between interior and exterior?
  - How mixing occurs?





Field Campaigns: US-French Initiative

http://www.lmd.polytechnique.fr/VORCORE/



VORCORE (2005)

Hertzog et al. [2007] J. Atmos. Oceanic Technol.

27 super-pressure balloons launched from McMurdo during Sep and Oct 2005.

CONCORDIASI (2010)

Rabier et al. [2010] BAMS

19 super-pressure balloons launched from McMurdo during Sep and Oct 2010.

Research Interests

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  - What's the boundary between interior and exterior?
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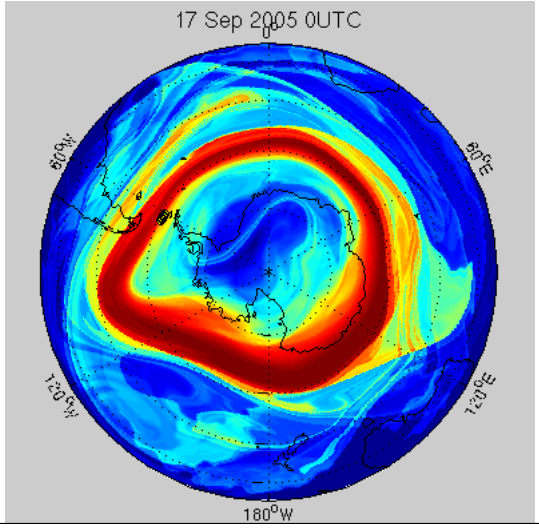

Concluding Remarks

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