Atmospheric Predictability (ATM 652)
Fall Semester 2012 (3 credits), Class Number 9097
Lecture: Tuesday & Thursday 8:45-10:05 in ES B13
http://www.atmos.albany.edu/facstaff/torn/atm652

Instructor:
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Course Objective:
This course will describe methods of evaluating the ability of a model to predict the evolution of the atmosphere, which is an example of a chaotic system. In addition, the course will cover techniques used to address the challenges associated with these systems, including ensemble prediction systems, improving a model’s initial conditions through data assimilation and advanced methods of improving model forecasts.

Prerequisites:
ATM 562 recommended, familiarity with linear algebra, differential equations, and computer programming.

Recommended Text:
Atmospheric Modeling, Data Assimilation and Predictability, by E. Kalnay

Course Requirements:
Paper Discussion: 10%
Guided projects 30% each
Independent Project: 30%
Grading: A-E

Course Outline:

1. Introduction (1 week)
   - Overview of the course and topics
   - Review of linear algebra and probability (handout)

2. Fundamentals of Chaotic Systems (3 weeks)
   - Non-linear systems
   - Flow stability
3. Data Assimilation (3 weeks)

- Early Schemes: Successive correction and nudging
- Baysian Estimates
- Multivariate methods: Variational and OI
- Least squares: Kalman Filter
- Extended and Ensemble Kalman Filter
- Hybrid schemes
- Treatment of observations

4. Ensemble Forecasting (3 weeks)

- Liouville Equation
- Monte Carlo methods
- Ensemble Prediction: initial condition techniques
- representation of model error in ensembles
- Probabilistic Verification

5. Forecast Sensitivity Analysis (3 weeks)

- Adjoint Methods
- Ensemble-based methods
- Observation impact and targeting
- Longer-range predictability