Metr 6803: Numerical Weather Prediction Syllabus: Spring 2013

M / W – 10:00-11:15, NWC 5930

Professor Lance M. Leslie

1. ***Introduction and Course Overview***
- historical perspective
- what are numerical weather analysis (NWA) and numerical weather prediction (NWP)?
- why are they important?
- how "good" are they at present?

2. ***Governing Equations for NWP***
- derivation
- classification
- barotropic vorticity equation
- shallow water equations
- normal modes
- forced modes

3. ***Numerical Weather Analysis I***
- definitions
- concepts
- applications

4. ***Numerical Weather Analysis II***
- local and global polynomial interpolation
- empirical linear interpolation
- least squares minimization including Kalman filter and variational methods
- emerging techniques

5. ***Geostrophic Adjustment***
- theory
- applications

6. ***Model Initialization***
- model shock and model spin-up
- static and dynamic initialization

7. ***NWP Methods I: Definitions and Operators***
- spectral and finite element methods
- finite-difference methods

8. ***NWP Methods II: Theory***
- concepts
- consistency, convergence and stability

9. ***NWP Methods III: Types of Schemes***

- time differencing
- spatial differencing
- boundary conditions
- conserving schemes
- filters

10. ***NWP Methods IV: Examples of Models***
- Overview of numerics of GFS, RUC/RAP, CAPS, MM5, WRF models

11. ***Atmospheric Predictability***
- basic concepts and definitions
- chaos theory
- error growth
- predictability of tropics vs extra-tropics
- ensemble forecasting methods

12. ***The Future of NWA and NWP***
- a look at what we might expect over the next decade