METR 6803 SECTION 1: NUMERICAL WEATHER PREDICTION

SPRING SEMESTER 2008

Class Times: Tues / Thurs 1pm 2-15pm, Room NWC 5930

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1. Introduction and Course Overview
   - a brief historical perspective
   - what are numerical weather analysis (NWA) and numerical weather prediction (NWP)?
   - how does NWP differ from climate modeling?
   - why are NWA and NWP so important?
   - how good are they?

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

3. Numerical Weather Analysis I: Background
   - definitions
   - concepts
   - applications

4. Numerical Weather Analysis II: Techniques
   - local and global polynomial interpolation
   - empirical linear interpolation
   - least squares minimization
   - 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 of Finite-difference methods**
   - concepts
   - consistency, convergence and stability

9. **NWP Methods III: Types of Finite-difference Schemes**
   - time differencing
   - spatial differencing
   - boundary conditions
   - filters

10. **NWP Methods IV: Examples of Models**
    - numerics of LFM, GFS, ETA, RSM, RAMS, MM5, WRF models

11. **Climate Modeling: An Introduction**
    - a climate modeling primer

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

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