

Large-Scale Atmospheric Circulations

EAS - 4470

Fall 2003

Lectures: Tuesday and Thursday; 3:05-4:20

Location: ES&T L1116

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Textbook

Required:	None required
On reserve:	Large-Scale Dynamical Processes in the Atmosphere

Office Hours

By appointment (e-mail recommended)

Course Overview

The course is designed to provide an introduction to the phenomenology and dynamics of large-scale atmospheric variations having time scales of a week and longer. Using papers from the recent scientific literature and real-time analyses, we will overview the basic characteristics, underlying physics, and current status of a number of large-scale atmospheric phenomena. Topics will include weather regimes, storm track variability, stratospheric polar vortex variability, El Niño-Southern Oscillation, teleconnections, monsoon circulations, the Arctic and Quasi-Biennial Oscillations, and stratosphere-troposphere coupling. The class format will include reading assignments and student presentations.

Outline

Week:

1. Tools of the Trade

-> Basic state and eddy decomposition, time filters, harmonic analysis, zonal averaging, pattern identification, linear regression and compositing techniques, wave properties, dynamical diagnostic methods.

2. Basic state characteristics

-> Seasonal mean circulations: jet streams, stratospheric polar vortex, forced stationary waves, transient eddies, power spectra, heat and momentum fluxes, storm tracks, (contrast winter and summer, NH and SH, midlatitude and tropics, etc)

3-5. Midlatitude tropospheric variability

-> Weather regimes, teleconnections, atmospheric blocking, storm track variability.

6-7. El Nino Southern Oscillation

-> Atmospheric and oceanic evolution, atmosphere-ocean coupling, remote effects.

8-9. Other tropical tropospheric variability

-> Monsoon circulations, Madden-Julian Oscillation, Hurricane modulation, tropical-extratropical interactions.

10-11. Stratospheric variability

-> Annular modes, stratospheric warmings, Quasi-biennial oscillation

12-13. Stratosphere-troposphere coupling

-> Tropospheric planetary wave propagation, the Arctic Oscillation, direct and indirect feedback mechanisms, seasonal transitions.

14-15. Long-term circulation trends

-> Global warming, volcanic emissions, ozone trends, and solar cycle variability.