GGS-319 Air Pollution
Review Guide for Midterm Exam
Lecture 1: Introduction

What are the major chemical components of the atmosphere?
Atmospheric Layers and their major characteristics:
- Troposphere
- Stratosphere
- Mesosphere
- Thermosphere

Temperature profile of the atmosphere.
Inversion
What is the environmental lapse rate?
How does photosynthesis influence the atmosphere?
Atmospheric pollutants – categories
Primary pollutant types & sources
Secondary pollutant types & sources
Definition of hazardous & criteria pollutants
Air pollution source categories

Lecture 1: Introduction (Con't)

Definition of Planetary Boundary Layer (PBL)
PBL structure
Importance of PBL in air pollution studies
Definition and physical importance of spectral gab
What is atmospheric dispersion?
Turbulent transport
Dispersion in the PBL
Characteristics of pollutants behavior
- Looping
- Fumigation
- Fanning
- Conning

Contrasting PBL with free atmosphere

Lecture 2: Measures of Atmospheric Composition

Earth system & Earth system cycles
Early evolution of the atmosphere
Atmospheric composition
Measures of atmospheric composition
- Mixing ratio
- Number of density
- Partial pressure

Lecture 3: Atmospheric Pressure

Properties of the Atmosphere
Ideal gas law
Temperature and pressure profiles
Hydrostatic Balance
Factors affecting vertical velocity
Factors affecting horizontal wind
Effects of heating and cooling

Lecture 4: Atmospheric Stability

What is atmospheric stability?
What is adibatic process?
Key players in stability (lifting, air parcel temperature & moisture)
DALR vs. SALR
Stability conditions
- absolute stability
- absolute instability
- conditional stability

Upper air obs and SKEW-T/Log-P diagram and their importance in air pollution

Lecture 5: Simple Models

The simplest model: One box model

- Concept of lifetime
- Mass balance

Multi-Box models

Lecture 6: Concentration Calculation in Lagrangian Framework

What is Lagrangian framework
Particle mode vs. puff mode
Advantages vs. disadvantages of the Lagrangian framework
Mechanics of concentration calculation
- Governing equation
- Simulation domain setup
- Concentration grid points
- Initialization
- Numerical method
- Diffusion (P-G curves)
- Puff operations
- Calculation
- Post-processing

Uncertainty of the concentration calculation
Application of the Lagrangian framework

Lecture 7: Concentration Calculation in Eulerian Framework

What is Eulerian framework
Advantages vs. disadvantages of the framework
Mechanics of concentration calculation
- Governing equation
- Simulation domain setup
- Grid points
- Initialization
- Numerical method
- Eddy diffusivity coefficient
- Calculation
- Post-processing

Uncertainty of the concentration calculation
Application of the Eulerian framework

Lecture 8: Geochemical Cycles

Earth system cycles
One box model
Multi box model
Early evolution of the atmosphere
Measures of atmospheric composition
- Mixing ratio
- Number of density
- Partial pressure

The nitrogen geochemical cycle
The oxygen geochemical cycle
The cabon dioxide geochemical cycle

Lecture 9: Greenhouse gases

What are the greenhouse gases?
- Natural vs. Anthropogenic greenhouse gases

Relationship between atmospheric temperature and greenhouse gases

Impact on climate & climate change

The best estimate of solar energy

Radiation: SW radiation & LW terrestrial radiatio

Radiation Laws
- Planck's law
- Wien's displacement law
- Stefan-Boltzman law
- Kirchhoff's law

Scattering

Absorption

What is radiative forcing?