

ATMS 101 Winter 2003 Final Study Guide/Topic List

Past Material

Temperature

What does it measure?

Heat Transfer

3 different mechanisms

Radiation

General properties

Stefan-Boltzmann Law & Wien's Law

Heating of Atmosphere – what types of mechanisms are involved?

Satellite Images

IR vs. Visible

Buoyancy and its influence on convection

Daily cycle in air temperature

Relation to incoming solar radiation and outgoing IR radiation

Factors that influence surface temperatures under calm, clear conditions

Albedo

Sun Angle

Specific Heat of materials

Effects of clouds and winds on surface temperature

Inversions – relation to stability of air, how they form

Wind Chill – what types of objects does it affect?

Pressure

Two ways to think of it

-as the cumulative force exerted by all molecules striking a surface

-as the weight of the overlying fluid

Gas Law – relations between pressure, temperature, volume, and density

Displaying pressure on maps

Surface vs. 500mb (how are they plotted?)

What changes pressure

Aloft?

At the surface?

Influence of convergence and divergence

Influence of changes in the average temperature through the underlying column of air

Changes of phase of water

Latent heat – what is it? When is it released to environment, and when is it taken in from the environment?

Equilibrium/Saturation/Saturation Vapor Pressure

Relative Humidity

What it indicates

How it varies with temperature and water vapor content

Dew Point

What it indicates

How it varies with temperature and water vapor content

Dew and Frost

How they form

Differences

Fog

Different types and their causes

Saturation of air by mixing

How do clouds form?

Lapse Rates (why do air parcels cool as they rise?)

Adiabatic – what does it mean?

dry adiabatic – when is it used?

moist adiabatic – when is it used? Why does it differ from dry adiabatic?

Stable vs. Unstable air

Nuclei (why are they necessary?)

CCN

IN

Water drop and ice crystal formation and growth

- Terminal velocity – how does it affect different size droplets?
- Collision and coalescence
- Ice crystal process
- Accretion, riming
- Sleet, freezing rain - differences
- At what temperatures do you find: just liquid water, a mixture of ice crystals and liquid water, and just ice crystals?

Cloud types and forms

- Stratiform, Cumuliform – shapes, vertical motions which form them, stability of environment in which they form
- High, Middle, Low – composition of each
- Cirrus, Alto, Nimbo – how each relates to type of cloud

Why do the winds blow?

- Uneven solar heating/IR cooling of the earth's surface
- Temperature gradients, pressure gradients
- Forces (when and in which direction do they act?)
 - Pressure gradient force
 - Coriolis force
 - Friction force

Why are there seasons?

Atmospheric Circulation – role in global heat transport

- Hadley Cell – transport heat in which latitudes?
- Middle-latitude cyclones – transport heat in which latitudes?
- El Nino/Southern Oscillation – defined by what occurrence?

Middle-latitude cyclones

- Relation to horizontal temperature gradients
- Fronts (cold, warm, stationary, occluded)
- Indicators of the passage of a front
- Structure of a front
- Polar front model of cyclone development
- Influence of upper level waves – how do mid-latitude cyclones deepen or intensify?

New Material

Weather Prediction

Methods for measuring state of atmosphere
Major sources of errors in forecasts
Difficulty in predicting certain forecast variables

Local Circulations

Thermally Forced

Land/Sea Breezes – causes, influence on precipitation in Florida
Mountain/Valley Breezes – causes, influence on convection near mountains

Mechanically Forced

Air flow over mountains - lenticular clouds, mountain wave clouds
Puget Sound Convergence Zone – cause

Thunderstorms

Ingredients

Suitable environmental lapse rate (lots of conditional instability)
Adequate low-level moisture
Trigger

Basic Types

Single cell (air mass) – life cycle, cause of death
Multi-cell and Supercell – severe thunderstorms
Differences in how these types are produced
 Degree of conditional instability
 Low-level vertical wind shear – how does it prolong a storm?
How do multi-cell storms develop?
Why is the thunderstorm maximum in Florida?

Tornadoes

How is vertical rotation produced?
Which type of storm is it typically associated with?

Hail

What types of precipitation particles can develop into hail?
What allows it to become so large?

Lightning

Regions of charge found within thunderstorm
 What causes the separation of charge within these storms?
Anatomy of a lightning stroke

Hurricanes

Tropical Cyclone vs. Mid-Latitude Cyclone

- Winds
- Energy sources
- Longevity

Prerequisites for hurricane formation

- Very warm water
- Some Coriolis force – limits formation to certain areas
- Weak vertical wind shear

Stages of hurricane development

- Tropical disturbance
- Tropical depression
- Tropical storm
- Tropical cyclone
- How do tropical depressions develop rotation?

Structure of Hurricane

- Eye
- Eye Wall
- Spiral Bands

Hurricane Vertical Cross-Section

- Where are areas of ascent/descent found?
- Where are areas of inflow/outflow found?

Sources of Death and Destruction

- Wind Damage
- Storm Surge
 - Factors which affect storm surge
- Flooding due to heavy precipitation