

GEOGRAPHY 1112K
Weather and Climate
Review Sheet: Exam 2

The following list of topics and key words may or may not be of assistance to you. This list is a general study guide, and other terms and concepts not included within this list (but discussed in class) are possible material for the exam.

Stability – *the stability of the air is determined by comparing the temperature of a rising air parcel to that of its surroundings*

Stability Conditions

Absolute Stability **tendency of air to rise*

- the parcel of air is cooler than its surrounding environment
- the parcel will sink once the forcing mechanism is removed

Absolute Instability **tendency of air to rise, cool, and form clouds*

- the parcel of air is warmer than its surrounding environment
- the parcel will continue to rise once the initially forcing mechanism is removed

Conditional Instability

- the parcel of air is stable when it begins rising, but becomes unstable during ascent
- atmosphere spends most of its time in conditional instability
- frontal wedging

Vertical Motion and Stability - *cooling with vertical motions (convection)*

Orographic Lifting **stable*

- occurs when elevated terrain (mnts) acts as a barrier to the flow of air
- air ascends a mtn slope (windward side) and cools adiabatically
- air descends (**subsidence**) on the other side of the mtn (leeward side) and warms adiabatically

Frontal Wedging **stable*

- occurs when 2 air masses come in contact
- the warmer, less dense, and moist air overrides the cooler, more dense air

Convergence **conditional instability*

- occurs whenever air flows together
- results in a general upward movement of the air and hence, condensation

Localized Convective Lifting **unstable*

- when air rises because it is warmer, and less dense, than surrounding air
- sometimes called **free convection**

Climatic Significance of Stability

- smog in urban areas
 - stable atmosphere does not allow pollutants to rise, traps them at surface*
- air mass types
 - maritime tropical air = unstable = thunderstorms*
- west vs. east coasts of continents
 - ocean currents: east = warm west = cool*
- rainshadow effect
 - leeward side of mtn is dry*
- cloud/precipitation type
 - unstable = heavier precipitation, shorter duration*
 - stable = light, moderate precipitation, longer duration*

Precipitation – liquid water or ice that falls to Earth's surface (**hydrometeors**)

Cloud Condensation Nuclei – microscopic particles that serve as surfaces on which water vapor condenses

Examples: Dust, clay, organic particles, smoke, sea spray = **hygroscopic**

Hygroscopic

Micro-scale precipitation processes

-cloud droplets are very tiny and fall at slow speeds

-a mechanism is needed to increase the size of a cloud droplet to that of a raindrop

or snow:

Collision and Coalescence process – a process of raindrop formation in warm clouds (above 0°C) in which large cloud droplets collide and **join together** with smaller droplets to form a raindrop

-large droplets fall faster

-more collisions = larger raindrop

-warm rain = above freezing

Bergeron-Findeisen process – a process of precipitation formation in which ice crystals grow in preference to **supercooled** water droplets in a mixed cloud (**ice crystals & water = mixed cloud**)

Supercooled water droplets – water in clouds below freezing that's not touching another surface and is not yet frozen

Major precipitation types

– the type of precipitation that reaches the ground is modified by conditions in the air layer between the cloud and the ground – **temperature and humidity**

Examples: Rain, mist (*smallest*) and drizzle, snow, sleet, freezing rain, ice pellets

***virga = precipitation that doesn't reach the ground**

Hail

-hard, round pellets or irregular lumps of ice

-produced in a large *cumulonimbus* clouds with strong updrafts

Macro-scale precipitation processes

-the macro-scale precipitation processes are the same as those processes that produced condensation and clouds

Orographic = mtns

Frontal = fronts

Convergent = 2 similar fronts

Convictional = vertical motion of air

Global average distribution of precipitation over land

Global variability of precipitation

United States distribution of precipitation: January/July

-inter-tropical convergence zone (ITCZ) = convergence and convection

-eastern US = frontal and convection

-mountain ranges = orographic

-*areas with the most variability in precipitation are the driest

Precipitation measurements

Rainfall

-rain gauge (human observer)

-standard rain gauge (human observer)

-tipping bucket gauge (automated)

-weighing gauge (automated)

Snow

- depth = ruler
- water equivalent = heated rain gauge

Measurement errors:

- unrecorded precipitation
- proper exposure
- wind conditions
- typical errors range between 7% and 20%

Clouds -visible aggregates of minute droplets of water or tiny crystals of ice

Cloud classification on basis of 2 criteria:

1) **Cloud form**

- Cirrus = wispy, detached, ice crystals
- Cumulus = individual globular masses, flat base, puffy
- Stratus = sheets, layers, cover much or all of sky

2) **Cloud height**

- High = base at or above 20,000 feet, ice crystals
- Middle = base between 6,500-20,000 feet, water, ice, or both (mixed cloud)
- Low = base below 6,500 feet
- Clouds of vertical development = base can form at low levels but expand upward through multiple height levels/layers. Example: *thunderstorm clouds*

Ten major cloud types

High clouds

1) **Cirrus**

- detached clouds composed of white, delicate, icy filaments
- wispy, wind-blown appearance
- most common clouds worldwide
- not associated with precipitation
- can sometimes indicate weather on the way

2) **Cirrostratus**

- transparent, whitish cloud veil of fibrous or sometimes smooth appearance that may cover much or all of the sky
- halo around sun/moon through cirrostratus
- not associated with precipitation
- can be found when warm front is approaching

3) **Cirrocumulus**

- appear as white patches composed of very small cells or ripples
- detached
- can indicate convection or convection coming
- not associated with precipitation

Middle Clouds

1) **Alto cumulus**

- large patches composed of rounded masses or rolls that may or may not merge
- can indicate incoming cold front or orographic lifting

2) **Altostratus**

- formless layer of grayish clouds covering most of the sky
- uniform
- infrequent precipitation
- can indicate approaching warm front or orographic lifting
- no halo, sun/moon still bright spot