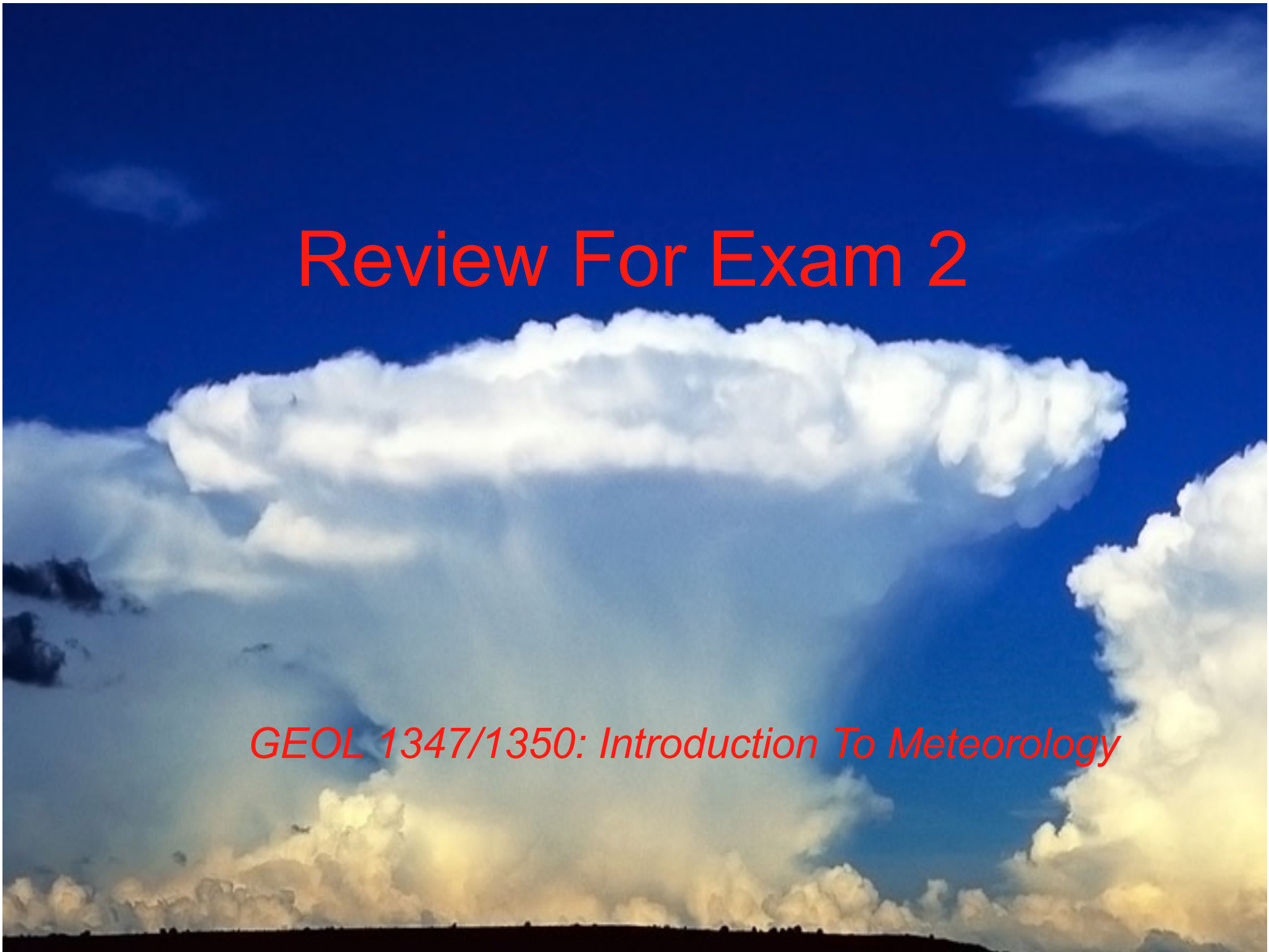


# Review For Exam 2

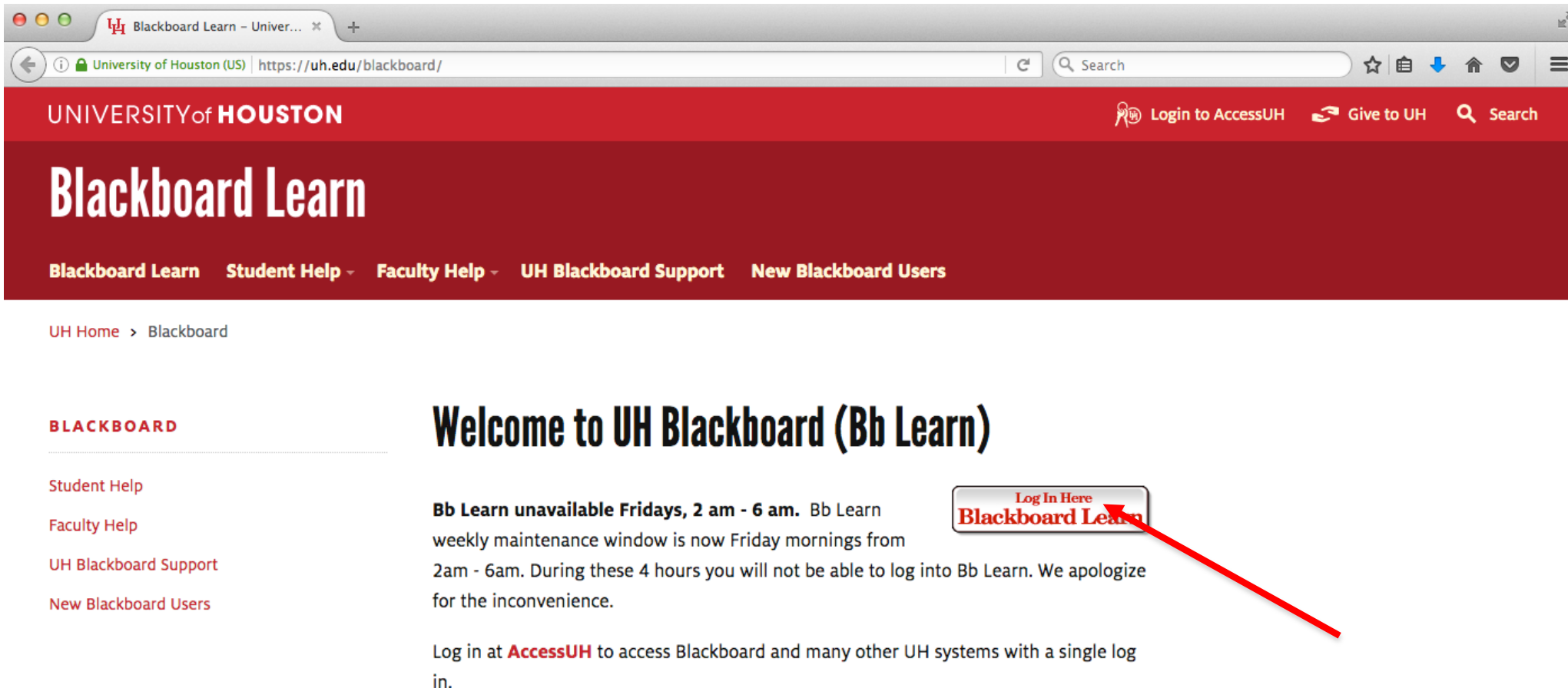
*GEOL 1347/1350: Introduction To Meteorology*



# Exam 2

## Online Test on Blackboard

Website: <https://uh.edu/blackboard/>



Blackboard Learn – Univer... x

University of Houston (US) | <https://uh.edu/blackboard/>

UNIVERSITY of HOUSTON

Login to AccessUH Give to UH Search

# Blackboard Learn

Blackboard Learn Student Help Faculty Help UH Blackboard Support New Blackboard Users

UH Home > Blackboard

## BLACKBOARD

Student Help  
Faculty Help  
UH Blackboard Support  
New Blackboard Users

## Welcome to UH Blackboard (Bb Learn)

**Bb Learn unavailable Fridays, 2 am - 6 am.** Bb Learn weekly maintenance window is now Friday mornings from 2am - 6am. During these 4 hours you will not be able to log into Bb Learn. We apologize for the inconvenience.

Log in at **AccessUH** to access Blackboard and many other UH systems with a single log in.

Log In Here  
**Blackboard Learn**

The screenshot shows a web browser window with the title "Welcome (UH) - Blackboard...". The address bar displays "https://elearning.uh.edu/webapps/portal/execute/tabs/tabAction?tab\_tab\_group\_id=\_6\_1". The page content is divided into two main sections. The top section, titled "Login Here", contains links for "Change Text Size", "High Contrast Setting", and "Privacy and Terms of Use". Below these links, a message states "You are not logged in" and provides information about the University of Houston's computing and networking facilities, including a warning about unauthorized use and links to security policies. The login form consists of two input fields: "USERNAME" and "PASSWORD", followed by a "Login" button. The bottom section, titled "My Announcements", displays a message: "No Institution Announcements have been posted in the last 7 days." and a link for "more announcements...".

Welcome (UH) - Blackboard... x

University of Houston (US) | https://elearning.uh.edu/webapps/portal/execute/tabs/tabAction?tab\_tab\_group\_id=\_6\_1

Search

### Login Here

[Change Text Size](#) | [High Contrast Setting](#) | [Privacy and Terms of Use](#)

You are not logged in

Use of University of Houston and University of Houston-Victoria computing and networking facilities requires prior authorization. Unauthorized use is prohibited. Usage may be subject to security testing and monitoring. Misuse is subject to criminal prosecution. Users have no expectations of privacy except as otherwise provided by applicable privacy laws. A complete manual of security policies and procedures is available for UH students at <http://www.uh.edu/infotech>. UHV students can review the security policies and procedures available at <http://www.uhv.edu/fin/policy/g/g-2.aspx>. Enter your username and password.

USERNAME

PASSWORD

Login

### My Announcements

*No Institution Announcements have been posted in the last 7 days.*

[more announcements...](#)

Username and password are your Cougarnet username and password.

UH Search - University of Houston

myCourses - Blackboard Learn

+

elearning.uh.edu/webapps/portal/execute/tabs/tabAction?tab\_tab\_group\_id=\_42\_1

Update

2023SP-12302-GEOL1347-Introduction To Meteorology

Instructor: Xun Jiang;

2023SP-13425-GEOL1147-Introductory Meteorology Laboratory

Instructor: Xun Jiang; Thishan Dharshana Karandana Gamalathge;

2023SP-14968-GEOL1147-Introductory Meteorology Laboratory

Instructor: Mohammad Jahirul Alam; Xun Jiang;

2023SP-17814-GEOL1147-Introductory Meteorology Laboratory

Instructor: Morshad Ahmed; Xun Jiang;

2023SP-19560-GEOL1147-Introductory Meteorology Laboratory


Instructor: Xun Jiang; Shailaja Wasti;

▼ My Announcements

No Institution Announcements have been posted in the last 7 days.

No Course or Organization Announcements have been posted in the last 7 days.

more announcements...



Connect your students to their required and supplemental course materials through Blackboard using the UH Libraries' Course Reserves service. The Libraries can help you obtain and post copyright-cleared articles, book chapters and more for your students to access easily through Blackboard. Use the available self-service options or let our friendly Course Reserves staff take care of everything for you!

**Website:** <https://libraries.uh.edu/services/course-reserves/>

**Email:** [libreserves@uh.edu](mailto:libreserves@uh.edu)

**Phone:** 713-743-9730

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**Emergency Preparedness Faculty Guide**

UH Search - University of Houston x Bb Content - 2023SP-12302-GEO x +

elearning.uh.edu/webapps/blackboard/content/listContentEditable.jsp?content\_id=\_10103288\_1&course\_id=\_173623\_1&mode=reset

2023SP-12302-GEO1347-Introduction To Meteorology Content

Content

Build Content Assessments Tools Partner Content

**Test2 Spr23**

Availability: Item is hidden from students.

This is an online test. The test is close book and close notes. There are 25 multiple choice questions. Students have a total of 1 hour to complete the test. The test is not resumable, once you begin you need to finish. You can use a scientific calculator.

**Course Management**

- Control Panel
- Content Collection
- Course Tools
- Evaluation
- Grade Center
- Users and Groups
- Customization
- Help

You should be able to see Test 2 after 1pm on Mar 2. Please finish the test during 1pm-2:30pm.

- The test is close book and close notes.
- There are 25 multiple choice questions.
- Time limit is 80 mins.
- Once started, the test must be completed in one sitting. Do not leave test before clicking save and submit.
- The test will save and submit automatically when the time expires.
- Please take the test during 1pm-2:30pm on Mar 2.
- You can use a scientific calculator.

## Exam 2

**Cover:** L5 (Air Temperature); L6 (Humidity, Condensation, and Clouds-I); L7 (Humidity, Condensation, and Clouds-II); L8 (Cloud Development and Precipitation-I)

Close-book Exam

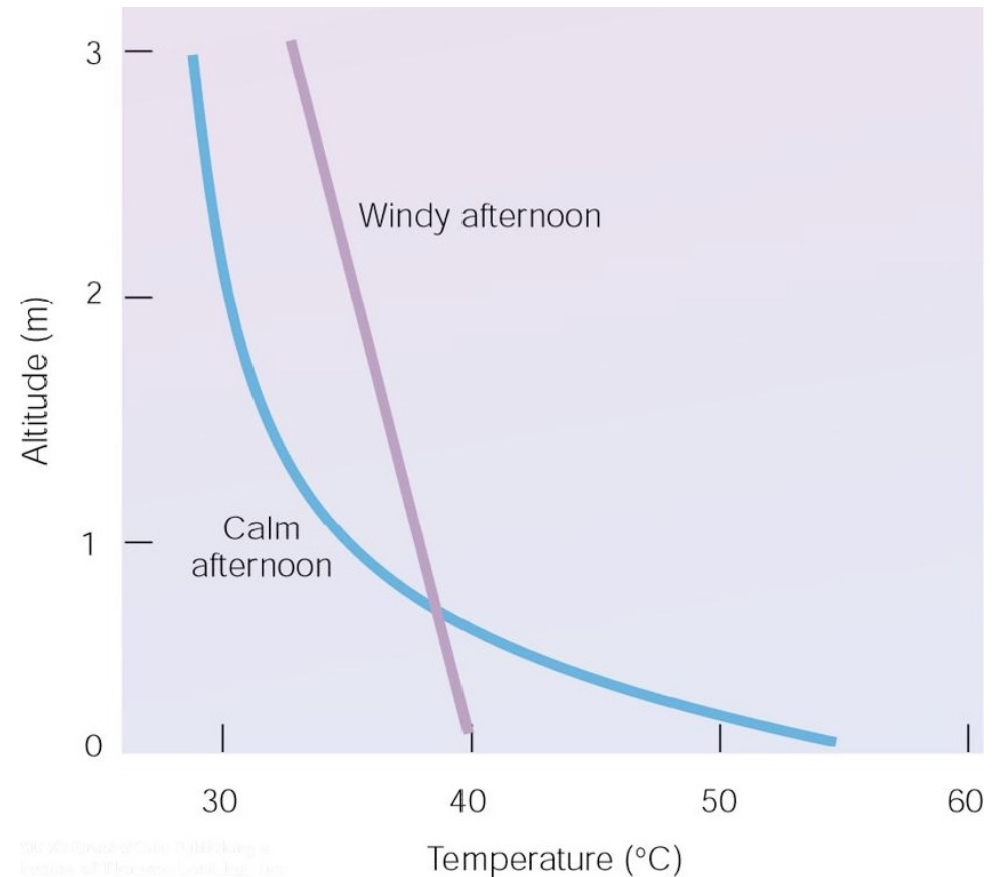
Exam counts 25% of the total grade.



# Daytime Warming

- On **windy** days, turbulence **eddies** are able to **mix** hot, surface air with cooler air above.

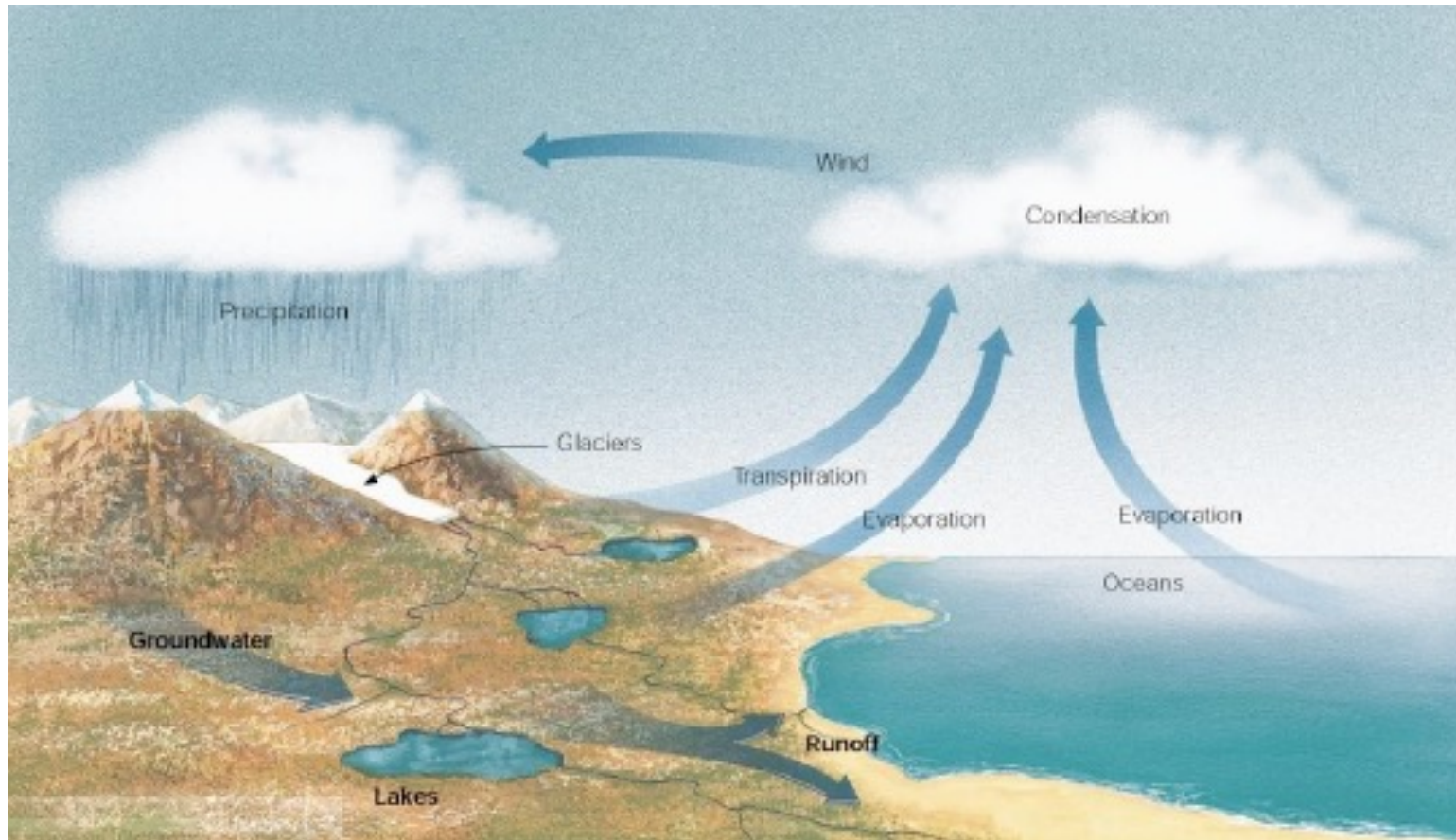
- This form of mechanical stirring, called **forced convection**, helps the thermals to **transfer heat** away from the surface **more efficiently**.



***Temperature gradient is smaller in windy day than calm day.***



# Where does the moisture in the atmosphere come from ?



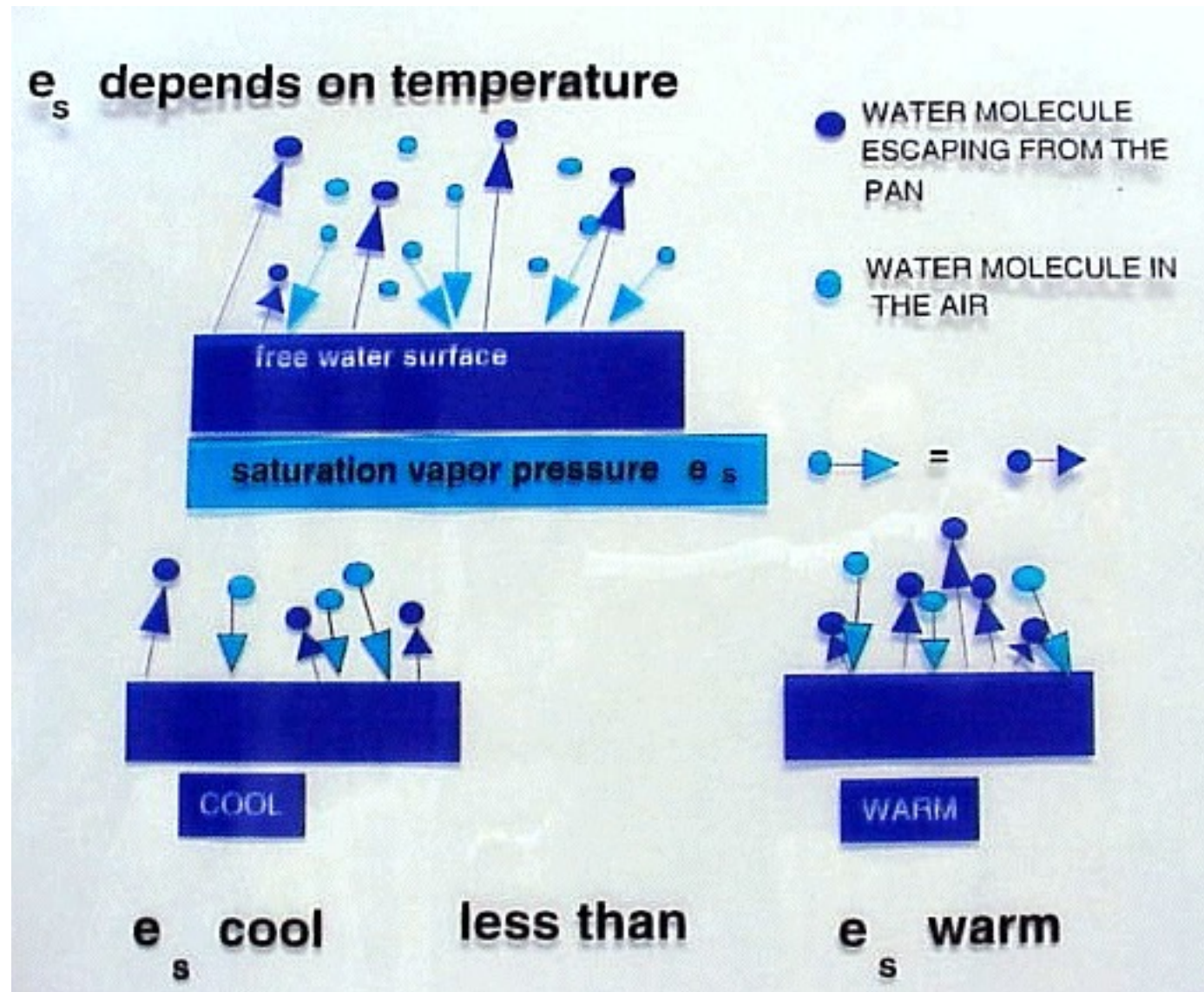
**Major Source**

**Evaporation from ocean**

**Major sink**

**Precipitation**

Saturation vapor pressure  $e_s$  depends upon temperature  
**higher** temperature, **higher**  $e_s$ ,  
**more** water vapor that the air can hold



- The saturation vapor pressure of water increases with temperature
  - At higher T, faster water molecules in liquid escape more frequently causing equilibrium water vapor concentration to rise
  - We sometimes say “warmer air can hold more water vapor”
- There is also a vapor pressure of water over an ice surface
  - The saturation vapor pressure above solid ice is less than above liquid water,  $e_{s(\text{water})} > e_{s(\text{ice})}$  at all temperatures

# Absolute Humidity - $\rho_v$

- Density of water vapor
    - A measure of the total number (mass) of water vapor molecules in a unit volume of air ( $1 \text{ m}^3$ )
    - Absolute humidity = mass of water vapor / volume of air
- $$\rho_v = m_v / V_{\text{air}}, \quad m_v = n_v M_v, \quad M_v = 18 \text{ g/mol}$$
- Changes in volume cause changes in absolute humidity

# Specific Humidity - $q$

- Ratio of mass of water to total mass of air in a unit volume
- Invariant to change in volume

$$q = \frac{m_v}{m}$$

Since  $q$  is on the order of  $10^{-3} \text{ g}_v/\text{g}_a$ , we prefer to use  $\text{g}_v/\text{kg}_a$

$q$  values normally range from 1 to 20  $\text{g}_v/\text{kg}_a$  and decreases with increasing height

## **Relative Humidity – R.H.**

**The ratio of the amount of water vapor in the air compared to the amount required for saturation.**

**R.H. = water vapor content / water vapor capacity**

$$\text{R.H} = e/e_s$$

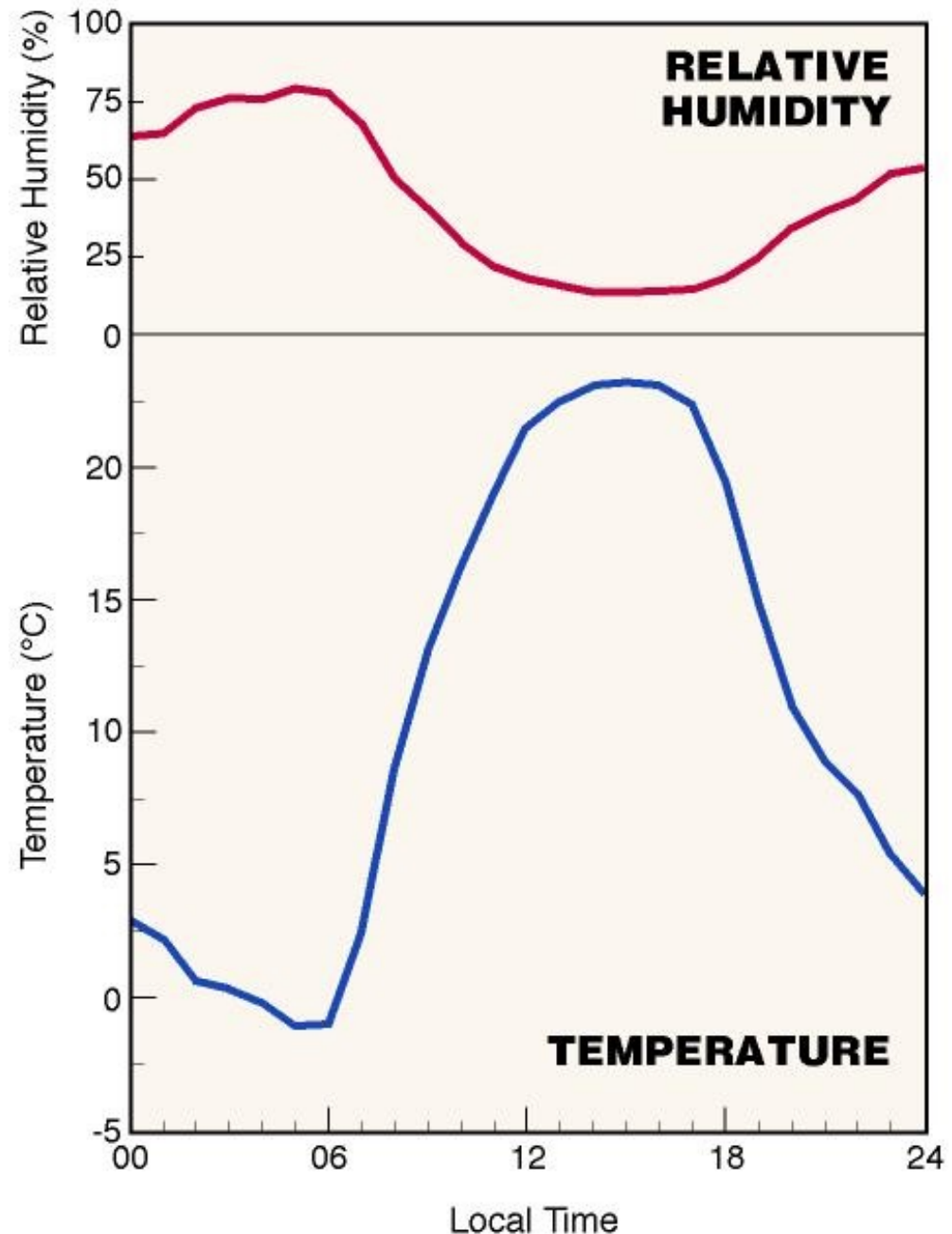
**e: Vapor pressure;  $e_s$ : Saturation vapor pressure**



# Change of relative humidity in a day

What time of the day when relative humidity is usually high ?

As the air cools during the night, the relative humidity increases. The **highest** relative humidity occurs in the **early morning**, during the coolest part of the day.





# Dew Point Temperature - $T_d$

- Temperature to which air must be cooled (at constant pressure and constant water vapor content) to become saturated.
- When  $T=T_d$ ,  $e_s(T_d) = e$ ,  $q_s(T_d) = q$ ,  $r_s(T_d) = r$
- $T_d$  is less or equal to  $T$
- Unlike relative humidity which is a measure of how near the air is to being saturated, dew point temperature is a measure of its actual moisture content. *The higher the dew point, the more water vapor in the air.*
- **Dew point depression:**  $T - T_d$
- The **larger** the dew point depression is, the **drier** the air is, or the air is farther away from saturation

# Summary of Cloud Types

	<b>Layered</b>	<b>Broken Layer</b>	<b>Separate</b>
<b>High</b>	Cirrostratus	Cirrocumulus	Cirrus
<b>Middle</b>	Altostratus	Alto cumulus	
<b>Low</b>	Stratus Nimbostratus	Strato cumulus	
<b>Vertical</b>			Cumulus Cumulo- nimbus

Dry adiabatic lapse rate – the rate of temperature decrease of a rising *unsaturated* air parcel

$$\Gamma_d = -\Delta T / \Delta z = 9.8 \text{ }^{\circ}\text{C km}^{-1} \approx 10 \text{ }^{\circ}\text{C km}^{-1}$$

*Stability* is determined by comparing parcel's temperature with that of its environment

Simply speaking,

$T_{\text{parcel}} > T_{\text{env}}$       unstable

$T_{\text{parcel}} < T_{\text{env}}$       stable

$T_{\text{parcel}} = T_{\text{env}}$       neutral

# Stability and lapse rate

Absolutely stable  $\Gamma < \Gamma_s$

Absolutely unstable  $\Gamma > \Gamma_d$

Conditionally unstable  $\Gamma_d > \Gamma > \Gamma_s$

$\Gamma = \Gamma_d$  for unsaturated air

Neutral

$\Gamma = \Gamma_s$  for saturated air

$\Gamma$ : Environmental Lapse Rate;  $\Gamma_d$ : Dry Adiabatic Lapse Rate;  
 $\Gamma_s$ : Moist Adiabatic Lapse Rate