

## Lecture 6: Weather, Music Of Our Sphere



(From Understanding Weather & Climate)

- ❑ Weather and Climate
- ❑ Mid-latitude and Tropical Weather
- ❑ Weather Maps and Forecasts

## Weather and Climate

### ❑ WEATHER

- The daily fluctuations in atmospheric conditions.
- The atmosphere on its own can produce weather.

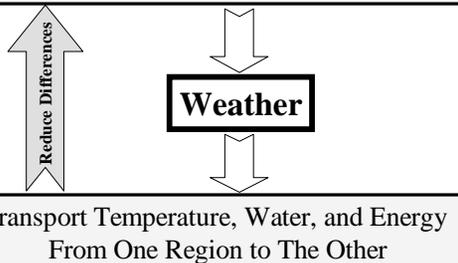
### ❑ CLIMATE

- The long-term average of the daily variation.
- For climate to fluctuate, the atmosphere has to interact with the land, ocean, and ice underneath it.

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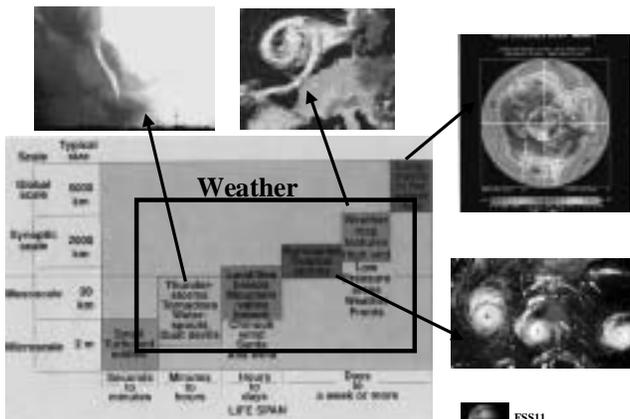
## Why There Is Weather?

Differences in the Global Distributions of Temperature, Water, and Energy (such as the North-South Temperature Difference)



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## Scales Of Atmospheric Motion



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## Parameters Determining Mid-latitude Weather

- Temperature differences between the equator and poles
- The rate of rotation of the Earth.



## Rotating Annulus Experiment



(from "Is The Temperature Rising?")



(From *The Blue Planet*)

## How Cyclone Grows?



Potential Energy  $\rightarrow$  Available P. Energy

(cold/warm air moves south/north)

$$(V * T^* > 0)$$

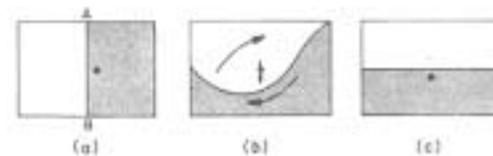
Available Energy  $\rightarrow$  Kinetic Energy

(cold/warm air moves down/up)

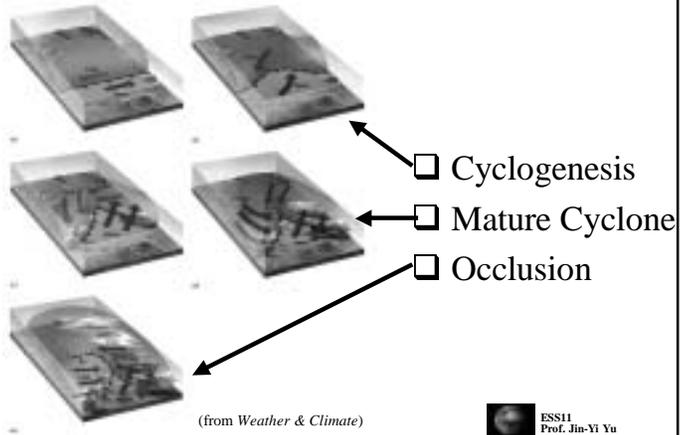
$$(W * T^* > 0)$$



## Available Potential Energy

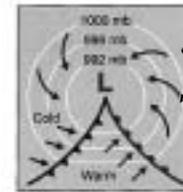


## Life Cycle of Mid-Latitude Cyclone

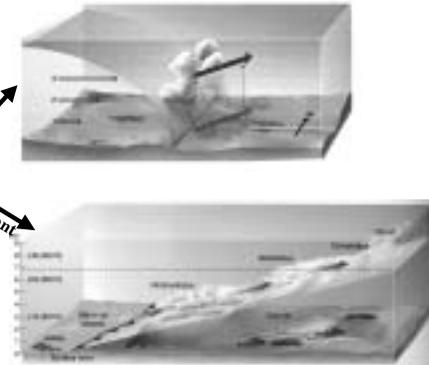


## Cold and Warm Fronts

Mid-Latitude Cyclone



(From *Weather & Climate*)



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## Storm Track And Weather



- Mid-latitude weather systems are steered around by the jet stream (the strong westerly winds in the upper troposphere).
- Therefore, the jet streams are also referred as the “storm tracks”.

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## Winter and Summer

The equator-to-pole temperature difference is larger during winter than summer

→ Weather is “wilder” in winter than summer.

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## Tropical Hurricane

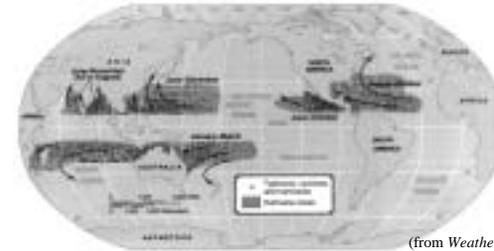


(from Understanding Weather & Climate)

- ❑ The hurricane is characterized by a strong thermally direct circulation with the rising of warm air near the center of the storm and the sinking of cooler air outside.



## They Are the Same Things...



(from Weather & Climate)

- ❑ **Hurricanes:** extreme tropical storms over Atlantic and eastern Pacific Oceans.
- ❑ **Typhoons:** extreme tropical storms over western Pacific Ocean.
- ❑ **Cyclones:** extreme tropical storms over Indian Ocean and Australia.



## Weather Forecasting Methods

- ❑ **Climatological Forecasts**  
“It usually rains at this time of the year”
- ❑ **Persistent Forecasts**  
“Since it rains today, it will probably rain again tomorrow”.
- ❑ **Numerical Weather Forecasting**  
Use computers to solve a set of mathematic equations that govern the motion of the atmosphere.



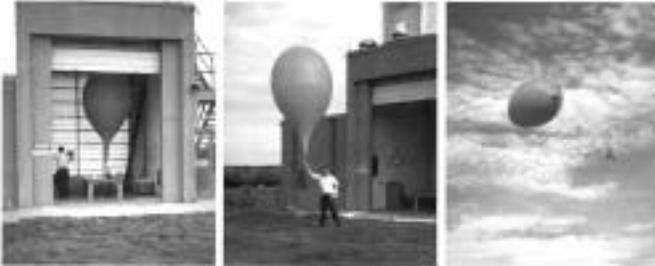
## What Do You Need For Numerical Weather Forecasting?

- ❑ Observations (Ground Networks and Satellites)
- ❑ Analysis (Weather Maps)
- ❑ Computer Models



## Ground-Based Observations

Radiosonde Lunch in Topeka, Kansas



(from *Understanding Weather & Climate*)



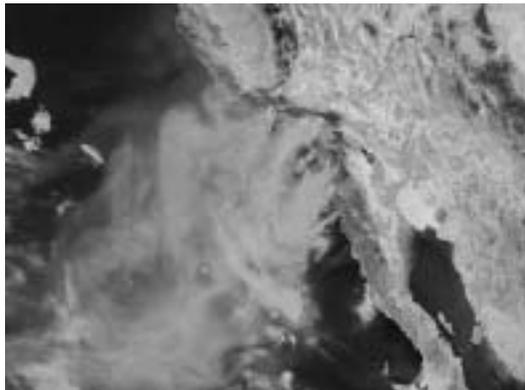
## Space-Based Observation



- ❑ Geostationary Satellites: Stay 22,238 miles above the equator. Stay at the same spot all the time. Can view the earth from pole to pole.
- ❑ Polar-Orbiting Satellites: Orbit over the North and South poles about 530 miles above the Earth. Their view is more limited, but they have a more close-up view.



## Southern California Wild Fire 2003

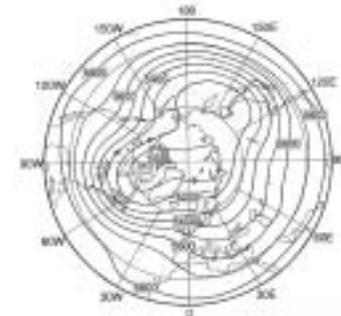


(from NASA)



## Global Weather Maps

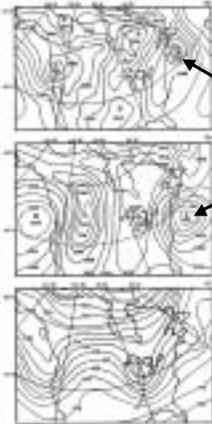
January Height of 500-mb Pressure Surface



(From *Global Physical Climatology*)



## Weather Maps – April 1 Storm

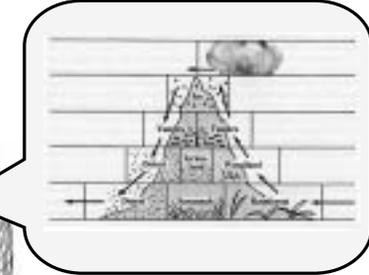


April Fool's Storm in 1997

(from *"Is The Temperature Rising?"*)



## Computer Model of the Atmosphere



(from *"Is The Temperature Rising?"*)

