

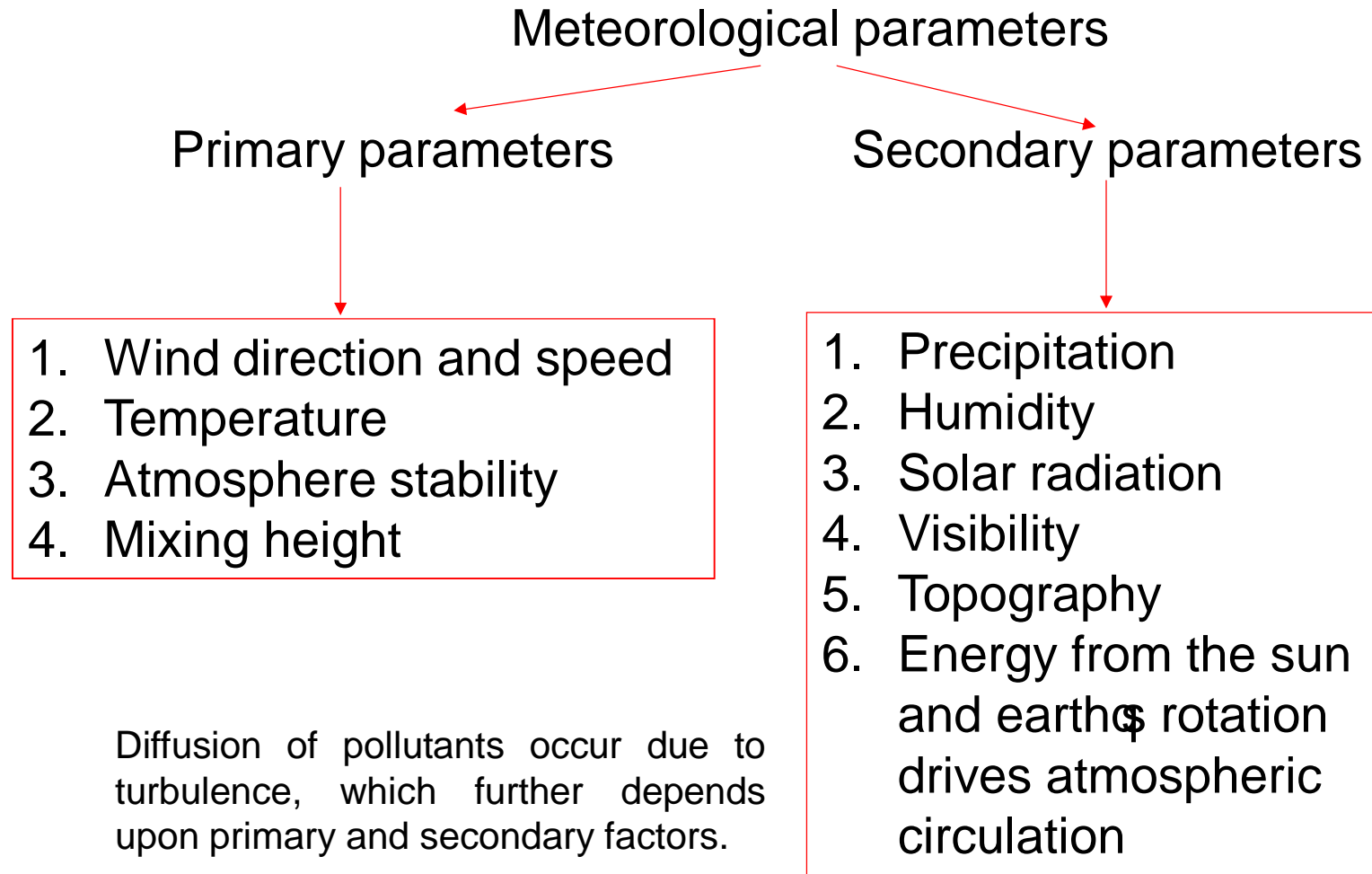
Lecture 9

Meteorology Measurements and their interpretations

Meteorology Factors Influencing Air Pollution

- “ The degree to which air pollutants discharged from various sources concentrate in a particular area depends largely on meteorological conditions.
- “ The **application of dispersion theory and a knowledge of local weather conditions** are necessary **to determine the require stack height** for an emission and to evaluate the intensity of air pollution.

Meteorology Factors Influencing Air Pollution



The parameters vary widely as a function of latitude, season and topography.

Weather affects the severity of air pollution, air pollution may effect weather conditions.

➤ Wind Direction and Speed

➤ Atmospheric Stability

➤ Temperature Inversion

- “ The direction and speed of surface winds govern **the drift and diffusion of air pollutants** discharged near the ground level.
- “ Higher will be the wind speed or near the point of discharge of pollution the more rapid the pollutants are carried away from source.
- “ When the wind speed is low, pollutants tend to be concentrated near the discharge and due to these the concentration of pollutants will be high.

- “ Surface wind is directly proportional to its speed and determines the extent to which the pollutants are mixed and diluted with the surrounding air.
- “ In rough terrain, it cannot be assumed that the wind direction and speed near the source govern the subsequent motion of the contaminants.
- “ Hills may deflect the air flow either horizontally, vertically or both, the amount of deflection depending on the vertical stability of the atmosphere.

Slow wind
speed->



higher
wind
speed->



“ In valleys, the wind carrying a pollutant tend to flow either up or down the valley, following its meanderings.

Buoyancy Factors

- “ **Atmospheric temperature** and **pressure** influence the buoyancy of air parcels.
- “ Holding other conditions constant, the **temperature of air (a fluid) increases** as atmospheric **pressure increases**, and conversely **decreases as pressure decreases**.
- “ With respect to the atmosphere, where air **pressure decreases** with **rising altitude**, the normal temperature profile of the troposphere is one where **temperature decreases** with **height**.

- “ An **air parcel** that becomes **warmer** than the surrounding air (for example, by heat radiating from the earth's surface), begins to **expand and cool**.
- “ As long as the **parcel's temperature is greater than the surrounding air**, the **parcel is less dense** than the **cooler surrounding air**.
- “ Therefore, **it rises, or is buoyant**. As the parcel rises, it **expands** thereby **decreasing** its **pressure** and, therefore, **its temperature decreases** as well.
- “ The initial cooling of an air parcel has the opposite effect. In short, **warm air rises and cools**, while **cool air descends and warms**.

- ” The extent to which an air parcel rises or falls depends on the relationship of its temperature to that of the surrounding air.
- ” As long as the parcel's temperature is greater, it will rise; as long as the parcel's temperature is cooler, it will descend.
- ” When the temperatures of the parcel and the surrounding air are the same, the parcel will neither rise nor descend unless influenced by wind flow.

Atmospheric Stability

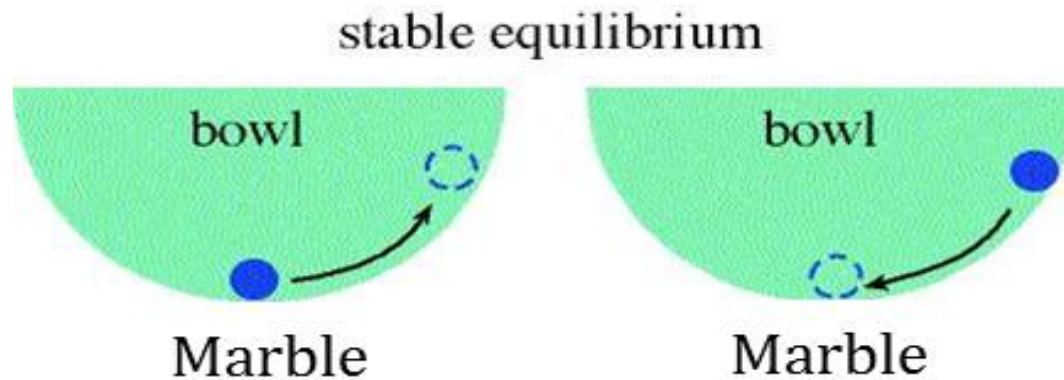
- “ Ability to dilute pollution
 - “ Wind
 - “ Sunlight
 - “ Geographical features
 - “ Actual change in air temperature with altitude
- “ Comparison of Adiabatic lapse rate with environment lapse rate gives idea of stability.

Atmospheric Stability

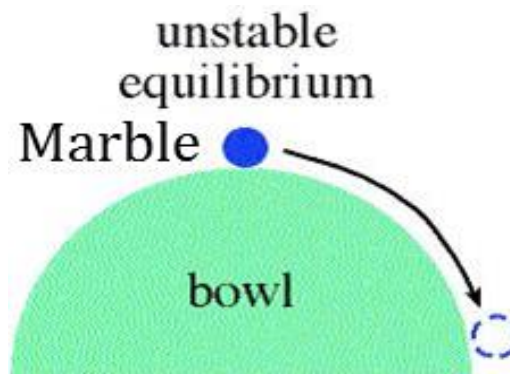
What is stability?

- “ It refers the condition to equilibrium.
- “ If we apply some perturbation to a system, how will that system be affected?
 - Stable: System returns to original state
 - Unstable: System continues to move away from original state
 - Neutral: System remains steady after perturbed

Stable: Marble returns to its original position



Unstable: Marble rapidly moves away from initial position



Stable Conditions

“ When the atmosphere is stable, a parcel of air that is lifted will want to return back to its original position:



Unstable Conditions

- When the atmosphere is unstable (with respect to a lifted parcel of air), a parcel will want to continue to rise if lifted:

