

Temperature

I. Temperature is measured by an instrument called a thermometer. There are many varieties:

1. Liquid in tube
 - a. Measures temperature by a moving column of liquid which expands and contracts with changes in temperature and is calibrated in some consistent way (Fahrenheit, Centigrade etc.)
 - b. Minimum-maximum thermometers (Six's thermometer) indicates the maximum and minimum temperature over a specific period.
2. Electric thermometers:
 - a. Have been developed for all types and uses.
3. Some concerns about changes in technology since electronic ones are more sensitive and record changes faster. This may affect long term comparisons
4. Placement of thermometers have also changed over time making comparisons a bit difficult.

II. Statistical measurements

- a. Centralizing tendencies:
 - i. Mean
 - ii. Mode
 - iii. Median
- b. Averages
 - i. Daily
 - ii. Monthly
 - iii. Annual
 - iv. 30 year averages
 - v. Highs, lows, and ranges of temperature

III. Factors affecting temperature

- a. Latitude
 - i. Height and angle of sun
- b. Altitude
 - i. Places at higher altitude are usually cooler
- c. Aspect
 - i. Direction in which terrain faces
- d. Surface type

- i. Plant covered
 - ii. Desert
 - iii. Concrete or asphalt
- e. Large bodies of water
 - i. Water heats and cools slower than land. Mediates nearby temperatures.
- f. Cloud cover
 - i. The more clouds, the more LW radiation returns to the earth, but also reflects more incoming SW light
- g. Geological phenomenon
 - i. Volcanos give off water vapor, CO₂ etc. Enough gases cloud the air and block sunlight reducing heating occasionally reducing annual temperatures over several years.
- h. Some records for high and low temperatures

IV. Daily variation

- a. Coldest around sunrise, warmest around late afternoon. Earth continues to cool overnight so coldest is around sunrise. Gains more heat than it loses during the day and so warmest is late afternoon.
- b. At dawn, the warmest air is by the ground which warms faster than the air. Can be severe differences between temperature at feet and at waist! So the lower air would be warmer than the air above it
- c. At night the reverse is true and produces an inversion. The ground cools faster and so air on the ground is colder than that above – so as one goes higher it gets warmer.
- d. In both cases the air needs to be still for wind would mix the 2 layers.

V. Geography can produce inversions as well.

- a. Cold air may sink down into valleys because of its density. Above that may be warmer air through which the colder air descended. Above the warmer air there can be higher air which is colder again. So from the cold air in the valley one can rise through to a higher warmer level (the inversion) and then on to higher colder air once again. This can leads to “freezes” in valleys, which is why farmers often prefer to plant on hill sides.
- b. River basins are often very fertile so these basins and valleys can be subjected to “freezes”

VI. Ranges - Daily

- a. The greatest temperature ranges are on the surface. The higher up one goes, the less temperature range you find
- b. The greatest range is on high desert areas where the air is dry and there is little cloud cover to radiate heat back to Earth at night.
- c. The greatest ranges of temperatures occurs in high deserts

VII. Ranges – Annual

- a. The Earth's tilt causes seasons
- b. Fluctuations at the poles are more extreme than at the equator.
- c. Temperature ranges are greater further from large bodies of water.

VIII. Special days

- a. Heating days ($65 - \text{mean temperature for the day}$)
- b. Cooling days ($\text{mean temperature for the day} - 65$)
- c. Growing degree days (base temperature/zero temperature is assigned to specific crops) Different crops require a different number of days to reach maturity. Growing degree days are acquired more rapidly in places where there is more clouds or humidity at night