

# Types of Models that We Build to Help Us Understand & Predict the Behavior of the Physical World (Including the Atmosphere)

## 1. Conceptual models

- Generalized and descriptive, based on observations
- Examples:
  - The mystery box (diagrams)  
*(based on observations of what happens to water that we pour into the top of the box)*
  - Daily temperature cycle  
*(based on observations of temperature at many places over many years)*
  - Diagrams of the earth lit by the sun (showing seasonal variations in sunlight)  
*(based on observations of day length, sun angle, stars in the sky, etc. at many places on earth over hundreds of years)*
  - Polar front with alternating “tongues” of warmer and colder air  
*(based on many observations of global temperature patterns over many years)*
  - Cold fronts (and warm fronts)  
*(based on observations of spatial temperature patterns associated with storms at midlatitudes over many years)*

# Types of Models (cont'd)

## 2. Physical models

- Physical objects and/or materials used to simulate the behavior of real systems or phenomena
- Examples:
  - Flashlight shining on piece of paper
  - Globes with projector light shining on them

# Types of Models (cont'd)

## 3. Quantitative models

- Statistical
  - Based on many observations of past behavior
  - Useful to the extent that past behavior can predict future behavior
  - Example (sort of):
    - Daily temperature cycle, quantified a bit to help us predict next day's 18Z temperature
- Mathematical
  - Based on fundamental laws of physics
    - Some laws describe how temperature, velocity, etc. of an object change, given current state of the object
  - Can be used to predict future state of a system (up to a point) if current (starting) state is known
  - Examples:
    - STELLA models of daily temperature cycle (based on Principle of Conservation of Energy and basic laws of radiation, etc.)
    - Weather forecast models used by the National Weather Service
    - Climate models used by climate scientists to simulate the earth's climate system