

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