Weather Forecasting - Qualitative

- Most information for a qualitative forecast can be seen on a simple weather map
- If you see a low pressure area that has been moving eastward towards Colorado, what type of weather might you expect?
- If a cold front is moving southward through Wyoming, what would you expect the temperature to do?
- If it's going to be cloudy tomorrow, will it be warmer or colder than it was today?
- Often the best forecast is persistence: if it's warm and sunny today, and it was warm and sunny yesterday, the odds are pretty good that it will be warm and sunny tomorrow (unless you know something else)

Weather Forecasting - Quantitative

- In order to predict specific quantities in a forecast (temperature, humidity, rainfall) we rely on computer models
    - Numerical weather prediction (NWP) uses a system of equations that describes the behavior of the atmosphere
    - NWP model uses the current state of the atmosphere as its initial condition and steps through a small time step, recalculating every number for each step until the forecast time is reached
- Why aren't forecasts always right?
    - Uncertainty in observations
    - Computers aren't fast enough
    - Chaos Theory
        - Basically says that even the most insignificant change to initial conditions will magnify into drastic changes
        - Limits forecasts to about 2 weeks even if computing power and initial conditions were perfect
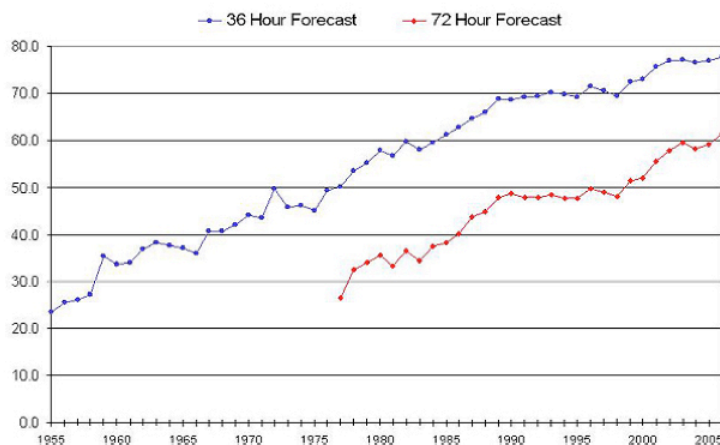
NWP Basics

- First NWP forecast 1950 (ENIAC)
- Now have many models that forecasters use as a tool in making forecasts
  - GCM, NAM, ECMWF
  - Also use statistics from the model output (MOS)
    - Acts as a sort of a climatology
  - Can have 'ensemble' forecast or spaghetti plot, using different models or initial conditions to make several forecasts (usually take the average)
- Forecasts are now reliable out to about 3 days
- These products can be found on the National Weather Service website:
  http://www.nco.ncep.noaa.gov/pmb/nwprod/analysis

How far have we come?