

# How can I forecast tomorrow's weather?

## Materials

- Example station plot map with sea level pressure contours (good place to find archived maps is at <http://vortex.plymouth.edu/u-make.html>)
- Access to a few days of weather analyses, including surface data with station plots (and upper-level data if the lab is extended to include this)

## Overview

While there are considerable difficulties in forecasting the day-to-day weather accurately in a quantitative sense, it is relatively easy to make your own qualitative forecast. A relatively good forecast can be made one day in advance based on knowledge of the weather conditions the day before. By completing the basics of this exercise, you should be able to make an informed decision as to whether it will rain, the relative intensity of the rain, and whether it will be hot or cold. The more advanced areas of the following activities will help you to develop a more quantitative forecast.

## Theory

Most information for a qualitative forecast can be seen on a simple weather map created by taking observations at many different places at the same time. If you see a low-pressure area that has been moving eastward toward your current location, what type of weather might you expect? If a cold front is moving southward out of Canada, what would you soon expect the temperature to do? If it is going to be cloudy tomorrow, will it be warmer or colder than it was today? Often the best qualitative forecast follows from persistence. If it is warm and sunny today, and it was warm and sunny yesterday, the odds are pretty good that it will be warm and sunny tomorrow, that is, unless you see something else heading in on your weather map.

In order to predict specific quantities in a forecast, such as temperature, humidity, and rainfall, we rely on computer models. **Numerical weather prediction (NWP)** uses a system of equations that describe the behavior of the atmosphere. NWP models read in the current state of the weather from observations as an initial condition and then calculates the solutions to the equations that will tell us what the weather will be a few seconds into the future. Then it uses that information and repeats the calculations many times until it gives a quantitative forecast for a few days into the future. For finding numerical weather prediction products (forecasts produced by a model), refer to the National Weather Service website: <http://www.nco.ncep.noaa.gov/pmb/nwprod/analysis/>

## Doing the Experiment

### Part 1: Analyze your own weather map from station plots

- Obtain a map of station plots as directed under the materials section
- Explain the coding of the station plots to your students
  - Details can be found at <http://www.hpc.ncep.noaa.gov/dailywxmap/wxsymbols.html>
- Read the data off of the station plot map and determine the location of cold and warm fronts based on your knowledge of noted precipitation, wind shifts, pressure troughs, and rapid spatial temperature changes
- For further inquiry:
  - Have students contour the sea-level pressure or temperature before analyzing the map for fronts

### Part 2: Tracking day-to-day weather

In this section, you will compile a few days of national weather maps and satellite images (optional) in order to make a qualitative forecast for a location of your choosing. Collection of the maps can be done on a daily basis, making predictions for the next day based on new observations or you can collect archived maps.

- Show the students each weather map in order to get a feel for how weather systems move across the United States. Pay particular attention to cold and warm fronts, wind patterns, pressure patterns and any precipitation.
- Make a prediction for a certain city based on the movement of the weather. One way to do this is to mark the location of weather patterns (i.e. low pressure centers and fronts) from day to day on a map, connect them with a line and then use this ‘trail’ to try to predict the next movement. Then forecast based on your knowledge of the structure of low-pressure weather systems and cold and warm fronts. Make sure to verify your prediction the following day.
- For further inquiry:
  - Look at upper-level wind and height charts and determine whether surface cyclones will intensify based on your knowledge of upper-level convergence and divergence.

## Summing Up

After completing this set of exercises, you should have a feel for how meteorologists and you can forecast tomorrow’s weather. It turns out that all you really have to do is read a map or some model data.