

## Chapter 14, Part 1

Weather Forecasting

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### Overview

1. Weather forecasting approaches
2. Weather forecasting using surface weather charts (which you can do)
3. Weather forecasting by a meteorologist

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### Acquisition of Weather Information

- Worldwide: 10,000 land-based stations, 100's of ships, radiosondes, aircraft, and satellites
- Information provided at the same time, Coordinated Universal Time (UTC), which is also Greenwich Mean Time (GMT).
- For surface weather usually 0, 6, 12, 18 UTC, while satellites are continuous.
- Data gathered by [World Meteorological Org. \(WMO\)](#) and [National Weather Service /National Centers for Environmental Prediction \(NCEP\)](#).

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## Watches and Warnings

- The National Weather Service issues
- Watch – atmospheric conditions favor hazardous weather
- Warning – hazardous weather is either imminent or presently occurring

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## Examples of Watches & Warnings

- Flash-flood
- Severe thunderstorm – winds exceeding 57mph or hail > 0.75 inch in diameter
- Tornado
- Dense fog – visibility less than 1/8 mile
- Hurricane – winds exceed 74mph

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## Weather Forecasting Methods

- Numerical weather prediction
  - Ensemble forecasting
- Persistence forecasts
- Steady-state method
- Analogue method
  - Prediction by weather types
  - Long range forecasts
- Climatological forecasts

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## Numerical Weather Prediction

- Use atmospheric (numerical) models and weather information from observations to evolve weather forward in time on a computer.
- Resulting forecast chart = prognostic chart or prog for short.
- Usually, 12, 24, 36, and 48 hours in advance.
- A weather forecaster uses progs as a *guide* to predicting the weather.

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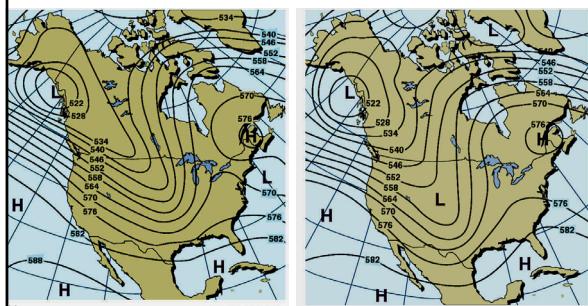
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48 hour 500mb Charts



- Notice similarities and differences between the predictions of the two progs.

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## Forecasting “Rules of Thumb”

- Cloudy or clear? On a 700mb forecast chart the 70% relative humidity line encloses areas that are likely to have clouds.
- Will it rain? On a 700mb forecast chart the 90% relative humidity line encloses areas where precipitation is likely.
- Along the West coast precipitation is more likely north of the 5640m height contour on the 500mb forecast chart.

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## Why do forecasts go awry?

- Computer models idealize the real atmosphere.
- Most models are not global.
- Data from observations is sparse in places.
- Models do not take into account all factors that may influence the weather (e.g., local terrain).
- Small disturbances or errors tend to amplify over time – chaos.

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## Persistence & Steady-state Forecasts

- Persistence forecast – future weather will be the same as the present weather.
- Steady-state or trend method – surface weather systems tend to move in the same direction and at the same speed.

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## Analogue Method

- Existing weather features resemble features that produced certain weather conditions in the past (analogy).
- Sometimes called pattern recognition.
- Note: weather systems are never exactly the same as before.

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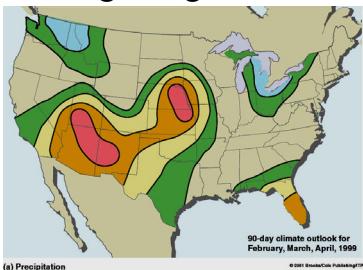
## Predicting by Weather Types



Example of the analogue method categorizing weather into types based on

- position of subtropical highs,
- upper-level flow, and
- prevailing storm track.

## Long Range Weather Forecasting



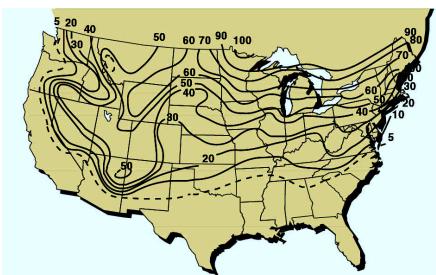
90-day precipitation outlook 2/99 to 4/99: Green means greater than normal precipitation, and red means less than normal.

- Since upper-air circulation changes gradually and tend to repeat, extended weather forecasts can be made (outlooks).

## Ensemble Forecasting

- Run weather simulations based on different models and/or slightly different weather observation data.
- If the simulations match each other fairly well, then confidence in prediction.
- Less agreement means less predictable weather.

## Climatological Forecast



- Based on average weather predictions can be made as to the probability of an event, e.g., of a "White Christmas" above.

## Probability

- Example: The chance of rain is 60%.
- Means: There is a 60% chance that any random place in the forecast area will receive measurable rainfall.

## Accuracy and Skill in Forecasting

- Accuracy – whether or not prediction came true (care in defining exact prediction)
- Skill – prediction better than current weather (persistence) or normal weather (climatology)
- Predictions of 12 hrs. to a few days show more skill than persistence.
- Beyond 10 days forecasts are only slightly better than climatology.

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## Summary

- Weather forecasts: numerical, persistence, steady-state, analogue, climatological.
- Forecast inaccuracy is due to the models used, sparseness of input data, and chaotic behavior.
- Predictions of 12hours to a few days show more skill than persistence, while those beyond 10 days are ~ same as climatology.

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