25 Predictability and Forecast Accuracy

Smooth			Locally variable
Easiest to predict			Hardest to predict
Pressure	Winds	Temperature	Precipitation

While most of us care most about precipitation, it is hard to assess a regional precip forecast since precip varies considerably between nearby locations.

Instead, usual measure of midlatitude forecast skill is prediction of height of 500 mb pressure surface.

Forecast Error = Average over region of
(predicted - observed) 500 mb height

Must beat two simple forecasts:
Persistence - atmospheric state doesn't change (has little skill after 3 days)
Climatology - atmospheric state reverts to average.

Example of Error Calculation

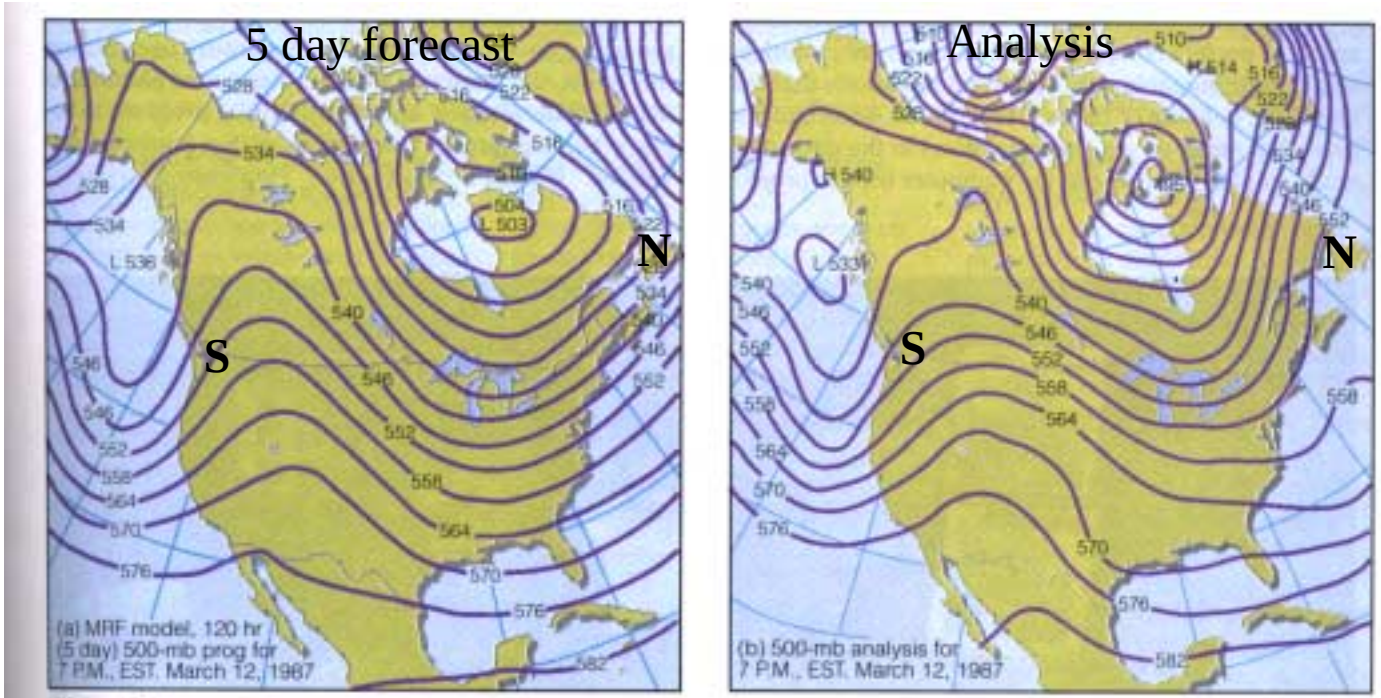


Figure 9.1
(a) An upper-level forecast chart (prog) for 7 P.M., EST, March 12, 1987—5 days (120 hr) into the future. The prediction was made on March 7. Solid lines on the map are height contours, where 552 equals 5520 meters. (The name of this model, MRF, means *medium-range forecast*.). (b) The upper-level analysis for 7 P.M., EST, March 12, 1987. This chart shows that the forecast model did an excellent job of predicting the positions of troughs and ridges across North America.

EOM 9.2, 2nd ed.

Location	Forecast	Analysis	Error
S	5520	5550	30 meters
N	5280	5540	260

Map Average 60 - ridge and trough locs well forecast.

Current Skill

1980		1990		2000	
5 day	=	7 day	=	10 day	forecast skill
3.5 day	=	5 day	=	7 day	
1.5 day	=	3 day	=	5 day	

0-12 hrs: Can track individual severe storms
12-48 hrs: Can predict weather changes well, including general regions threatened by severe weather.
5-10 days: Can predict major storms, heat and cold waves. Precip forecasts less accurate.
10-14 days: Can predict five-day average temperature and precip with some skill, but day-to-day weather not well forecast.
30-90 days: Only slight skill, and then only in predicting average temp., precip. over period. Forecasts may use statistical correlations (e.g. with El Nino).

Chaos and Limits on Forecasting

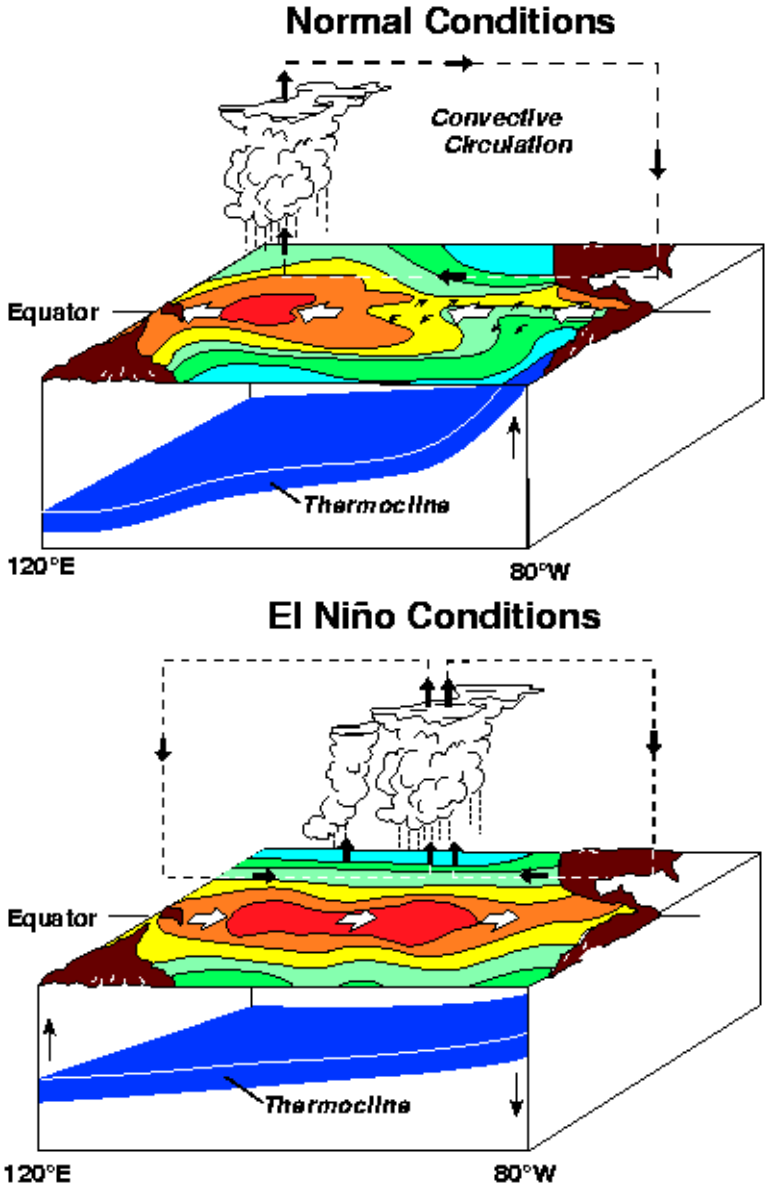
Atmospheric scientists believe that even if our models were perfect, we would not be able to predict individual storms more than 10-14 days ahead.

This is because an undetectably small error in the observations can magnify to ruin the forecast after this time.

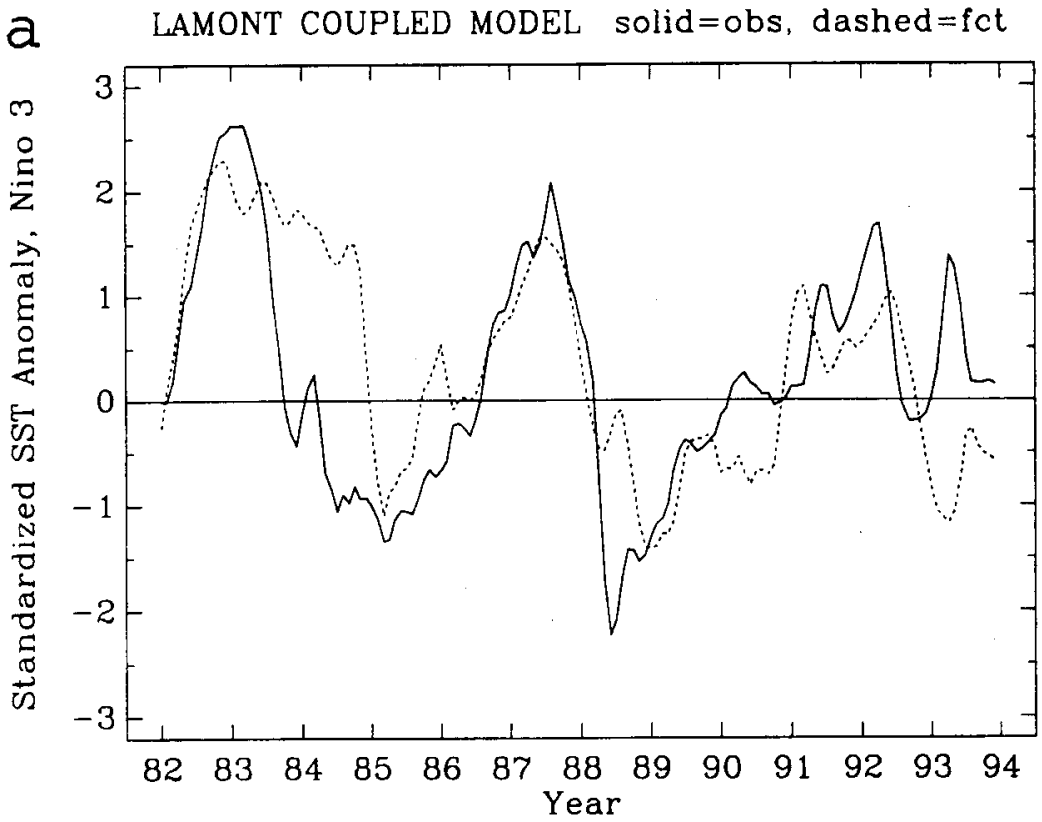
*The butterfly effec*t: Even a butterfly flapping its wings changes the atmospheric state, and ultimately affects the weather all over the globe. This is a manifestation of the *chaotic* nature of our atmosphere.

Chaotic systems are characterized by not settling down into a simple, predictable behavior, and being very sensitive to small changes in their initial state.

El Nino Forecasting



E Pacific SST Anomaly 6 mo'hindcasts'



Barnston et al. 1994, BAMS

www.pmel.noaa.gov/toga-tao/el-nino/home.html

Current ENSO Forecasts

NCEP/CMB

Weak La Nina conditions in summer
Marginal El Nino conditions in winter

FORECAST SST ANOMALIES