

Exploratory Data Analysis

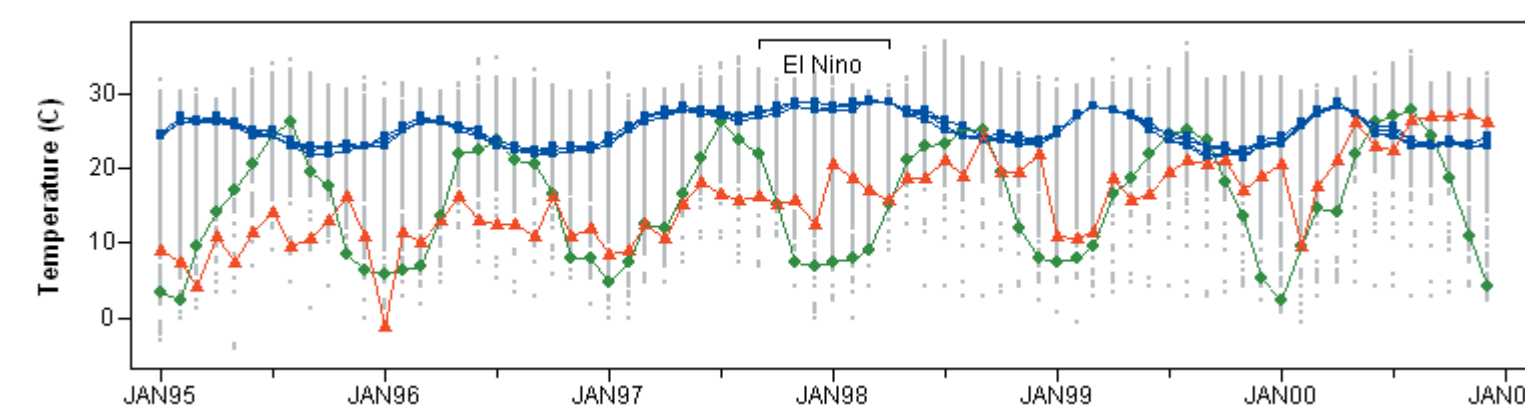
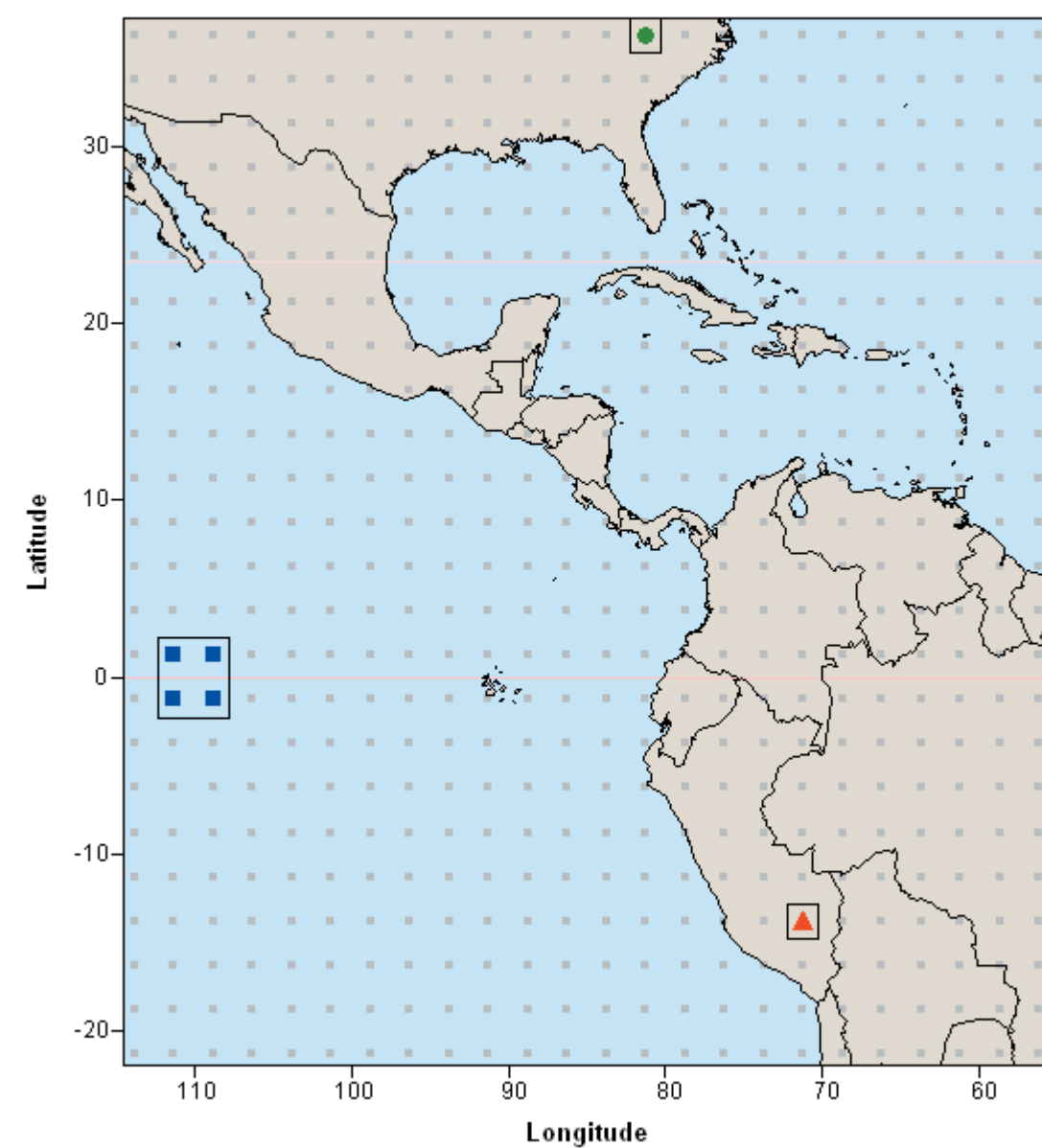
For each location or region, investigate corresponding time series for temperature, ozone, and pressure.

Sample regions:

Eastern United States (green), elevation 306 m

Equatorial Pacific Ocean (blue), elevation 0 m

Peruvian Andes (red), elevation 4270 m

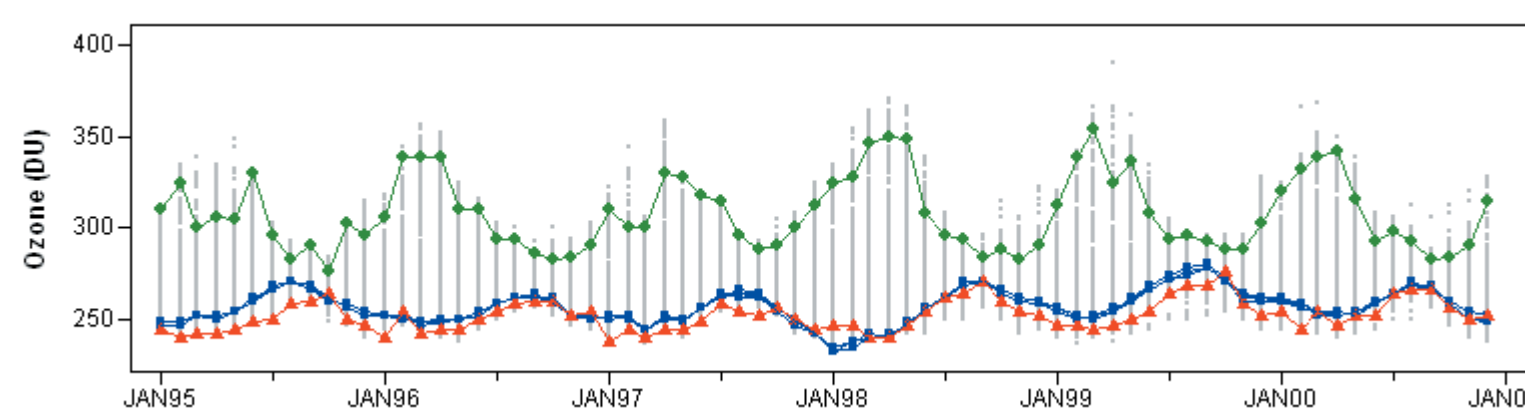


Near-Surface Air Temperature

Eastern US: hot in August; cold in January; large seasonal variation

Pacific: hot in April; cold in October; small seasonal variation
- Homogeneous region: high spatial correlation
- 1997–98 El Niño caused warm temperatures.

Andes: strong upward trend; little seasonality (?!)
Lows in January, during southern summer (?!)

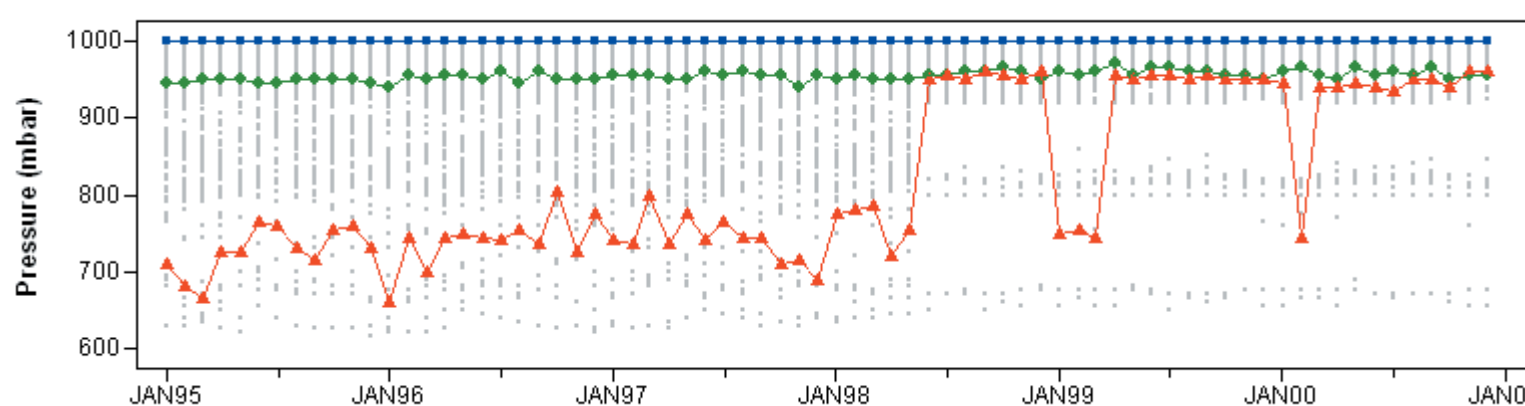


Ozone

Eastern US: high values due to northerly location; peaks in April

Pacific: low values; peaks in August

Andes: similar to the equatorial Pacific, but phase-shifted



Pressure

Eastern US: fairly constant, $\mu = 954$ mbar, $\sigma = 6$ mbar

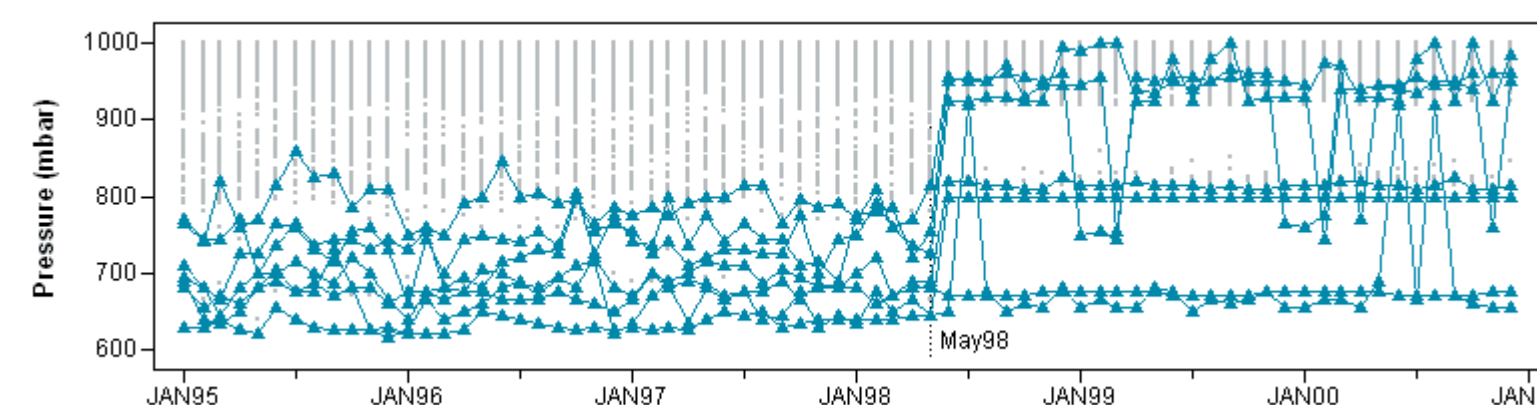
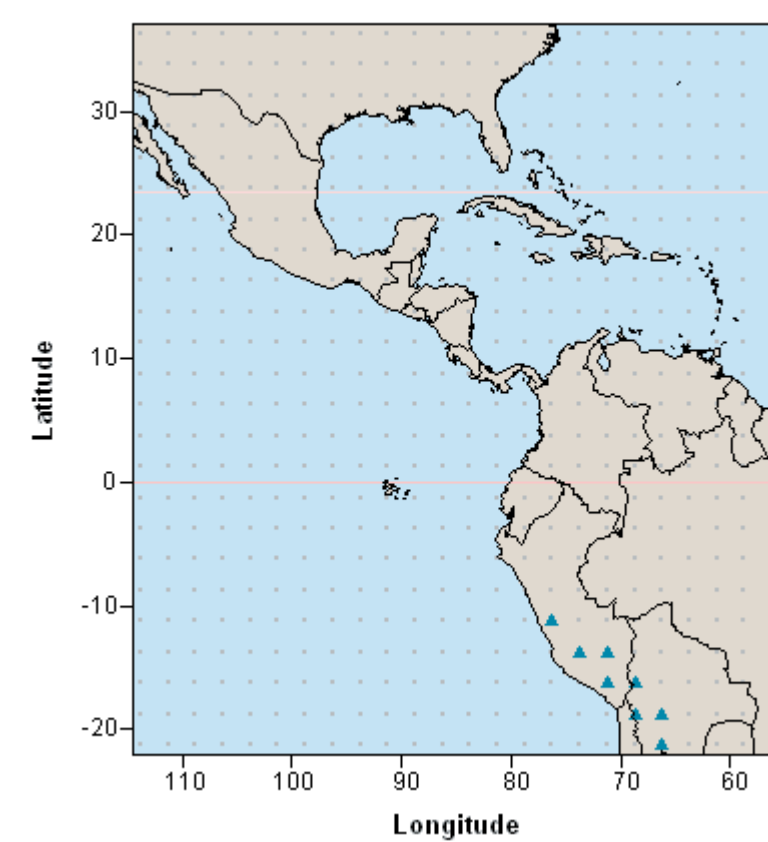
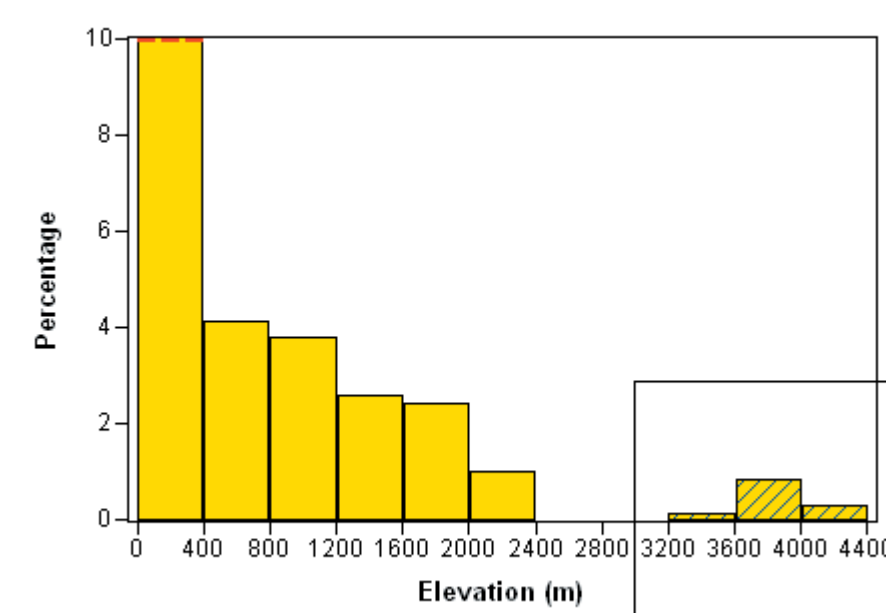
Pacific: constant sea-level pressure of 1000 mbar

Andes: extremely surprising! Some event happened about May 1998?

Detecting Outliers: Unusual Pressures

Exploratory data analysis reveals an unusual pressure series in the Peruvian Andes. Is this location unique, or an indicator of a widespread phenomenon? Investigate locations with high elevations.

Select high-elevation positions (> 3000 m)

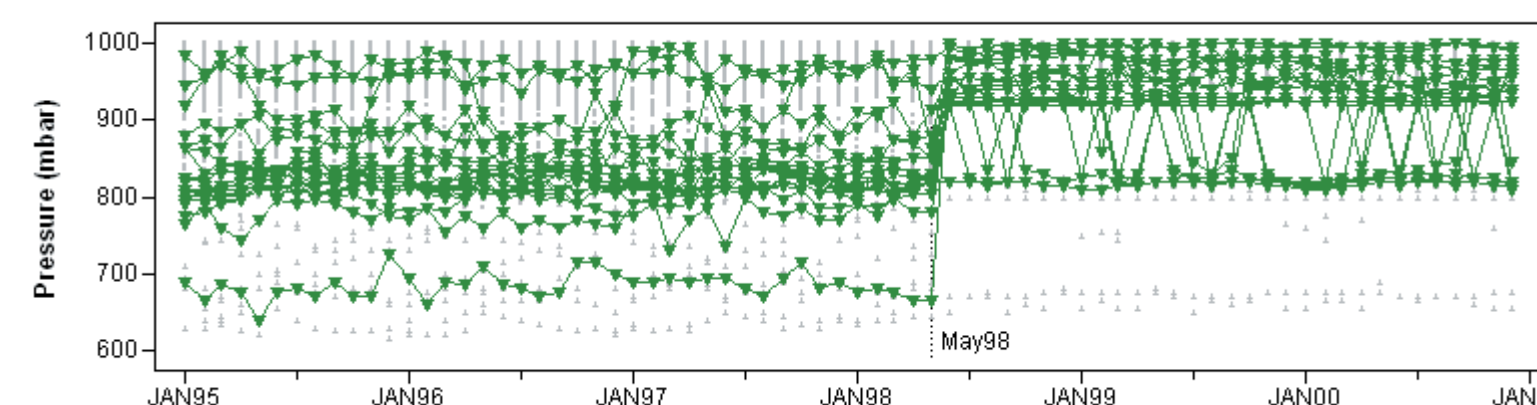
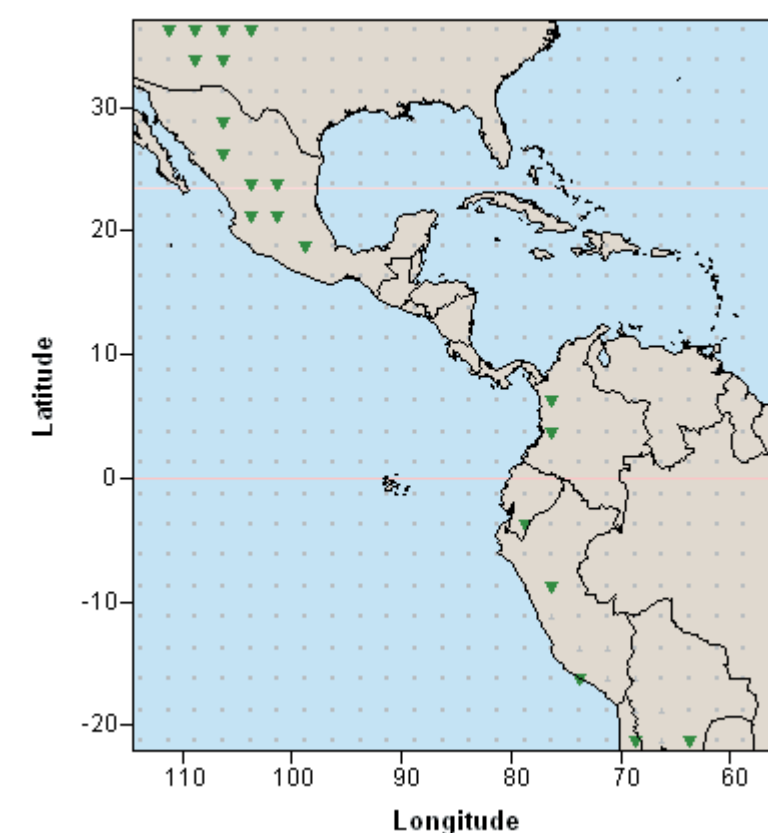
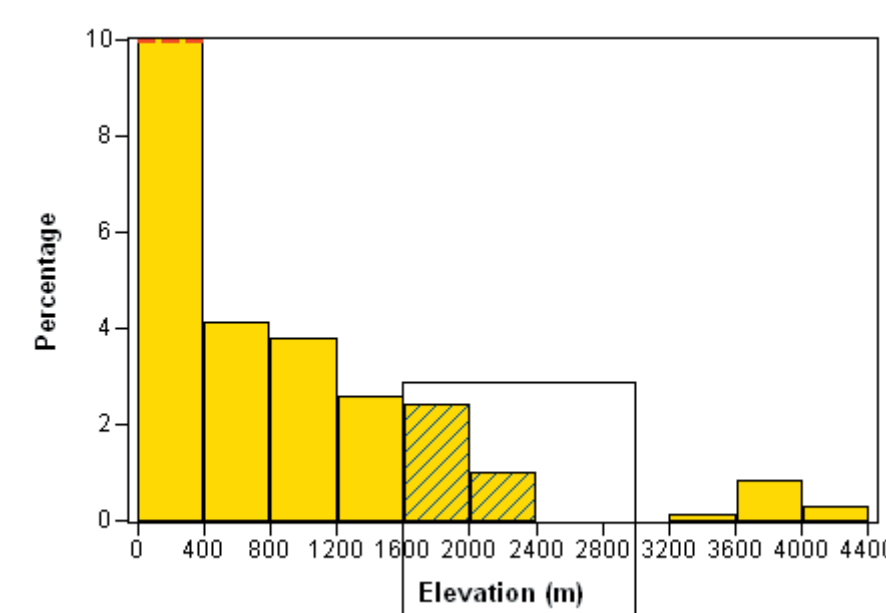


Qualitative change in pressures after May 1998

Analysis

- **Prior to May 1998**
 - Data record **station pressure?** (Higher elevations have lower station pressure.)
 - **Large seasonal variations** (> 100 mbar) too large to be from natural phenomena
- **After May 1998**
 - Most pressures > **920 mbar**
 - Most positions have **small variations**

Select mid-elevation positions (1600-3000 m)



Anomalies are spatially widespread

Conjectures

- **Change** in meaning or method of recording pressure after May 1998?
- **Low pressures** (> 920 mbar) after May 1998 due to:
 - Stations not conforming to change?
 - Interpolating onto a 24x24 spatial grid to estimate data?
 - In mountains, nearby positions are at vastly different elevations
 - Averaging pressures between mountains and sea leads to errors