MET 3502 Synoptic Meteorology

Lecture 6

Contour Analysis
Kinds of Contour Lines

- **Isopleths**: General term for lines along which some scalar has a constant value.
- **Isotherms**: Constant temperature
- **Isodrosotherms**: Constant dew point
- **Isobars**: Constant pressure
- **Isallobars**: Constant pressure change
- **Isohyets**: Constant rainfall
- **Isotachs**: Constant wind speed
- **Streamlines**: Not contours, but arrows that parallel the wind direction.
- **Isohypses** (or simply contours): Constant height of an isobaric surface
Let’s concentrate on Isobars

- $1004 < p < 1008$
- $996 < p < 1000$
- $1000 < p < 1004$
- $1004 < p < 1008$
- $1012 < p$
- $p < 996$
- $996 < p < 1000$
- $1000 < p < 1004$
- $1004 < p < 1008$
- $1008 < p < 1012$
Relation of Isobars to Data
Pressure Analysis

- Trace features from previous map, if available.
- Locate highs and lows
  - Extreme values
  - Places where the wind blows in a circle
  - Near past position
  - Draw innermost closed contours
- Draw subsequent contours
  - Interpolating pressure values
  - Lines parallel the wind
- Wind turns counter clockwise around low pressure
Let’s draw some isobars
Anticyclones

- High pressure
  - Clockwise flow
  - Counter clockwise in Southern Hemisphere
  - Pressure field broader, flatter and larger than lows
- Wind barbs point out
- Winds
  - Generally calm in the center
  - Weaker than in lows
  - But winds are stronger if the p gradient is the same
- Skies
  - Clear near the center,
  - But fog may form at night
Cyclones

- Low pressure
  - Counterclockwise flow
  - Clockwise in Southern Hemisphere
  - Pressure field narrower, sharper and smaller than highs
- Wind barbs point in
- Winds
  - Only a small area of calm in the center
  - Stronger than in highs
  - But winds are weaker if the $p$ gradient is the same
- Skies
  - Cloudy south and east of the center
  - Often clear NW of the center
Cols and Troughs

Axis of Contraction

Axis of Dialation

Inverted Trough
About Cols & Troughs

- A trough is an open, broad area of low pressure that merges into the general poleward decrease of pressure in the middle-latitude westerlies.
- An inverted trough joins into the equatorward decrease of pressure beneath an anticyclone.
- A col lies between two cyclones and two anticyclones.
- In the case illustrated, the center of the col lies in the calm between the north winds of the western high and the south winds of the eastern high.
- A col is a saddle in the pressure distribution with (for example) low pressure north and south and high pressure east and west.
- Wind approaches the col from the NW and SE: Axis of contraction.
- Wind recedes from the col toward the NE and SW: Axis of dilation.
- The flow in the col is nearly pure deformation, ie both nondivergent and irrotational.
- Surface fronts form in cols.
Discontinuities

- Zeroth-order discontinuities
  - Value itself changes abruptly
  - Temperature and dewpoint at fronts
  - Do not occur for pressure.

- First-order discontinuities
  - Derivative changes abruptly
  - Pressure at fronts
  - Produces first-order discontinuity of wind

- Deformational flow collapses gradients into discontinuities---FRONTS
Summary

- Represent scalars with isopleths that divide > contour value from < contour value
- Drawn subjectively
- Called iso-whatevers. I.E. Isobars
- Features:
  - Anticyclones & Cyclone
  - Cols & troughs, including inverted troughs
  - Deformational flow
- First and second-order discontinuities
More practice: 09Z Feb 5, 2013 US Surface Data