Lecture 23. Floods and Droughts

Flash floods - as little as one hour of extremely intense rainfall, especially over mountains. Records: 1 min -1.5" (W Indies), 3 hrs -22" (D'Hanis, TX)

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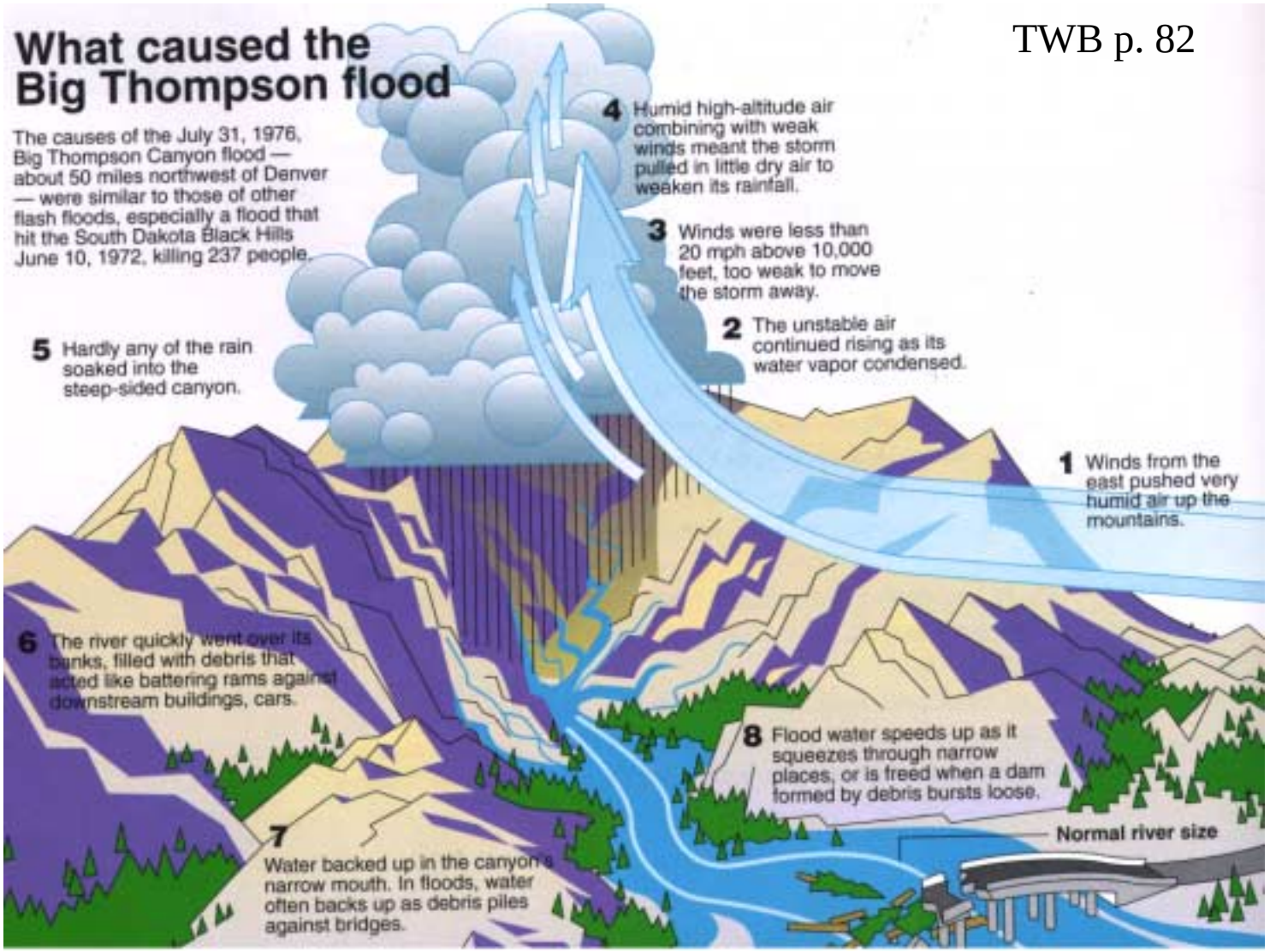
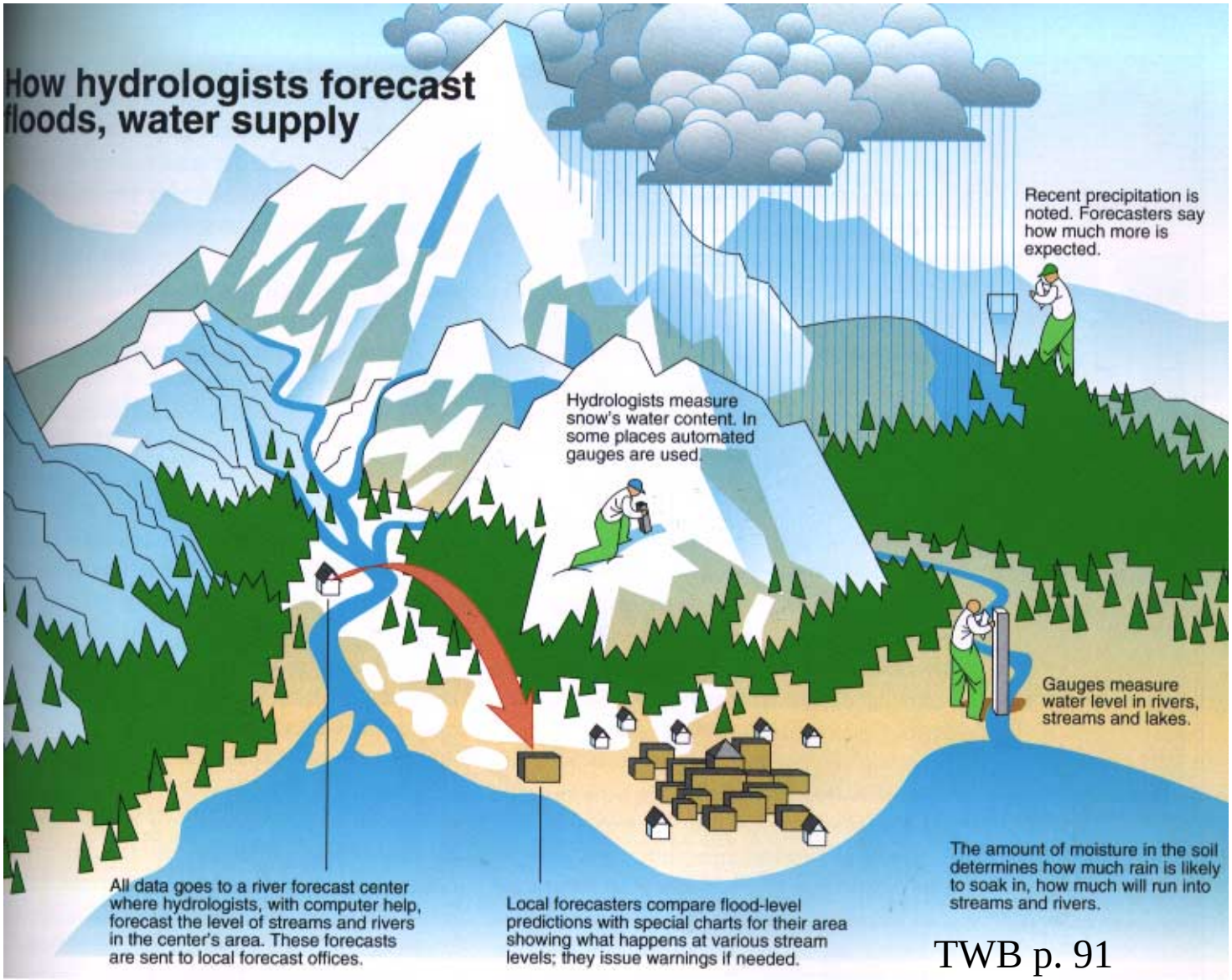


Typical Northwest floods occur due to several days of heavy warm rainfall, often combined with snowmelt. Flooding can be forecast days in advance.



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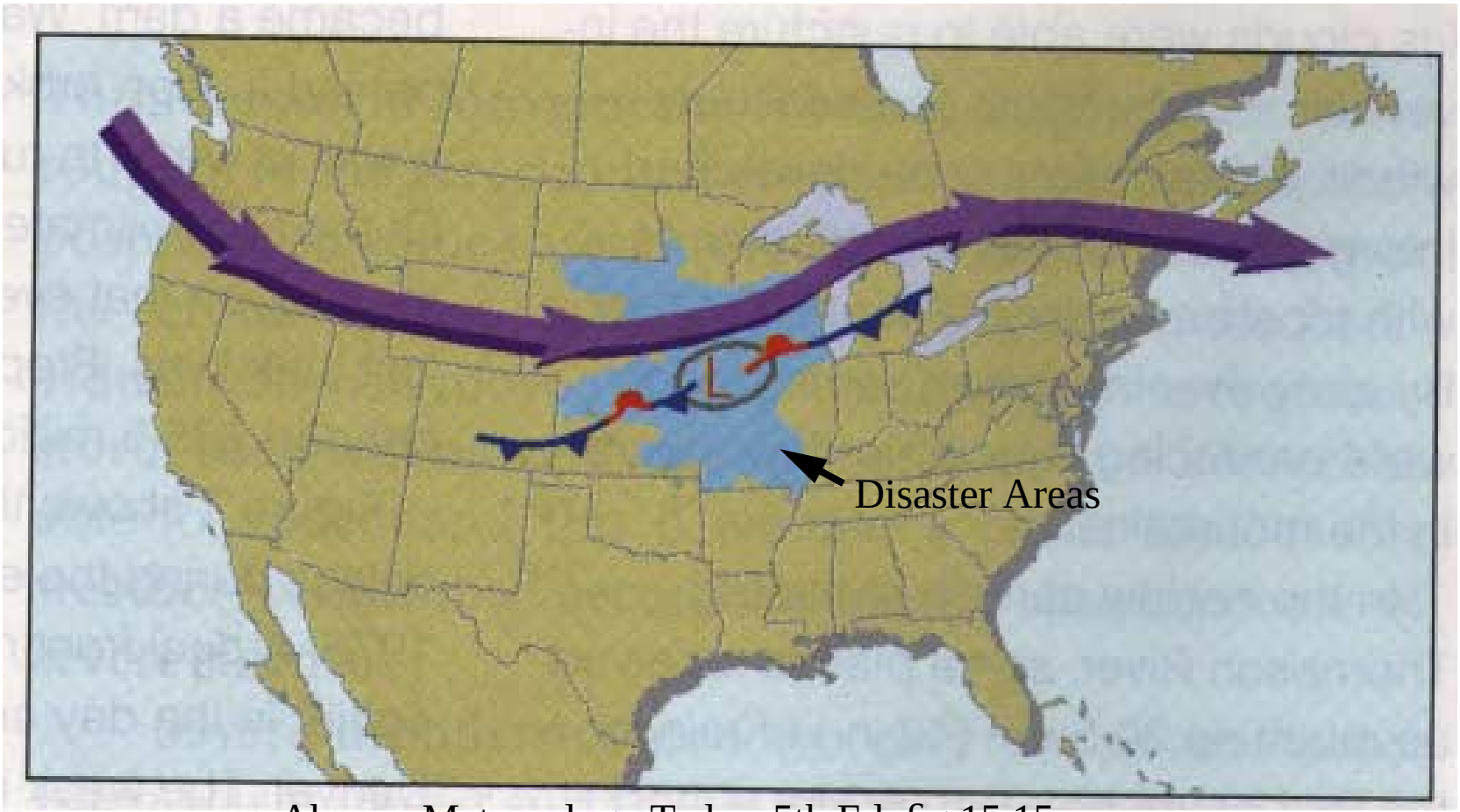
The June-July 1993 Missisippi River floods

Created by six weeks of persistent rain (10-20”) over much of the Midwest associated with cumulonimbus development along a persistent stationary front associated with a jet stream well S of normal.



Ahrens, Meteorology Today, 5th Ed, fig 15.15

Rainfall, Climate, and Drought

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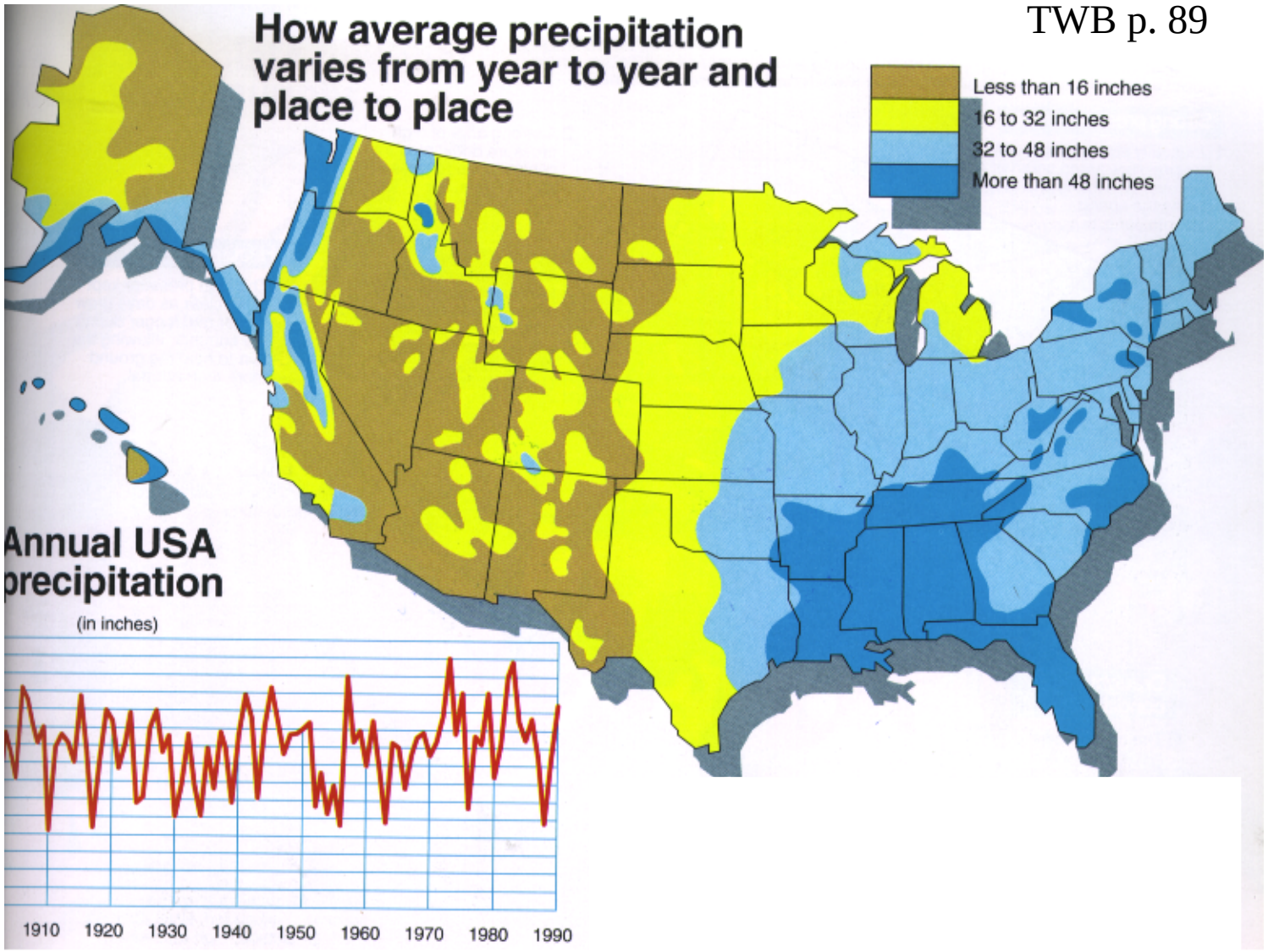

Drought (prolonged abnormal dryness) is *relative* and *regional*. Rainfall over the entire US only varies by 20% from year to year.

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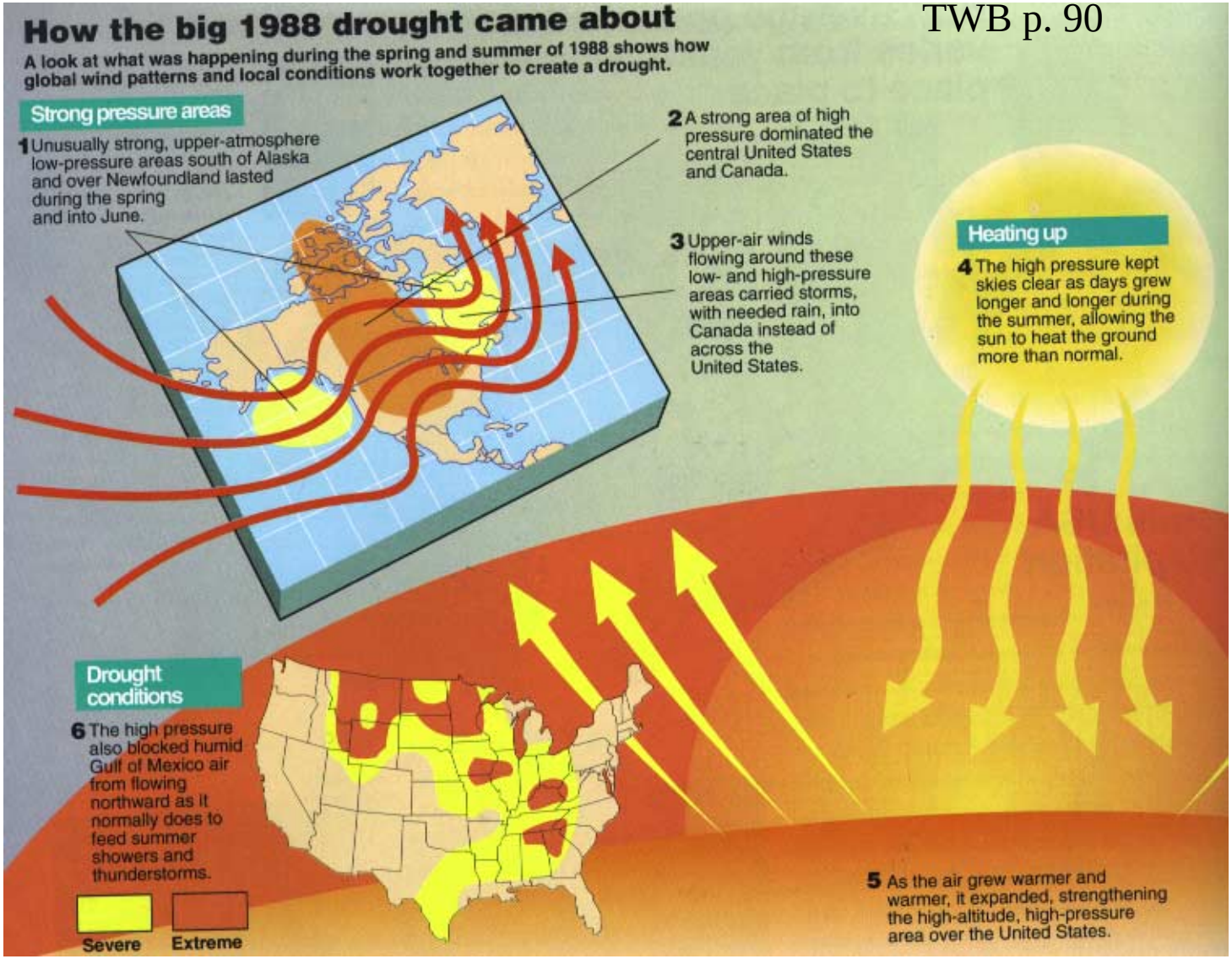
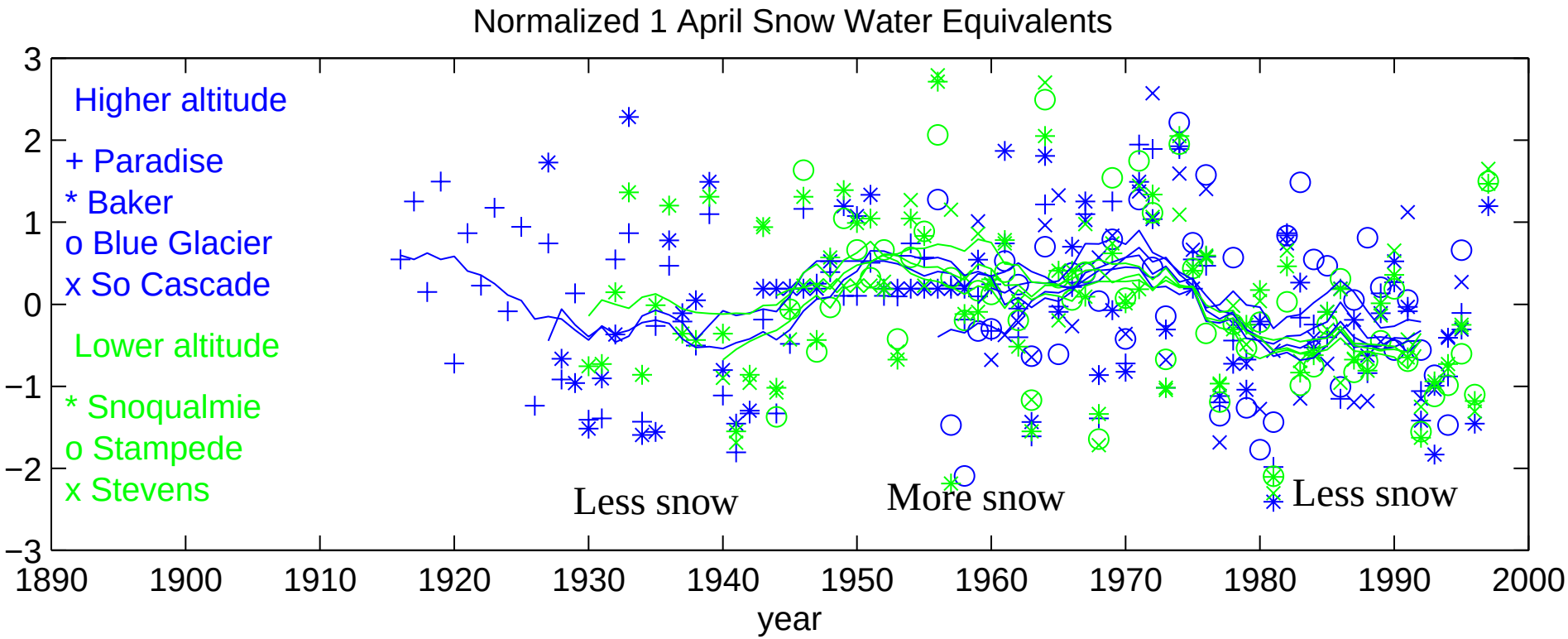


- Droughts are driven by anomalies in atmospheric circulation.
- As ground dries out, so does air, promoting clear, hotter, drier summer days.

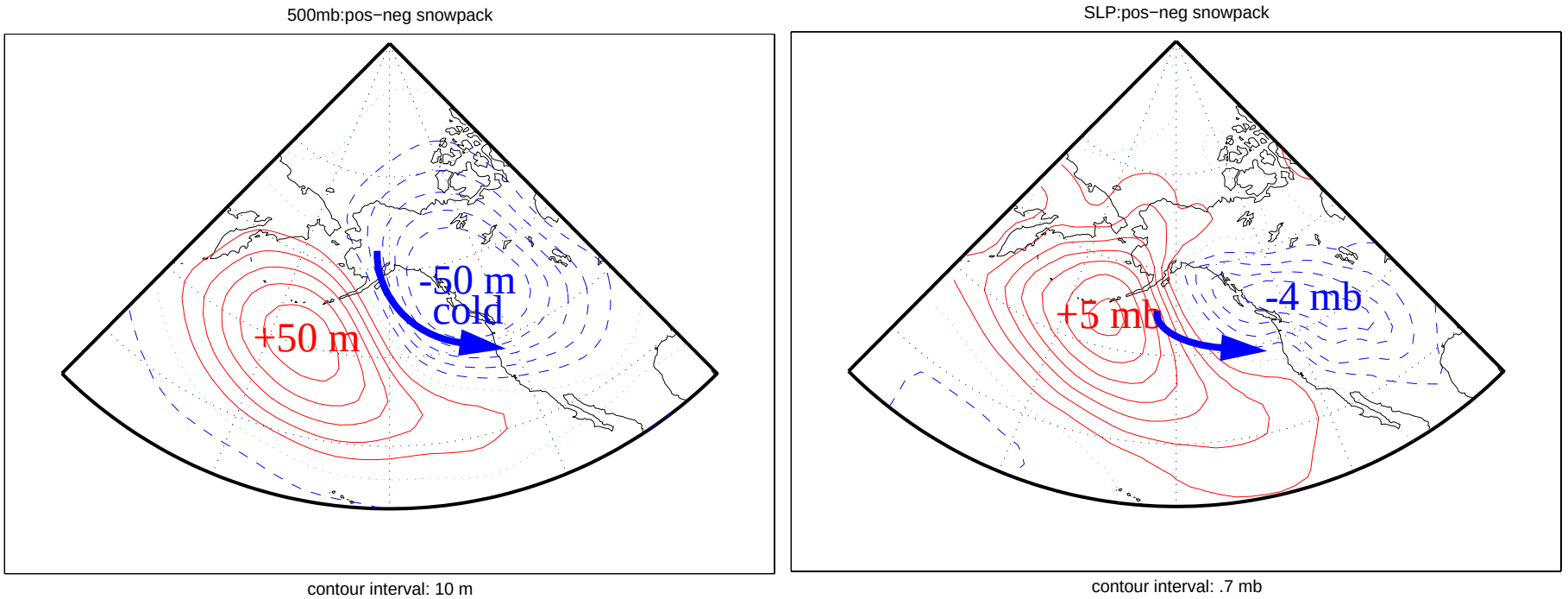
Pacific Northwest Snowpack variability

In the Pacific NW, where summers are dry, mountain snowpack:

- a critical store of water for agriculture, hydropower, and urban uses
- moistens soil, reducing threat of summer forest fires.
- varies considerably between years and decades, with a slow long-term decreasing trend due to regional warming (likely greenhouse-induced)



• Snowpack increases in cool, moist winters - 10% increase in snowpack requires a 0.5-1 C temperature decrease or a 10% precipitation increase, which are driven by changes in the wintertime jet stream position that enhance cool, moist northwesterly airflow from the Gulf of Alaska into our region.



This Pacific North America (PNA) pattern of year-to-year jet stream variability is about 2/3 random and 1/3 driven by ENSO and the Pacific Decadal Oscillation (PDO) in North Pacific sea-surface temperatures. On decadal timescales it is much more closely tied to the PDO.

Positive PDO phase promotes dry, warm, low snow winters in Pac NW (e.g. 1930s, 1980s).

Negative phase promotes high snow winters (e.g. 1950s, 1970s)