Flash Flooding

Mteor 417 – Iowa State University – Week 13

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General background

- Flash flooding is a bigger killer than tornadoes, wind, or hurricanes each year.
- Where do you forecast it?

- the heaviest precip occurs where the rainfall rate is highest the longest.

P=RD where P=precip, R is rate, and D is duration

R=Ewq where E=efficiency, w=vertical motion, and q=specific humidity

or E=R/wq (efficiency is related to how much water reaches ground compared to what is condensed up high)

- Thus, length of time is important (slow moving or training cells)
- Dryness of air (low RH) hurts chances
- Vertical motion and specific humidity generate rain

General Characteristics

- Convection usually present
- High surface dew points (usually 60s or higher)
- Lots of moisture through deep depth of atmosphere (even at 700 mb)
- Upper forcing (usually some PVA and upper-level divergence)
- Also, often there may be weak winds or wind shear

***IF winds are not very weak, training convection becomes the biggest cause of flash flooding. Training usually requires a surface boundary to be present and it may act like the tracks for a train

- Often, events happen near ridge axis aloft/mid-levels (not always where you'd expect bad weather)

- Nocturnal due to either radiational cooling of cloud tops which destabilizes cloud or the LLJ being strongest at night
- NOTE: Many of these rules for flooding location are similar to MCS rules (and many MCSs cause flash flooding)

In the 1970s, many severe flash flood events killed hundreds of people at a time in the U.S., prompting a surge in researc

4 synoptic or mesoscale patterns were identified as favorable for flash floods:

1) Synoptic
2) Frontal
3) Mesohigh
4) Orographic

1) Synoptic

a) Lots of severe weather also happens
b) Major upper forcing

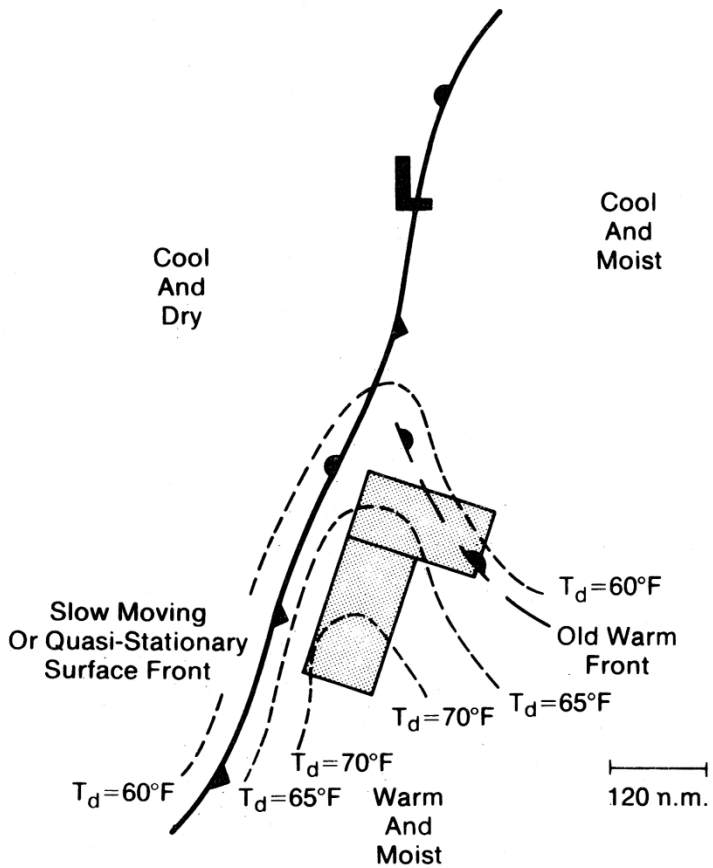

FIG. 6a. Surface pattern for a typical synoptic type flash flood event. Potential for heavy rains and flash flooding exists in the shaded areas.

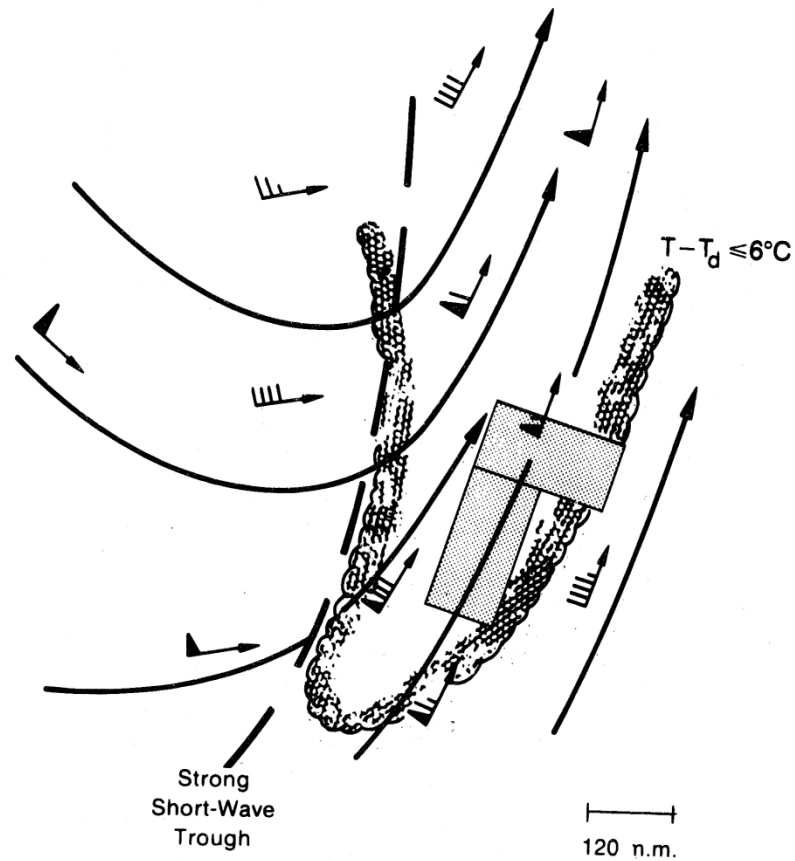

FIG. 6c. The corresponding 500 mb flow pattern for a typical synoptic type flash flood event.

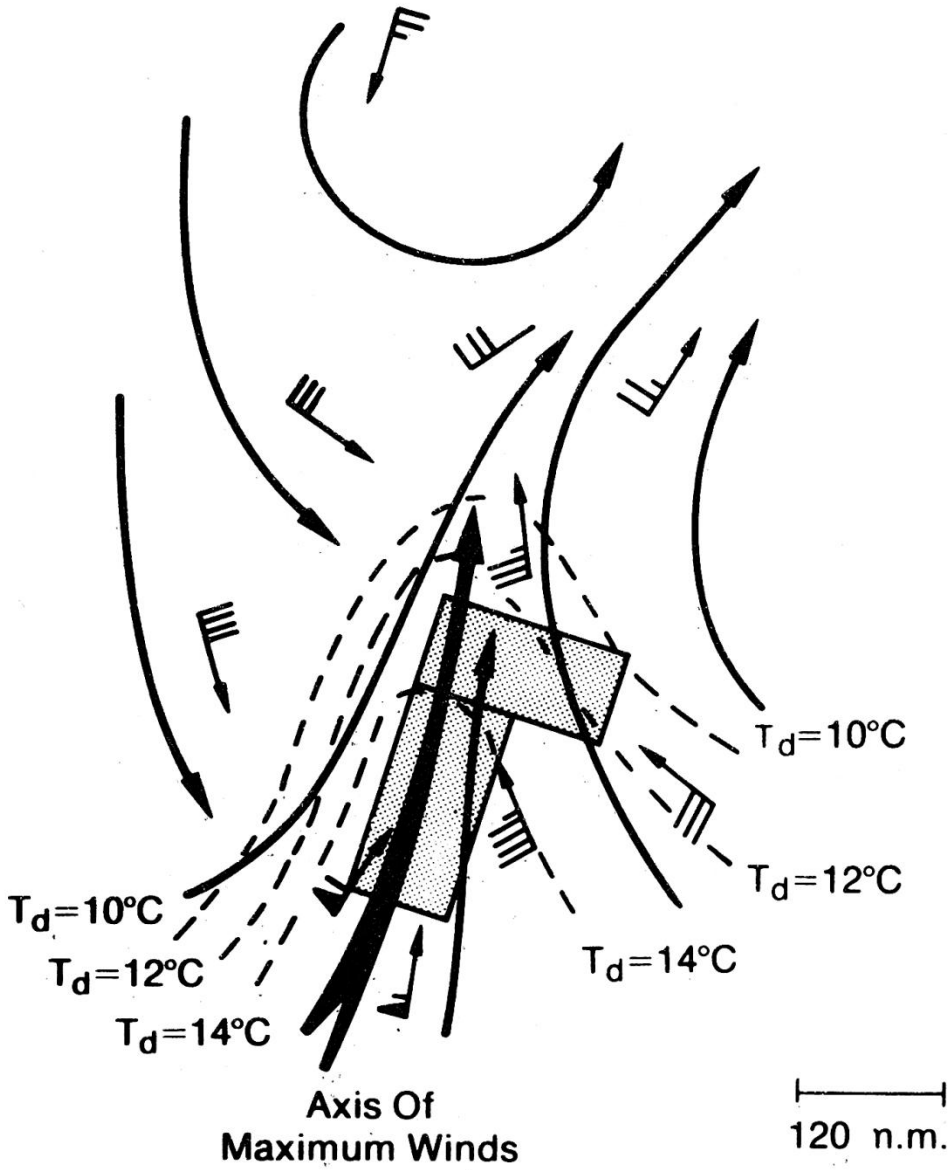

FIG. 6b. The corresponding 850 mb flow pattern for a typical synoptic type flash flood event. Winds are in knots with full barb = 10 kt and flag = 50 kt.

Frontal

- a) some severe present
- B) upper forcing just grazes area to the north
- C) many IA events fall into frontal class

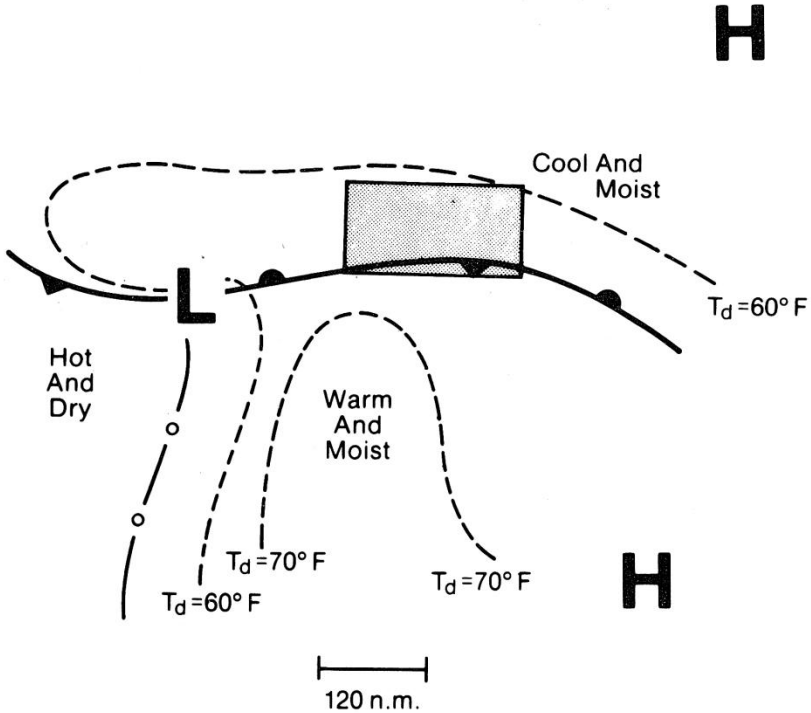

FIG. 8a. Surface pattern for a typical frontal event with details as in Fig. 6.

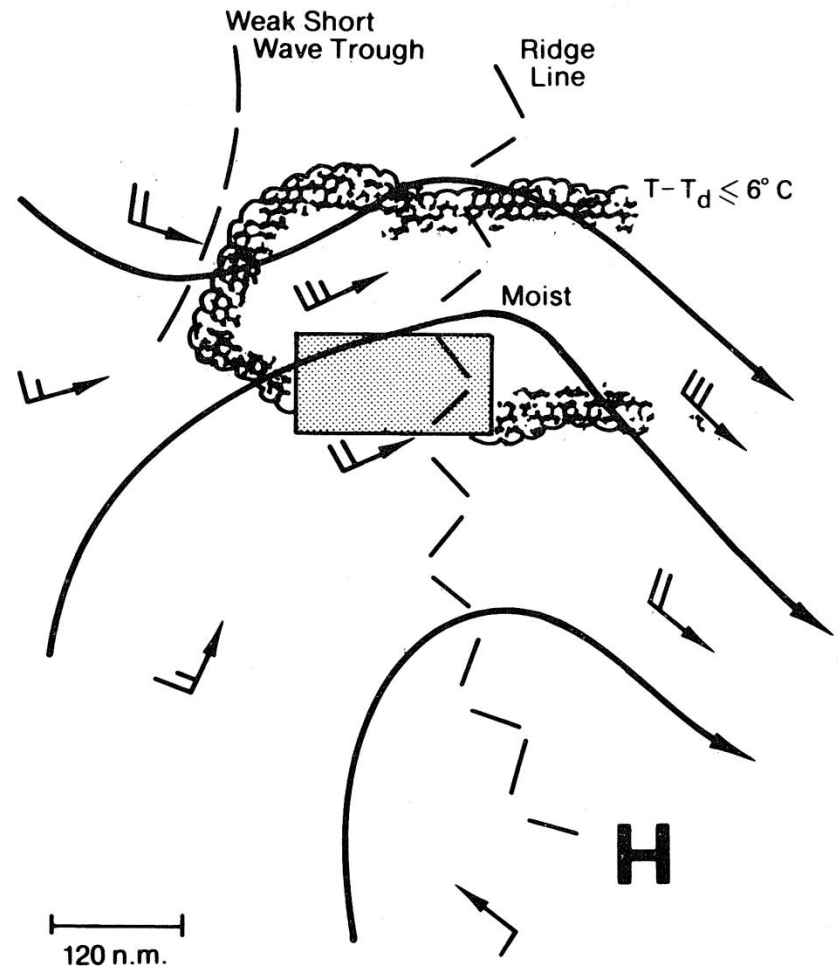

FIG. 8c. Corresponding 500 mb pattern for a typical frontal event.

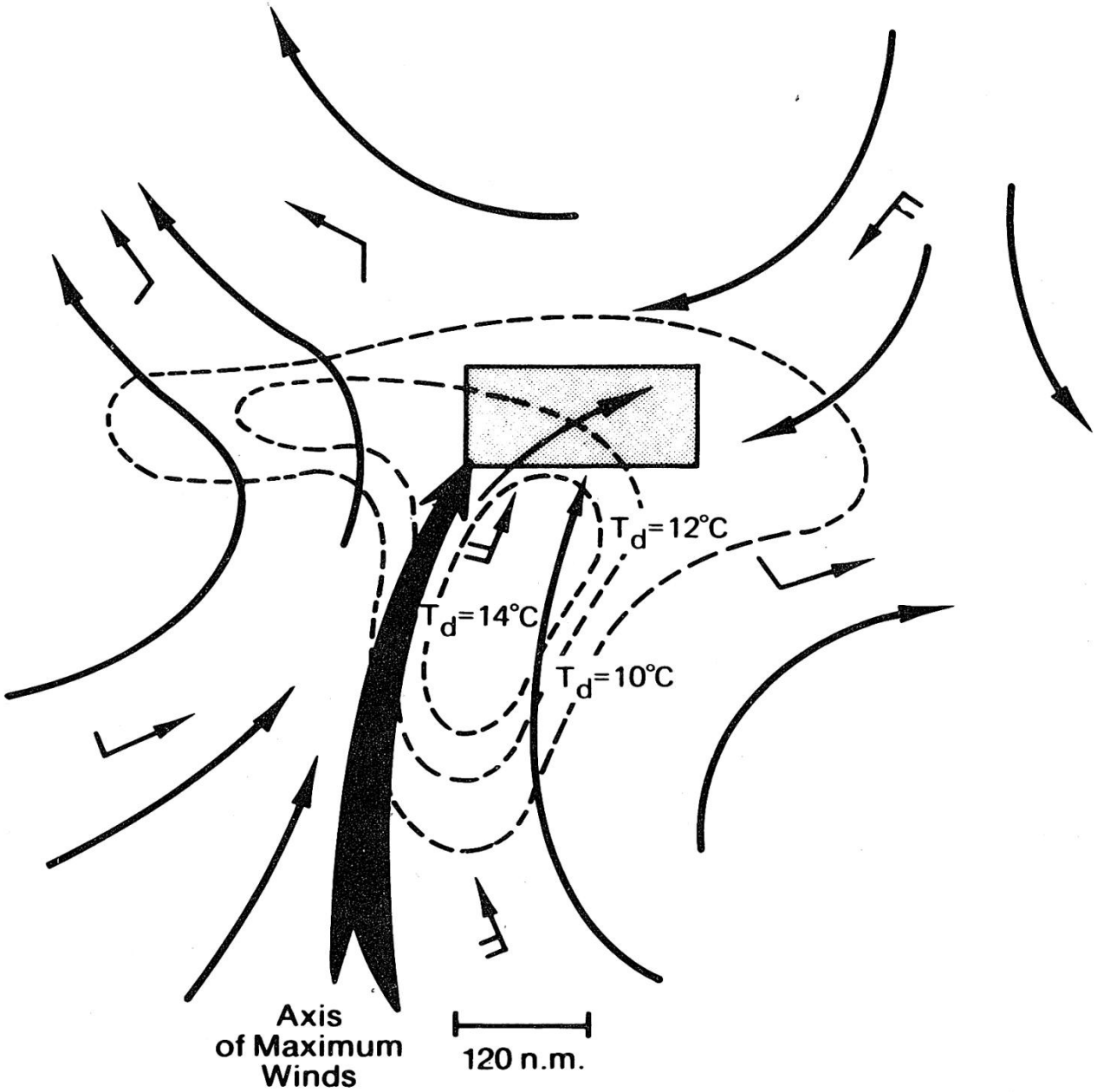

FIG. 8b. Corresponding 850 mb pattern for a typical frontal event.

Mesohigh

- A) some severe present
- B) weakest upper-forcing of all types, but most moisture present
- Corfidi vectors may show the flood potential.
- If mean wind matches up closely with LLJ, then storm motion will effectively be close to zero

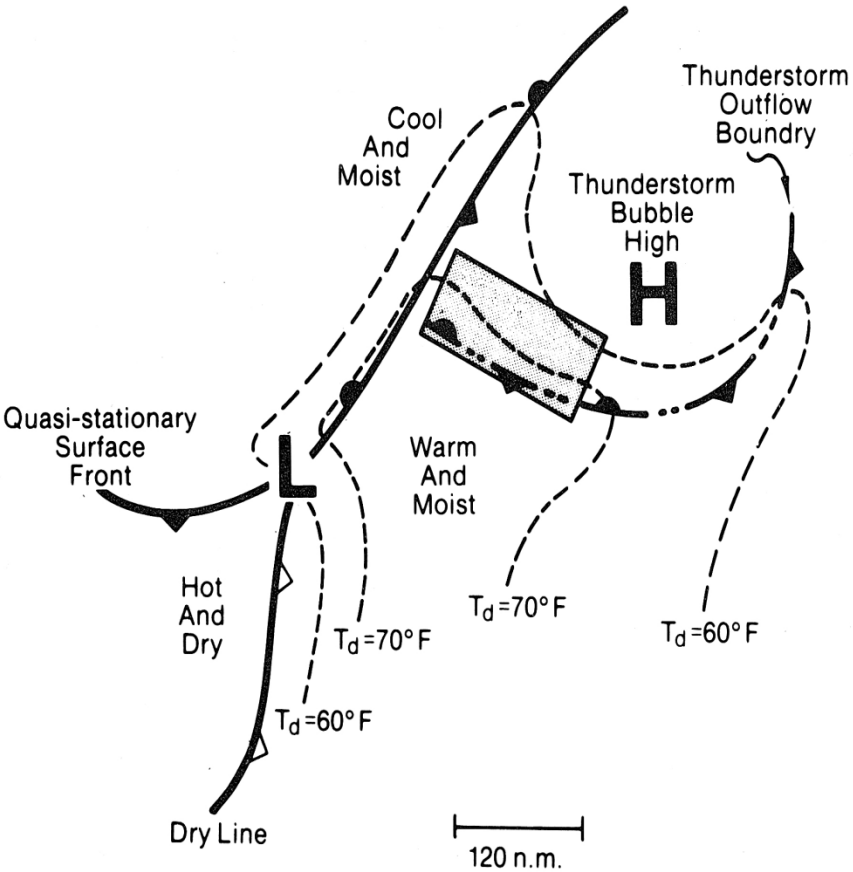

FIG. 10a. Surface pattern for a typical mesohigh event with details as in Fig. 6.

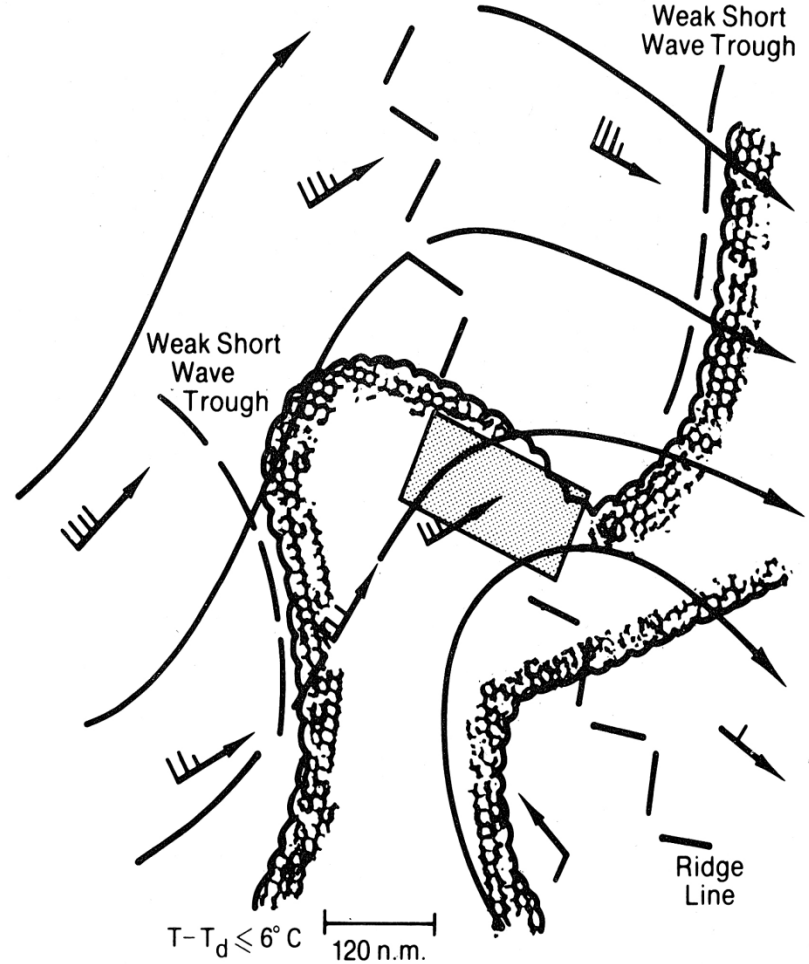

FIG. 10c. Corresponding 500 mb pattern for a typical mesohigh event.

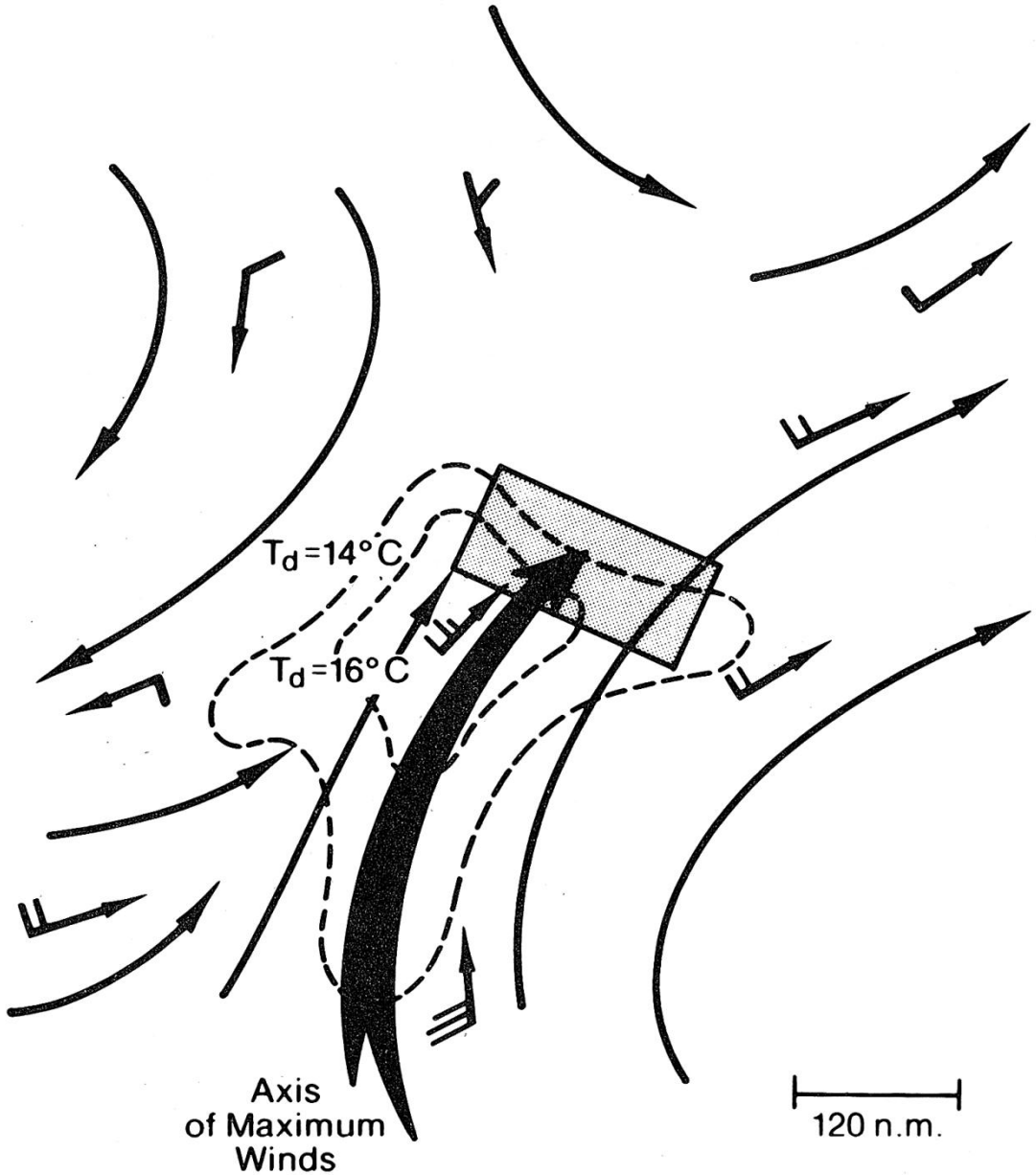

FIG. 10b. Corresponding 850 mb pattern for a typical mesohigh event.

Orographic

- Happens when moist air flows up into mountains.

Typical flood values

Parameter	Mean	Max	Min
PW	3.7 cm	5.2	2.4
Sfc Td	66F	75	56
LI	-5	-9	-1
TT	53	62	45
850 wind speed	12 m/s	23	5
500 speed	12 m/s	30	3

850 dew points are usually > 13 or 14 C
700 dew points > 2 or 3 C