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SUMMER FRONTAL PASSAGE RAIN PROBABILITIES AT DES MOINES, IOWA

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Data was collected for the summer months (June, July and August) from 1983 to 1987 at Des Moines. Days of frontal passage were determined from the Daily Weather Map series with hour confirmation from the MF1-10A observation form. A rain (or wet) event occurred when .01 inch of rain or more fell within 12 hours of passage. Thunderstorm gust fronts were not considered. Flow directions from 500 mb were recorded prior to frontal passage along with post and pre-frontal rain events. Warm fronts were also divided into day or night passage.

Cold Fronts

Forty out of 85 (47%) of the cold frontal passages from 1983 to 1987 were wet in Des Moines as compared to 40 out of 62 (65%) that McCann counted in Topeka from 1972 to 1976. The variability of yearly wet frontal passage was wide at Des Moines. For example, 67% were wet in 1987 compared to 36% in 1986. Twenty-two frontal passages occurred in 1985 and again in 1986, nearly twice the amount (12) that occurred in 1983. The summer of 1983 was the third warmest on record, most likely impacting the number of frontal passages.

Pre-frontal rains occurred 70% of the time with wet cold fronts. Synoptic conditions examined with each frontal passage showed that 50% of the pre-frontal rains occurred with westerly 500 mb flow, and 79% happened with a west to northwest flow. Post-frontal rains are more often associated with west or southwest flow aloft. Eighty percent occur under this flow regime. Of the dry cold fronts, 84% were associated with west or northwest flow.

Warm Fronts

Twelve out of 26 (46%) of the warm frontal passages were wet in Des Moines. The number of passages were small, varying from three in 1983 to seven in 1987. Eight pre-frontal rains (67%) occurred out of 12 wet warm frontal passages. Seventy-five percent of wet warm fronts occurred with southwest flow, while 92% occurred with southwest or south flow aloft. Sixty-four percent of dry warm fronts occurred with a west or northwest flow. Another interesting fact is that out of 26 passages only two occurred at night; of these two, one was wet and the other dry.

## Climatology

Similar to McCann (1977), the data was stratified into half months for climatology comparison. As shown in Table 1, cold front probabilities exceeded 24-hour climatology in every category, except early June. It does appear that the maximum heat of late July and early August has an effect on cold front probabilities.

Table 1  
Summer Rain Probabilities for Half Month Periods

	Cold Front (%)	Climatology (%)
Early June	37	38
Late June	54	37
Early July	60	27
Late July	40	27
Early August	36	29
Late August	56	31

## Conclusions

The following conclusions are suggested from this study:

1. A 50% probability of rain forecast with summer warm or cold fronts is justifiable at Des Moines.
2. Most rains will be pre-frontal with warm or cold fronts 70% of the time. This probability is even higher with northwest quadrant flow associated with cold fronts.
3. Post-frontal cold front rains almost always occur (80%) under a southwest quadrant flow.
4. Most dry cold fronts (84%) occur with northwest quadrant flow compared to 64% of the warm fronts.
5. Nearly all (92%) wet warm fronts occur with southwest or south flow.
6. Almost all warm frontal passages occur during the day.
7. All cold frontal passages have higher rain probabilities than climatology except for early June.

## Reference

McCann, D.W., 1977: Probability of rain during summer with a frontal passage. Central Region Technical Attachment 77-14.