Preliminary Assessment of Timing Differences Between Convection Initiation and Severe Initiation

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Introduction

Using a similar definition for convective initiation (CI) as was used during the 2012 Spring Forecasting Experiment (SFE), the time between CI and severe initiation (SI) was studied. The importance of determining the time interval between CI and SI has not yet been explored. Given the increase in radar based attributes and detection of severe storms, and the increase in skill of convection in convection allowing models, exploring SI gives yet another avenue for extracting information from models that can be used for verification. Fifteen cases of observed "clean-slate" afternoon CI occurring across the CONUS (with a bias toward the Great Plains) during the spring of 2011 were collected for the sample. Storm objects based on observed radar attributes were tracked through space and time, and matched to local storm reports (LSR's) to determine the elapsed time between their initiation and when they became severe to the nearest 15 min. Presented are histograms and probability distribution functions (PDF's) of timing difference between CI and SI, separated by LSR type.

Methodology

Dataset:

- LSR's from the Storm Data database
- Observed reflectivity at the -10ºC level on the NMQ grid
    - Interpolated to Center for Analysis and Prediction of Storms (CAPS) 4-km grid via budget scheme
    - Thinned from 5- to 15-minute temporal resolution

Convection definition:
Convective objects contained at least 4 continuous grid points of 35, and 1 grid point of 40, dBZ or greater at the -10ºC level. **The first instance of an object meeting these criteria was considered the CI time.**

Domains were designed to surround the convective event (comprised of the relevant convective object(s)) for each case. These domains were searched for LSR's, so that reports were associated with the desired convective event, not specific convective objects.

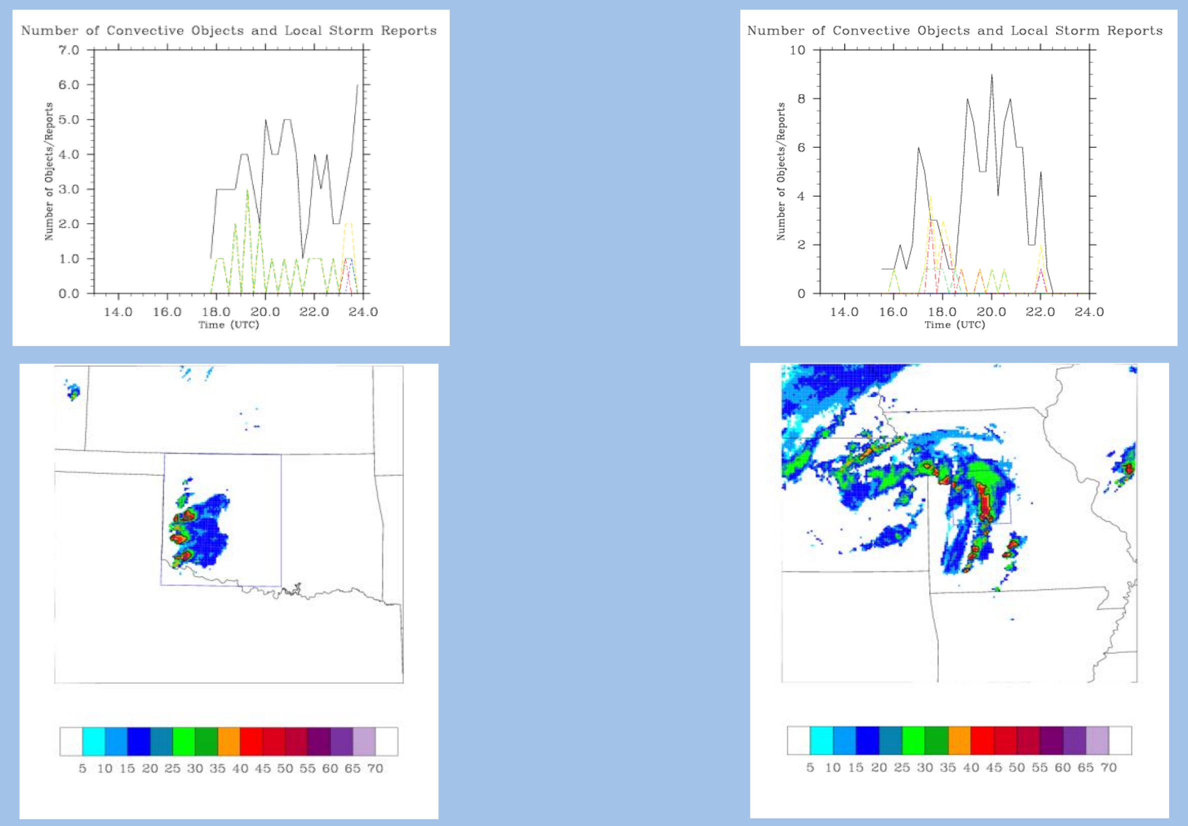

FIG. 2. Top: Example time series of convective objects and severe reports associated with those objects in the domain for two of the 15 cases examined. Convective objects are black, total LSR's yellow, hail-green, wind-blue, and tornado-red. Bottom: Observed reflectivity corresponding to the time series above. The blue box is the domain, convective objects are contoured in black, reflectivity is color-filled, and LSR's are indicated by triangles corresponding to their respective colors in the time series. See the extended abstract for valid dates and times.

Methodology (cont.)

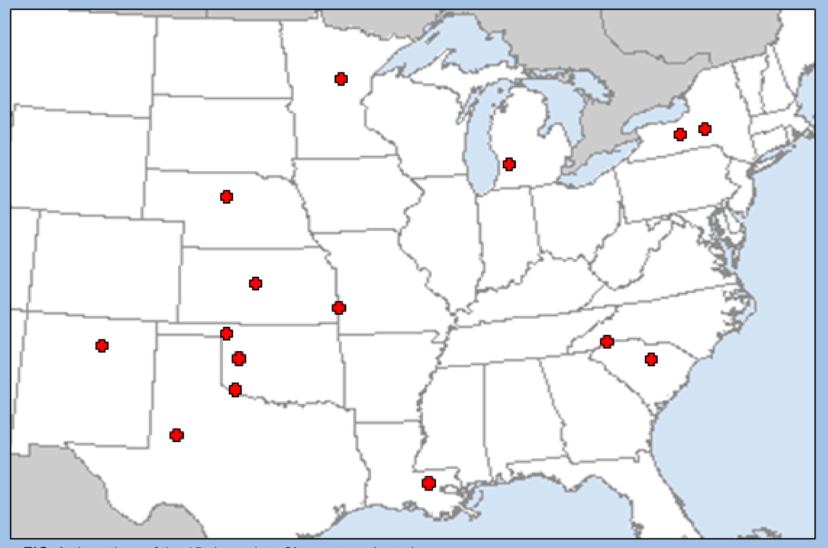

FIG. 1. Locations of the 15 clean-slate CI events evaluated.

Results

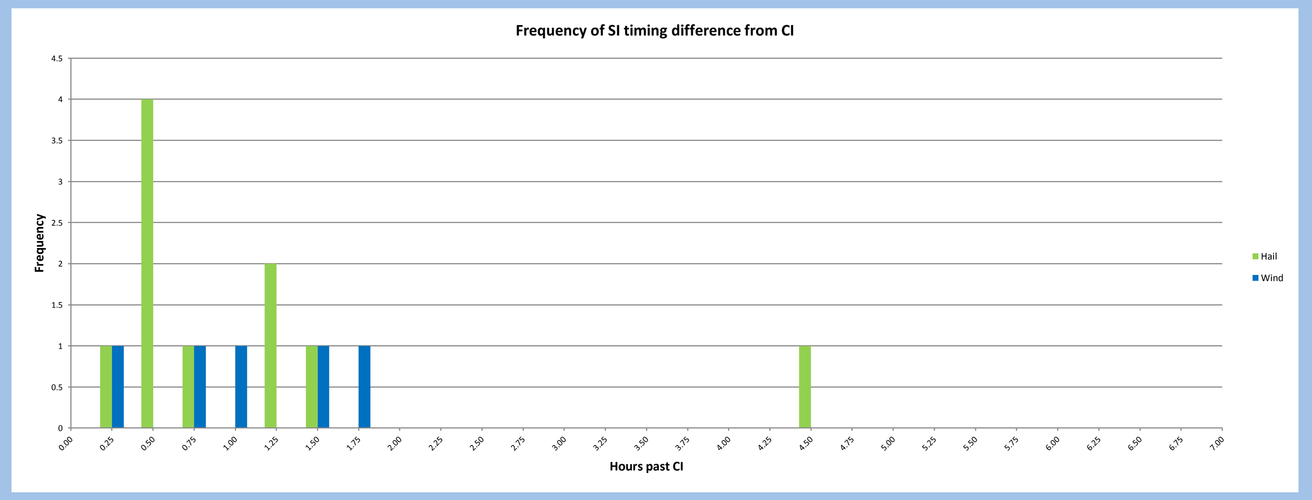

FIG. 3. Histogram depicting the time between observed CI and SI associated with convection for each case in the sample.

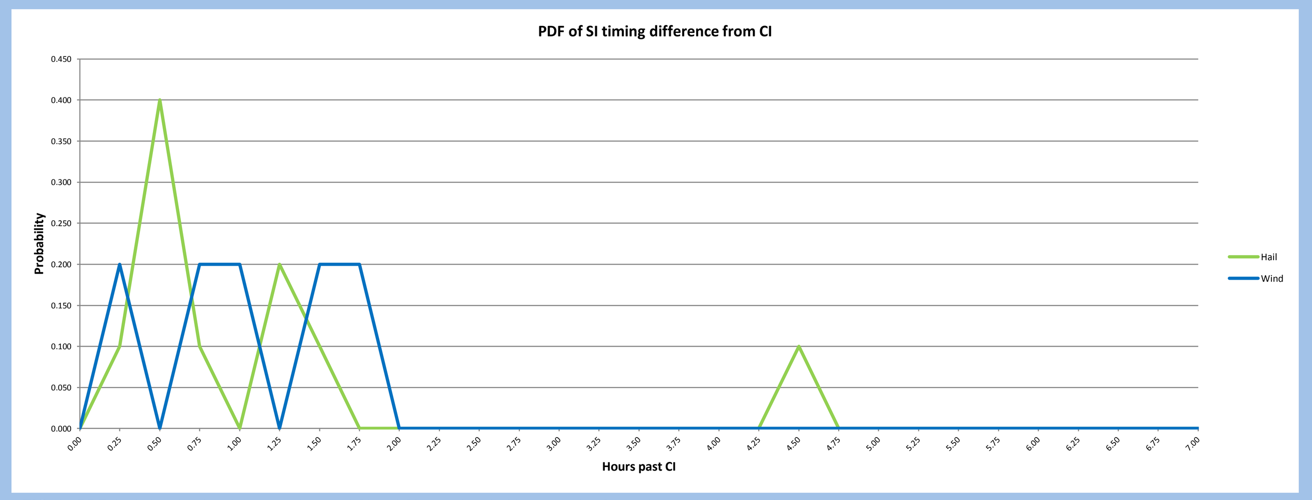

FIG. 4. PDF depicting the time between observed CI and SI associated with convection for each case in the sample.

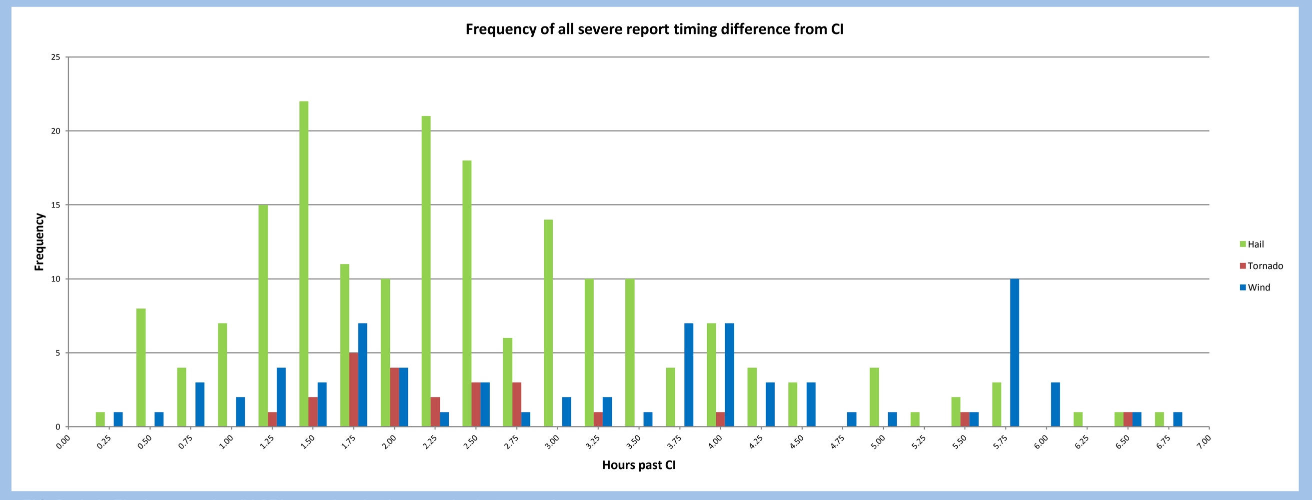

FIG. 5. As in Fig. 3., except for all LSR's associated with convection in the sample.

Results (cont.)

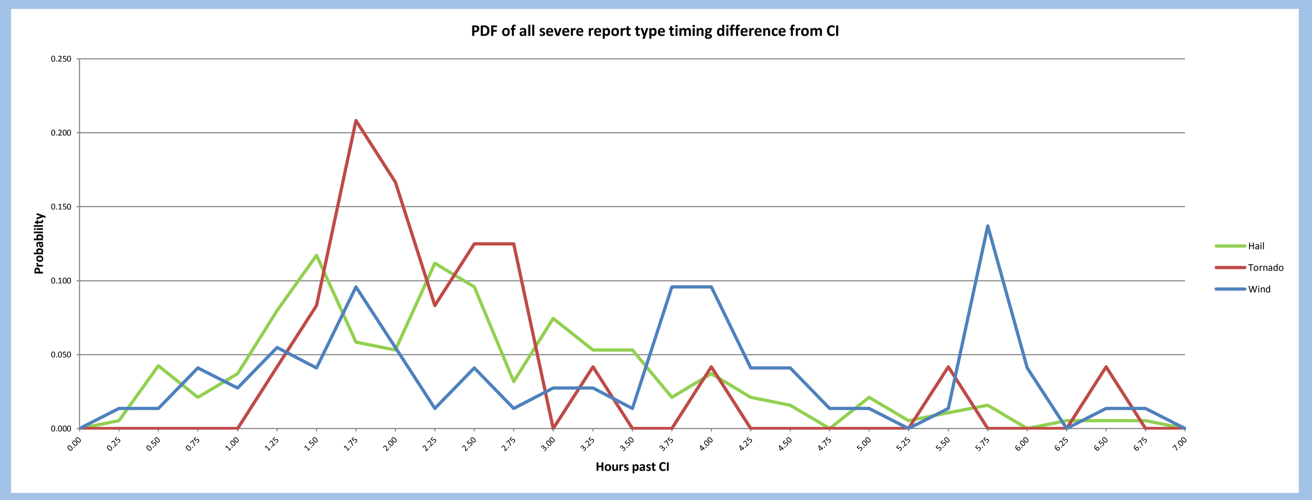

FIG. 6. As in Fig. 4., except for all LSR's associated with convection in the sample.

Conclusions

- The earliest severe threats came in the form of hail and wind.
- A majority of SI occurred within the first 2 hours after CI.
- When reports occurred in general, they were most probable between 1.75 and 2.75 hours after CI.
- In the context of watch and warning decision making, these data suggest that a forecaster has approximately 1.25 to 3.75 hours between CI and SI (in the temporal resolution of the dataset).
    - By FIG 5., hail occurred the earliest, on average, of all reports (2.50 h after CI). Its standard deviation of occurrence was 1.30 h.

Acknowledgements

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