

Dear CSTAR participants,

There has been some progress made with the CSTAR2 topic of the forecast implications of upstream convection/downstream forecast adjustments. Before diving into the research completely, we wanted to solicit feedback from all of the CSTAR offices. The attached document has three specific questions that we would appreciate each office answering, as well as a summary of the plan for this project and a brief discussion of some very preliminary findings.

We're very much looking forward to any comments and suggestions that you may have.

Thank you!

Kelly Mahoney

Gary Lackmann

Kermit Keeter

Specific questions for CSTAR office participants:

1. Do you have a record of any particularly egregious QPF error cases in which upstream convection is suspected of having played a role? If so, the dates/times/any cursory event summaries would be helpful.
2. We have proposed a simplified 3-part classification scheme (described below.) Are there other upstream convection scenarios that have been observed with some regularity that could be added?
3. CAE has shared their current operational practices during events where upstream convection has been noted. Do you have a certain practice or rule of thumb that you generally follow in these situations?

CSTAR Upstream Convection Project Background and Progress

Purpose:

Past events have demonstrated a weakness in the ability of numerical weather models to accurately simulate the effects of upstream convection on downstream precipitation. To begin assessing the effects of upstream convection on model QPF errors, progress has been attempted on two fronts. Both aspects aim to evaluate the frequency and implications of upstream convection affecting moisture transport and downstream precipitation in the Southeast/Mid-Atlantic region.

First, a collection of cursory case studies (made up of ten events characterized by large Eta model QPFs) has been examined and analyzed to assess several characteristics and features. The cases were examined in order to gain a

sense of how individual upstream convection events vary relative to one another, and to determine whether or not a relatively simple classification scheme will be employable.

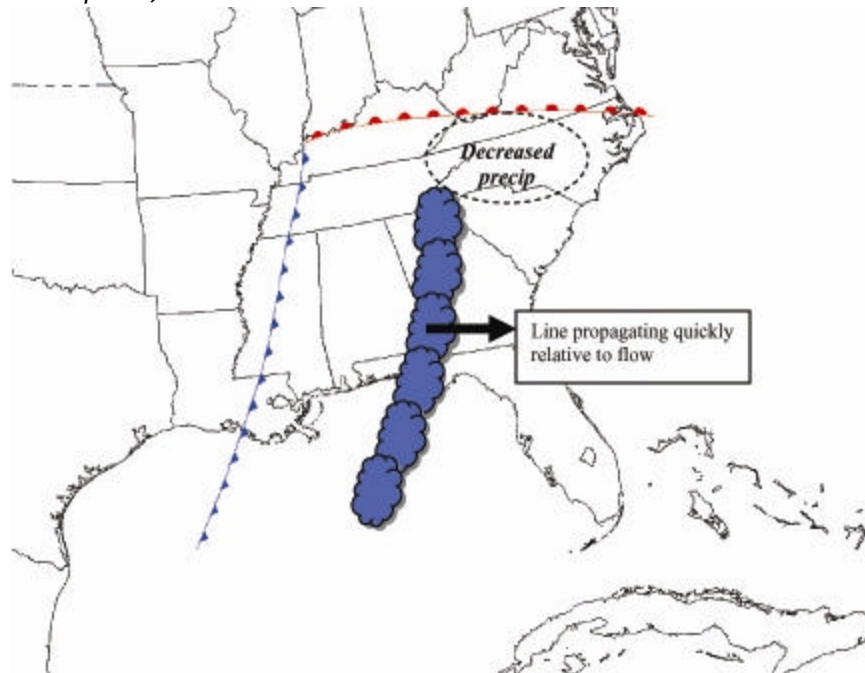
Second, the creation of a climatology of model QPF error is in its beginning stages. This climatology will provide the study with “ground truth” and in turn reveal the scope and frequency of large QPF errors over the Carolinas and Virginia resulting from scenarios with upstream convection. We will also use the results from the climatology to select more cases with which to perform in-depth case studies.

Methodology:

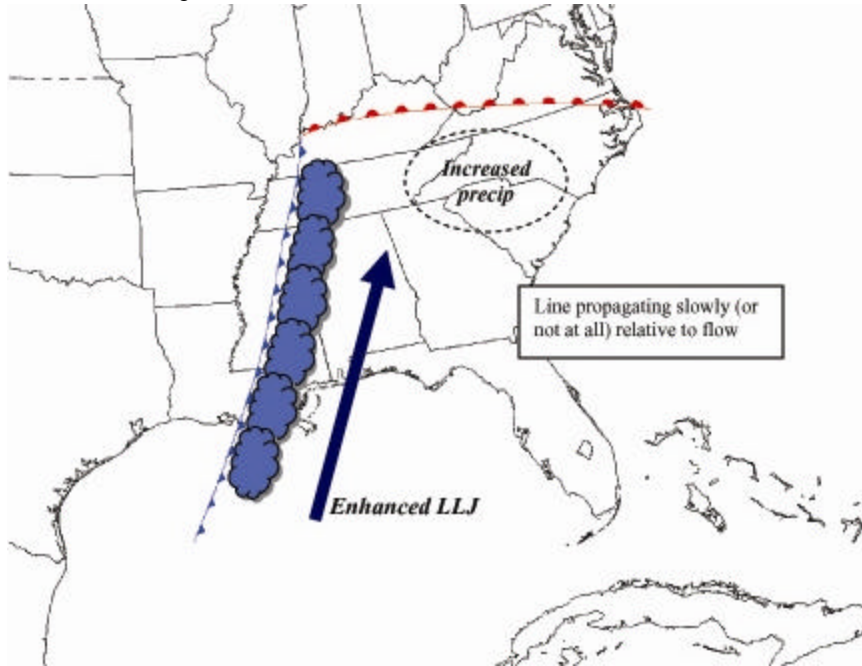
Preliminary case studies: The preliminary case studies were examined using radar data and Eta 211 forecast grids (80-km gridspacing) to describe 10 cold-season high-model-QPF cases in terms of upstream convection and other relevant fields. The cases were selected based on 24-hour precipitation totals averaged over an area centered on central NC and encompassing the Piedmont and much the coastal plain.

To begin drawing similarities between individual cases, each case was tentatively placed into one of the following (over-?) simplified categories:

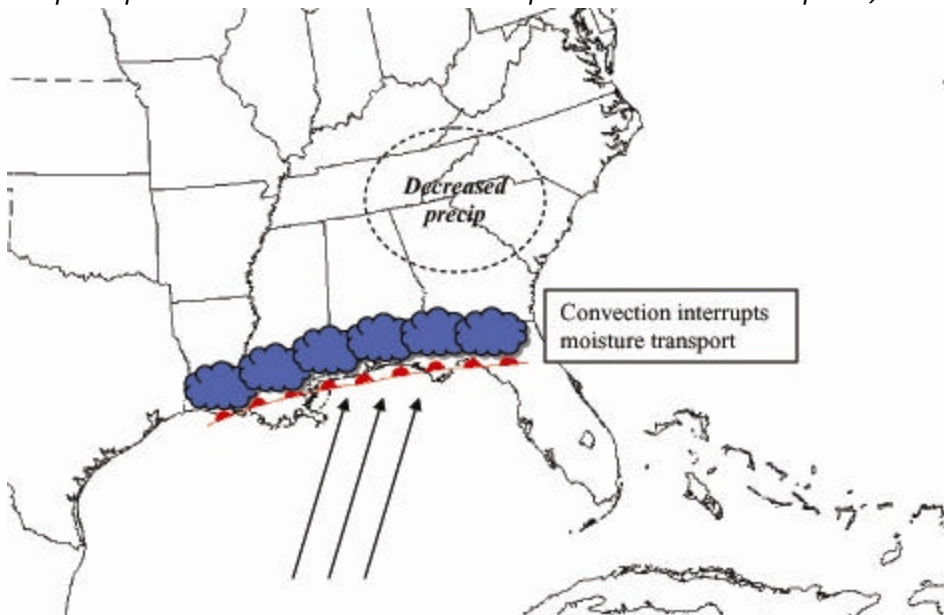
1. Upstream convection oriented parallel to flow and propagating quickly, perpendicular to flow. (*These cases would be expected to show decreased downstream precipitation as a result of interrupted moisture transport.*)



2. Upstream convection oriented parallel to flow and propagating slowly, or not at all. (These cases would be expected to show increased downstream precipitation as a result of enhanced moisture transport via an enhanced low-level jet.)



3. Upstream convection oriented perpendicular to flow. In these instances, the convection tends to align with the coast and/or frontal features. This same idea could also apply along the NC/SC coast with respect to convection forming along a coastal front in southeasterly (onshore) flow. (These cases would also be expected to show decreased downstream precipitation as a result of interrupted moisture transport.)



Climatology: The model QPF error climatology is essentially contingent upon the attainment of the NCEP Regional Reanalysis database, which continues to be generated and made available to the public. As soon as this dataset is complete, it will be used together with the model forecasts to define hits, misses, and false alarms for high-QPF events (both real and model-predicted) since 2000.

The next step will be to examine how the behavior of convection is related to the larger-scale synoptic flow by examining shear and thermodynamic characteristics. This information will be important in using the synoptic environment to predict the mode and orientation of potential upstream convection.

Finally, in-depth case analyses and modeling studies will be performed in an effort to understand the physics of each scenario and extend research results into operationally useful forecast applications.

Preliminary results to date:

The results of the preliminary case studies can be found on the following webpage, which contains 4-panel plots and select radar imagery for each case: http://tempest.meas.ncsu.edu/kelly/prelim_webpg/prelim_cases.html . A database that summarizes case characteristics in detail can be found at: http://tempest.meas.ncsu.edu/kelly/prelim_webpg/CSTAR_Cases_Matrix_Post.xls , and a more simplified version summarizing each event is located at: http://tempest.meas.ncsu.edu/kelly/prelim_webpg/CSTAR_11_cases_sum.doc.htm . In general, it was found that a significant number of the selected cases were affected by upstream convection, either via an enhanced low-level jet, interrupted moisture transport, or for reasons yet unknown. It was also found that many of the cases that exhibited upstream convection fit relatively neatly into the aforementioned three basic categories.

By virtue of being selected as high model QPF events, these ten cases are ones in which model QPF would be generally expected to be overdone, although it is certainly possible that some cases may have been significantly underpredicted depending on the character of the upstream convection as well as other factors. Thus these ten cases will likely fall into the category of hits or false alarms, while misses will be able to be defined upon obtaining the complete gridded precipitation database.

We feel that it is extremely important to gain suggestions and recommendations from all surrounding CSTAR offices and are very interested in garnering feedback regarding this project. In particular, we would greatly value any ideas that individual offices have for representative upstream convection cases to study, as well as any ideas describing how to make this research most useful to

forecasters. Any feedback regarding what has been done so far will be extremely valuable, and suggestions and recommendations for future work will be greatly appreciated.