LASSO-CACTI Tentative Case Selection and Description

This document contains an overview of the cases under consideration for LASSO-CACTI. ***We seek user input regarding:***

- Are there days not listed that should be?
- Should any of the candidate days be dropped? (e.g., key instruments down, etc.)
- For the secondary and stretch cases, should the prioritization be modified to reflect what you would find most valuable? This prioritization would help if we cannot run all selected cases.

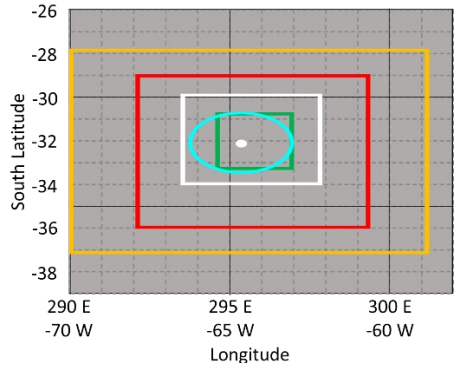
The selection process thus far consisted of the following steps:

- A candidate list of dates was obtained from Adam Varble, the CACTI PI. The list considered factors such as convection cases coinciding with data/instrument availability.
- Animations of VISST IR satellite data were then inspected for the occurrence of convective initiation and upscale growth occurring within the CSAPR2 observational domain. *Cases were not considered when convection only occurred outside of the CSAPR2 domain, or when initiation occurred outside of this domain and then advected into it, as the upscale growth was not observable by ARM instrumentation to vet and add value to the simulations*.
- A 33-member ensemble of mesoscale simulations were conducted (Δx=2.5 km grid spacing) for each candidate day. The ensemble members correspond to different large-scale forcings from ERA5 (1), FNL (1), ERA5-EDA (10), and GEFS (21). Case days with poor ensemble performance are lower priority as the large-scale conditions might not be adequately captured in the available forcings. Some cases are still retained, as it is possible that the LES resolution (Δx=100 m) might markedly improve dynamical features unresolved at 2.5 km that could improve the simulation.

This selection process resulted in 10 cases dates that seem viable. They are described in three groups: (A) primary, the likely best cases; (B) secondary, cases that might be more problematic to simulate or have very weak convection, and (C) stretch cases, where the cases may be very challenging to simulate.

Case details are provided below. Images provide a snapshot of the satellite IR brightness temperature (at 11.2 µm), where the white dot indicates the location of the AMF site and the white box indicates the tentative domain to be used for the Δx=500 m grid (domain 3) in the LES simulations. The images are ~for when the convective core area (BT < 219 K) is its maximum within domain 3. *The full IR animations for all days we evaluated are available at: https://engineering.arm.gov/~ttoto/cacti/ir/visst.html*

For reference when viewing the images, the layout of the tentative WRF nested domains is given below.

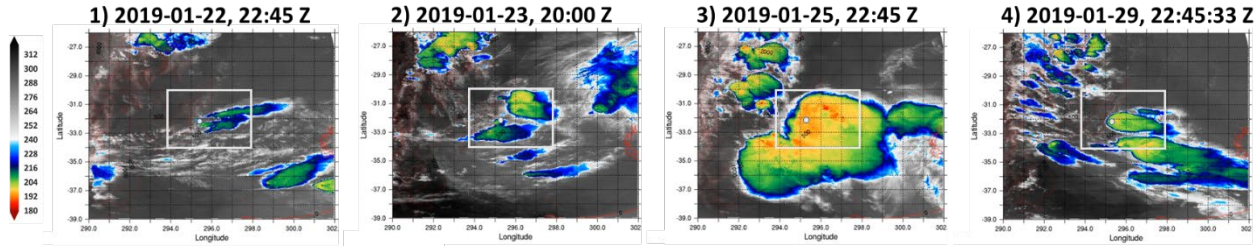


The dot marks the location of the AMF and the oval is the projection-distorted 'circular' domain for the ARM C-Band radar. The colored boxes indicate the WRF nested domains with their lat/lon coordinates and horizontal resolutions given below.

	DOMAIN			
	1 (gold)	2 (red)	3 (white)	4 (green)
lat min	-37.13	-35.98	-33.98	-33.28
lat max	-27.80	-28.99	-30.03	-30.75
lon min	-70.07	-67.96	-66.28	-65.40
lon max	-58.90	-60.67	-62.16	-63.07
dx (m)	7,500	2,500	500	100

A. Primary Cases

A series of four especially promising cases occurred between 2019-01-22 and 2019-01-29. They are discussed chronologically as there currently is no preference and all will be simulated. ***However, user input is desired as to whether the number of simulated ensembles should be increased for a particular case of special interest and scientific value.***



1. **2019-01-22**
   Small-scale, isolated convection with a second cell developing at the end of the day. Strong shear is present.

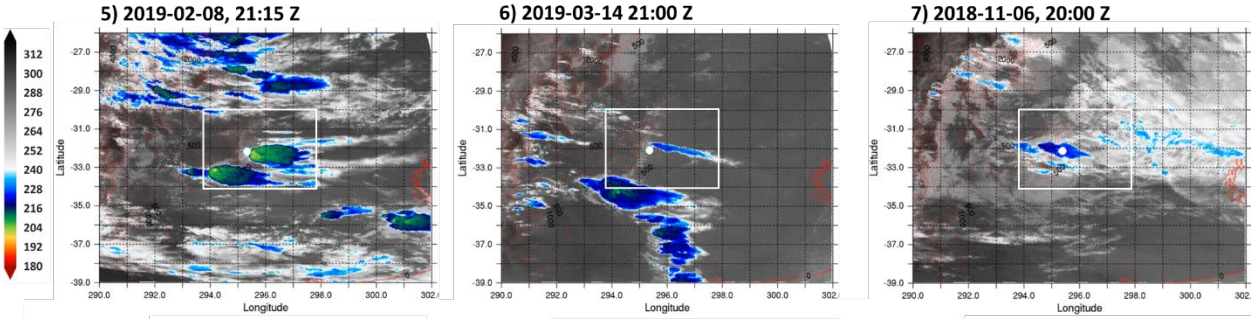
2. **2019-01-23**
   More vigorous convection occurring the day after the first case. Shear is less pronounced than before. Potentially it may be more challenging to simulate because the very deep development/pop occurs from the interaction and subsequent merging of two small systems within the study region.

3. **2019-01-25**
   The most vigorous convection of all cases. Two large systems merge within the study domain to generate a monster system.

4. **2019-01-29**
   Example of a mostly isolated deep convective system that develops on its own. It is more vigorous than on 1/22. Shear has increased again by this point.

B. Secondary Cases

These three cases are given in order of tentative priority. ***User input sought for reprioritizing based on potential scientific benefit.***



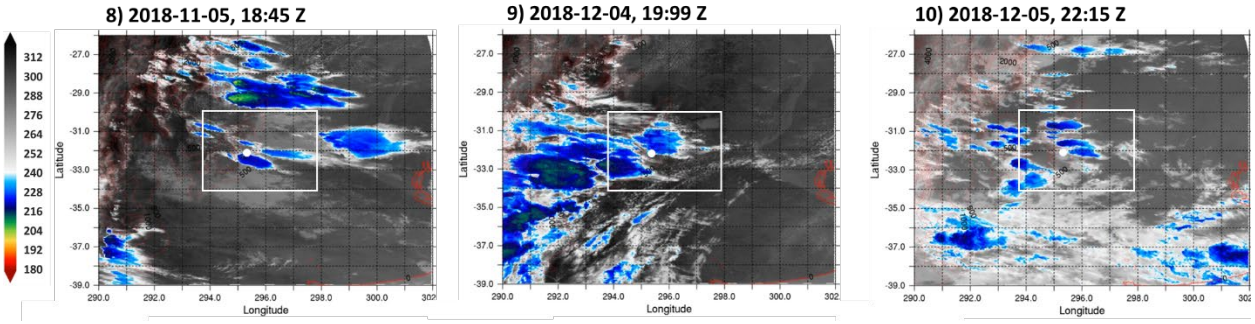
5. **2019-02-08**
   Multiple initiations occur within the Δx=500 m study region which then merge into a deeper system. All of the mesoscale ensembles capture the phase but dramatically underestimate the magnitude of the upscale growth, possibly because important fine-scale features are insufficiently resolved at 2.5 km that might be (?) captured at Δx=100 m for an improved overall simulation. Could be an interesting test case of small-scale processes.

6. **2019-03-14**
   Weak, isolated convection in a strongly sheared environment. It does not develop/blow up as in the prior cases.

7. **2018-11-06**
   Weak system develops that does not go deep, similar to 2019-03-14, but drops off within the day *so part of the system decay is captured within the domain*. This case may be harder to simulate because there are multiple, small convective cells that form and dissipate within the local region prior to the study event, which might precondition the convective environment in ways not captured in the large-scale forcings. However, some of the ensemble members still seem promising.

C. Stretch Cases

These cases are given in order of tentative priority. *These cases may not be simulated should we run out of time for the simulations*, be that either due to limited computer time or we run out of staff time before moving to the next LASSO scenario. ***User input sought for reprioritizing based on potential scientific benefit.***



8. **2018-11-05**
   Two to three small initiations occur within the domain and grow to merge, but they get overrun by 21Z by systems advecting in, so the simulation is of greatest value before then. Two to three of the mesoscale ensemble members seem viable.

9. **2018-12-04**
   System develops within the domain to the north of the AMF. The case has a lot of complicated activity and all mesoscale simulations dramatically underestimate the growth of the core area by a third to a half. The underestimation could be because of the large-scale forcing or the need for higher resolution to capture important fine-scale features for the growth.

10. **2018-12-05**
    Scattered, small-scale convective initiation but none of them grow. Only two ensemble members look potentially viable. Is there scientific interest in this case?