

Question and Answer Log
LASSO Deep Convection Session, 24-Jun-2020
2020 Joint ARM/ASR Principal Investigator Meeting

LASSO Update for Shallow Convection

Speaker: William Gustafson, PNNL

Ric Cederwall 02:06 PM: Bill - will your intro slides be linked to the agenda?

Andy Vogelmann 02:07 PM: They are, starting on page 2

Andy Vogelmann 02:09 PM: I see the issue. There is not a separate file for the intro -- all of his slides are in the "CACTI Deep Convection Scenario (7.68 MB) - William Gustafson" file

Rolanda Jundt 02:15 PM: Hi, Ric and Andy. The ASR website will be collecting presentations from breakouts to maintain long term. I will be following up with session organizers soon.

Toshi Matsui 02:15 PM: What kind of bugs in VARNAL?

- William Gustafson would like to answer this question live.

Yunyan Zhang 02:22 PM: there is a shift in the diurnal cycle of large scale forcing, such as advective tendencies, omega fields and T and q state variables. this is due to a data missing gap in the background meteorological datasets.

Shaocheng Xie 02:29 PM: Thanks, Yunyan. Just to add that. The bug is in handling the data missing gap in RUC/RAP analysis. This is not occurring often, but when it happens, the code cannot appropriately handle it. It will affect the derived domain-mean large-scale state variables (u, v, T, q) and the derived forcing.

Toshi Matsui 02:54 PM: Thanks! Clarified

Thijs Heus 02:16 PM: Are the cases that need to be reprocessed ones that did not have a very large skill score originally

- This question has been answered live

Yunyan Zhang 02:28 PM: we checked two days in 2018. The SAM LES with the variational forcing did not produce shcu fraction. it was not reported significant cloud fraction in LASSO runs with variational forcing either, however cloud field looks better with the other two forcings.

Thijs Heus 02:45 PM: yunyan, I didn't see a single forcing that was significantly better/worse at reproducing ShCu. Some of the high skill score simulations throughout the database were varanal, and I used them - hence my question. I guess we'll see :)

Yunyan Zhang 02:47 PM: yes! variational analysis often gives the best estimate for the large scale forcing based on our past experiences. we only tested two days in 2018, and this does not happen in other years' data. So this is not inconsistent with what you found.

Jake Gristey 02:19 PM: Which 2015 case was impacted by VARANAL error? Are the rest of 2015, 2016 and 2017 cases OK?

Cheng Tao 02:25 PM: The impacted case in 2015 is Aug 29th. All the other cases between 2015-2017 are OK.

William Gustafson 02:25 PM: 29-Aug-2015 was impacted. 2016-2017 and other 2015 days should be OK for VARANAL.

Jake Gristey 02:35 PM: Thank you, good to know - Jake Gristey

Larry Berg 02:18 PM: Would the team revisit running additional shallow cases in support of IOPs? William Gustafson 02:23 PM: We are open to requests. We are not necessarily never going to run ShCu again. But, for now, we will pause production. It could start again in the future as needed.

Marcus van Lier-Walqui 02:19 PM: has LASSO been run on SCM cases?

Lulin Xue 02:21 PM: Marcus, yes, we at NCAR started running some LASSO cases using SCM.

Roel Neggers 02:20 PM: Does ERA5 has the same vertical resolution as the original ECMWF data used to generate the LASSO forcings?

William Gustafson 02:26 PM: Hi Roel, we tested with the raw model-level ERA5. I would have to check to see the number of levels in the DDH forcing we are using.

Satoshi Endo 02:47 PM: Yes, both of them have 137 levels

Background on the CACTI Field Campaign

Speaker: Adam Varble, PNNL

John Peters 02:33 PM: 6000 J/kg is "quite high"

Andy Vogelmann 02:34 PM: Yup!

John Peters 02:37 PM cool!

Jiwen Fan 02:37 PM: To Adam: What are the good cases for aerosol-cloud interaction study, particularly aerosol-deep cloud interaction? It seems that the days for aerosol measurements and deep convective cloud measurements are not overlapped in the table you presented.

- This question has been answered live

Jiwen Fan 02:45 PM: I referred to the table you presented earlier with days for different categories (shallow, deep, aerosol, etc.). It would be great to have recommended cases for different foci including aerosol-cloud interaction.

LUIZ AUGUSTO MACHADO 02:38 PM: Relampago-CACTI measured several supercell - why not to pick up one case with a nice BWER and all typical supercell signature?

- This question has been answered live

Daniel Kirshbaum 02:40 PM: Do you have the data to quantify the strength of terrain-forced ascent over the Sierra de Cordoba? It would be good to know the local forcing for ascent

- This question has been answered live

James Marquis 02:42 PM: I am working on this for a few cases now using dual-Doppler data. We can talk later, if you like. (james.marquis@pnnl.gov)

Stephen Nesbitt 02:44 PM: There is often an inversion near the mountain top, which makes the vertical motion profile a bit complicated...

Daniel Kirshbaum 03:01 PM: Indeed, it is complicated. Doppler radar or lidar observations in the BL are probably the best hope. Can be difficult to parse the roles of local moist stability changes vs kinematic forcing in convection initiation

John Peters 02:41 PM: great talk adam

Adam Varble 02:41 PM thanks!

Motivations and Goals of the New LASSO CACTI Scenario

Speaker: William Gustafson, PNNL

Eric Bruning 02:55 PM: What do you consider LES for cold pools? It's a boundary-layer-scale interface and set of eddies attached to a tropospheric-scale downdraft.

Zhanqing Li 02:56 PM:

- 1) any comparisons of the evolutions with observations
- 2) what forcing you think is still missing for better simulations

- This question has been answered live

Guang Zhang 02:56 PM: Bill: by initiation, do you mean shallow to deep transition?

John Peters 02:58 PM: I think that's what they mean. I notice people in the "storms community" seem to call it CI, whereas people in the parameterization community tend to call it "shallow-to-deep." I tend to think of these as somewhat synonymous.

Adam Varble 02:59 PM: ice or precip initiation are the key determining factors

Stephen Nesbitt 02:54 PM: Comment: In some preliminary work from these cases, we find that going to sub-km resolution can impact the location of terrain-induced convergence features, impact the location and

properties of those features relative to the terrain, and the location and likelihood of convective initiation. Something to be aware of.

- This question has been answered live

Daniel Kirshbaum 02:57 PM: It could be difficult to reproduce observed storms with any skill in LASSO without including the mesoscale forcing provided by the terrain.

Adam Varble 02:59 PM: The plan is to have nested domains to hopefully capture some of this.

Stephen Nesbitt 03:00 PM: Surface fluxes will be on, correct?

Lulin Xue 03:47 PM: Depending on if studying the convective initiation is a priority or not, we probably can setup the case in a realistic way and a more semi-idealized way like the LASSO for shallow convection scenario

John Peters 02:56 PM: Not a question – but vis-à-vis think it's important to run at least 1 "bust" case where CI was expected but didn't occur

John Peters 02:57 PM: maybe it is a question – are there plans to do this?

Stephen Nesbitt 02:58 PM: The Nov 21 case Adam showed was a good case for this!

John Peters 02:59 PM: Yeah, vis-à-vis think it's important given that shallow-to-deep transition is an ASR priority.

Adam Varble 03:02 PM: I'm also hoping that for some of the weaker success cases that ensembles would produce some fail and some success. There will also be both in any one simulation for some cases because there are usually multiple cells that evolve in different ways.

John Peters 03:03 PM: I suppose we can also run some of these cases ourselves if they don't get run as part of LASSO

Stephen Nesbitt 03:04 PM: IT Singh (who I believe you met in Savannah) has a nice CM1 setup for the Sierras de Cordoba, happy to collaborate.

John Peters 03:06 PM: Great, we should talk at some point. I'll keep you updated on our plans.

Andy Vogelmann 03:30 PM: We can look into it.

samson hagos 02:58 PM: Is there a plan to connect it to the ARM diagnostic package that Chengzu talked about? It seems this work can ultimately be connected to climate model evaluation and development.

William Gustafson 02:59 PM: Hi Samson, we have not talked about this yet. I was not aware of them working with CACTI.

Shaocheng Xie 03:20 PM: We could include CACTI in the ARM-DIAGS. We plan to do ARMBE for this case, too.

Steve Krueger 02:58 PM: Lagrangian parcel trajectories could be useful. Is it possible to generate/save these?

Bill- For scale translation between 1km to 100m grid, you show a dramatic shift. Is this due to use of PBL parameterization vs. TKE-type of simple turbulence scheme? or all simulations use exact same turbulence parameterization?

William Gustafson 03:02 PM: PBL params definitely lead to issues in their gray zone. Not all of what is seen is due to the PBL though, as this extends through all of the atmosphere. You can see the details of the runs for the plots in DOI: 10.1175/MWR-D-15-0154.1

Toshi Matsui 03:12 PM Thanks!

McKenna Stanford 03:07 PM: Would microphysical process rates be considered in CACTI LASSO simulation output or is that anticipated to be too expensive?

William Gustafson 03:09 PM: I think we would want to output at least some of them. If you have ideas on which ones, we would love to hear it.

McKenna Stanford 03:14 PM: Could be worth considering outputting vertically integrated process rates to produce a bulk water budget while cutting down on dimensionality storage.

Stephen Klein 03:14 PM: Can you explain the domain, resolution, and forcing used in the simulations Andy is showing?

William Gustafson 03:16 PM: I'll talk about that in next portion. Basically, microphysics as P3 vs. Thompson and then Andy pulled the ERA5 ensemble data used for the WRF boundaries.

Observational Data and Skill Scores for the CACTI Scenario

Speaker: Andrew Vogelmann, BNL

Stephen Nesbitt 03:03 PM: We have a lot of mobile mesonet data in several cases from RELAMPAGO

Stephen Nesbitt 03:07 PM: All RELAMPAGO datasets are free and open to use.

Stephen Nesbitt 03:08 PM: We've worked very hard with the Argentines on this. 😊

Stephen Nesbitt 03:35 PM: All the data is at the NCAR site!

Andy Vogelmann 03:36 PM: I've not had time to look closely yet at the RELAMPAGO data. Looking forward to it.

Stephen Nesbitt 03:20 PM: They all have DOIs on the NCAR server

Andy Vogelmann 03:32 PM: Awesome! Thank you!

Courtney Schumacher 03:22 PM: Question appropriate for both of you...who was doing lightning during the campaign(s)?

Eric Bruning 03:30 PM: Timothy Lang (NASA MSFC) and Phillip Bitzer (UAH)

Eric Bruning 03:30 PM: And I was producing GLM imagery products in real time, though those should be reprocessed given advancements since then.

Courtney Schumacher 03:33: PM Thanks 😊

Scott Collis 03:09 PM: We have been using PyDDA for single radar u,v using an additional constraint from ERA5 with good results

Andy Vogelmann 03:34 PM Got it. Thanks.

Sheng-Lun Tai 03:10 PM: Was the Raman Lidar deployed during CACTI? Thought it could provide boundary layer moisture as well.

Adam Varble 03:14 PM: Unfortunately, no, a Raman lidar was not deployed. There may eventually be some AERI retrievals and soundings are 3-hourly between 9 AM and 9 PM.

Sheng-Lun Tai 03:17 PM Got it, thanks Adam!

Courtney Schumacher 03:26 PM: I know AERI retrievals are time consuming, but they would be useful for the cases chosen by LASSO.

Scott Collis 03:17 PM: Sounds very cool. Tracking and Lagrangian stats are good to do.

- This question has been answered live

joseph hardin 03:18 PM: For the reverse tracking, Zhe Feng has a pretty robust tracking system (mentioned in talk) that has cell and MCS tracks, would be good to touch base with.

- William Gustafson would like to answer this question live.

Zhe Feng 03:18 PM: As Adam mentioned, we are working on producing a CASPR convective cell tracking database for the CACTI campaign

- William Gustafson would like to answer this question live.

Scott Collis 03:19 PM: We've merged TINT with Tobac (led from Oxford/CSU) for tracking the Non MCS stuff. happy to collaborate as well

Andy Vogelmann 03:27 PM: Thank you. Let's talk

Toshi Matsui 03:19 PM: Andy- How about doing column classification (e.g., convective, transition, stratiform) for skill score?

Andy Vogelmann 03:36 PM: Thank you for the suggestion. Noted!

Stephen Klein 03:19 PM: Are there observational estimates of surface precipitation to compare to?

- William Gustafson would like to answer this question live.

joseph hardin 03:20 PM: We've run rain rate for the campaign from CSAPR2 from Taranis, just need to validate and possibly tweak the members of the blended estimator to adapt it to local environment.

Andy Vogelmann 03:24 PM: Great! We look forward to hearing more when you are ready.

Scott Collis 03:21 PM: We need to discuss Taranis vs. CMAQ2.0... Should we be using ARM VAPS?

Andy Vogelmann 03:26 PM: I'm open to either. Would be interested in understanding what the differences are.

Koichi Sakaguchi 03:52 PM: In addition to CAPE, CIN, etc., PBL height (if can be defined) would be a helpful diagnostic variable for the LES domains.

Current Thinking for the CACTI Scenario Framework and Model Setup

Speaker: William Gustafson, PNNL

Kiran Alapaty: NCAR has a good group doing LES modeling. do you collab with ncar?

- The GMTB folks have started including the capability to use LASSO data in their SCM comparisons.

Lulin Xue 04:02 PM: Bill, we have quite some experiences running WRF over complex terrain with high-res discussion data. We can talk offline on this topic.

- This question has been answered live

Steve Krueger 03:29 PM: I encourage a hero run. We are still using results from such a LES of deep convection done over 10 years ago

- This question has been answered live

Steve Krueger 03:40 PM: I would strongly encourage limiting the number of runs in order to do a 2 or 3 higher resolution/larger domain runs. Each run will be like a field experiment, and focusing interest on a small number of cases would be useful to motivate collaboration.

- This question has been answered live

Thijs Heus 03:37 PM: If the LES grid spacing is 100m, than a coarser output grid (200m) spacing might be reasonable – the rest is just grid noise

- This question has been answered live

Thijs Heus 03:46 PM: Effective resolution was what I was talking about

Koichi Sakaguchi 03:48 PM: Vote for options to download the 100-m LES data on 500-600m grid spacings grid = effective resolution of WRF & subsampled vertically. Also subgrid-scale momentum forcing and fluxes from the coarser 500- m grid simulation might be interesting to be compared to the 100-m simulation, with its implication on entrainment/detrainment?

Larry Berg 03:42 PM: We have found time series from discussion grid columns selected to be over specific discussion sites to be helpful for some vis-à-vis—and much smaller than the wrfout files.

Andy Vogelmann 03:57 PM Agreed. Thanks

Steve Krueger 03:46 PM: Average LES fields to larger output grid volumes, such as 500 m or 1 km, as Will just suggested.

- This question has been answered live

John Peters 03:37 PM: 500 m isn't too data expensive, so i think it's worth it

- This question has been answered live

High-res output and restart files

Philipp Griewank 03:19 PM: Given how quickly things can develop, how often will 3D outputs need to be stored?

Andy Vogelmann 03:25 PM: Bill will address that in the current presentation. Stay tuned!

John Peters 03:35 PM: I think we'll need 30 min or so with 5-10 second output

John Peters 03:36 PM: Thermal tracking and post mortem Lagrangian analysis really needs around 5 seconds in LES, if you are sending parcels through the most intense part of updrafts.

John Peters 03:36 PM: And we plan to use these analysis methods. Also, postmortem entrainment calculations need this kind of high output frequency.

Scott Collis 03:37 PM: Can we instrument the model? Take profiles etc on high res data and then upscale rest? This question has been answered live

Scott Collis 03:37 PM: do tracking etc at 200m and then save 500m

- This question has been answered live

John Peters 03:41 PM: I would emphasize the idea of having restart files available for users. This question has been answered live

Marcus van Lier-Walqui 03:41 PM seconded

McKenna Stanford 03:42 PM This seems very high priority.

John Peters 03:38 PM: Also, want a lot of restart files written out so that users can go back and restart small sections of the model run with higher temporal frequency output

- This question has been answered live

Lulin Xue 03:49 PM: I second comments on saving restart files with a finer interval first. After looking at the preliminary results, we can identify interesting periods to restart and have much higher output discussion (2-3 seconds for trajectory analysis) later.

- This question has been answered live

Stephen Nesbitt 03:38 PM: One of the unique things about this project was the availability of GOES 1-min scanning. It would be interesting to run a GOES simulator.

- This question has been answered live

John Peters 03:39 PM: I second this idea.

John Peters 03:38 PM: Does WRF do in-line trajectory calculations? If so, this would be useful.

Daniel Kirshbaum 03:40 PM: It does, but last I checked you are limited to a total of 1000 parcels. Not very useful.

John Peters 03:42 PM: yeah, that's not very many at all

Daniel Kirshbaum 03:43 PM: Probably can overcome it, but it will take some coding

John Peters 03:51 PM: I have a feeling we'll be stuck doing them with the model output, which again points to having a period of high temporal frequency

- This question has been answered live

John Peters 03:53 PM: does anyone have code that does direct entrainment calculations in WRF?

- Andy Vogelmann would like to answer this question live.

Steve Krueger 04:09 PM: entrainment direct calculation: See Dawe and Austin. Has been used in LES of deep convection. In SAM.

Zhe Feng 03:55 PM: Would polarimetric radar simulator be run offline? That would be valuable for evaluation efforts related to microphysics as it's very difficult to compare with observations

- This question has been answered live

Scott Collis 03:57 PM: Great idea Zhe. It would be even better to run it online! (yes, you would need one that could be integrated with the model)

Lulin Xue 03:59 PM: We had the same experience on comparing LASSO results with SGP lidar observations. We probably should discuss if single point(s) high frequency outputs are possible.

Vertical levels

Andreas Prein 03:48 PM: Could you run with fewer vertical levels? Lebo and Morrison (2015) did not find a lot of value when increasing the vertical levels from 90 to 180 levels.

- This question has been answered live

Zachary Lebo 04:04 PM: Apologies if I missed this, has there been any discussion of the vertical resolution for these simulations? .

John Peters 04:07 PM: I will make a plug for more vertical levels

- William Gustafson would like to answer this question live.

Susan van den Heever 04:09 PM: I would also plug for more vertical levels ... for updraft dynamics as well as for appropriate cold pool resolution

Kuan-Man Xu 04:09 PM: Just for reference, ERA5 has 137 vertical levels. So, 180 levels are in the similar ballpark. Just a comment.

PBL

Steve Krueger 03:31 PM: Must spin up BL turbulence, too.

- This question has been answered live

Brian Gaudet 03:36 PM: Would the 500-m domain be LES, or use PBL scheme?

- This question has been answered live

McKenna Stanford 03:34 PM: Which turbulence closure would be used? Any intentions to test sensitivity to this?

- This question has been answered live

Thijs Heus 03:33 PM: I would probably be more interested in parameter variation (multiple CDNCs) than multiple microphysics model settings, etc

- William Gustafson would like to answer this question live.

McKenna Stanford 03:54 PM: Second this. Parameter variations are often more useful and easier to interpret rather than using different schemes.

Roel Neggers 03:37 PM: Is the nesting of the inner domains going to be one-way or two-way?

- This question has been answered live

Daniel Kirshbaum 03:49 PM: Apologies if I missed this, but what are the lateral boundary conditions on the large grid?

- This question has been answered live

Edward Zipser 03:39 PM: Toughest issue may be evaluating the microphysics that help generate convective downdrafts

- This question has been answered live

Jiwen Fan 03:47 PM: It is really important to decide appropriate/enough variables for instantaneous 3-D and statistical outputs for the science foci to target.

- This question has been answered live

Vaughan Phillips 04:10 PM: Is the microphysics scheme selected for the run suited to the local aerosol conditions, vis-à-vis thresholds for autoconversion etc.? Is the microphysics aerosol-aware in any way ?

Scott Collis 04:05 PM: I might have missed it but what microphysical scheme are you running? Just Bulk?

- This question has been answered live

Vaughan Phillips 03:55 PM: Is there any contingency plan for what to do if the model crashes with a CFL condition violation or numerical instability ? With so many calculations and such fine resolution there is more chance of numerical instability.

- This question has been answered live

John Peters 04:02 PM: In CM1, i usually have to use a smaller time step than the "Recommended one" with 100 m or less spacing to keep it stable

McKenna Stanford 04:04 PM: WRF uses a mixing parameter cap that can be adjusted for stability as well (mix_upper_bound), although that maximum incorporates the time step.

John Peters 04:05 PM: though for stuff like thermal tracking, as close to isotropic is best

- This question has been answered live

Thijs Heus 04:06 PM: that's true for most LES subgrid models as well

Remote data access

Roel Neggers 03:18 PM: Having a super-large-domain LES at 100m resolution of deep convection available, in combination with extensive ARM data, is going to be awesome. But this is truly big data. What are the thoughts on how best to access this data? Downloading from an archive, or work with the data locally?

- Andy Vogelmann would like to answer this question live.

Thijs Heus 03:39 PM: Will there be some kind of interface to work with the data remotely? (Jupyter-like)

- This question has been answered live

Philipp Griewank 03:40 PM: A jupyterlab setup to play with the data before deciding what do download would be really welcome. This question has been answered live

Eric Bruning 03:41 PM: Yes, put this in a cloud environment with jupyterlab support.

joseph hardin 03:45 PM: ARM does have a jupyterlab setup already on Stratus, though it requires a Stratus research request to get access to, approved by the IMB.

joseph hardin 03:40 PM: For large files issue it might be worth either setting up something like a THREDDS server with siphon, or creating ZARR files which are better for large datasets stored as smaller files

Steve Krueger 03:42 PM: The DYAMOND project of global CRMS kept files on a single server and allowed analysis on that machine.

Toshi Matsui 03:47 PM: Agree. DOE should make cloud computer for post analysis.

Giri Prakash 03:58 PM: this is totally possible with the current Cumulus cluster where the LASSO is running. users need to request using the <https://arm.gov/capabilities/computing-resources>. The LASSO data is available or can be made available on the spinning disk that is connected to the Cumulus cluster

03:43 PM: Currently, this is available on Stratus. Bill, is correct

Scott Collis 03:40 PM: Thijs, ADC has a Jupyterlab style setup I am sure can be used for this.

- [This question has been answered live](#)

Giri Prakash 03:45 PM: as we move forward with Cumulus upgrade, we are currently developing various ways to seamlessly access the LASSO data, Zach and Jitu at ADC are developing the ARM Compute Environment (ACE) that will help with data access.

Heng Xiao 03:50 PM: I assume the CACTI runs will be done and data stored on cumulus (not stratus). It would be nice to have jupyterhub nodes for data analysis on cumulus setup for LASSO team members and ARM users at some point.

Zach Price 03:48 PM: Jupyterhub unfortunately cannot access Cumulus (I manage the service). Data can however be staged to Stratus and the manipulated. We hope to be able to overcome the security concerns of the OLCF team in the future

Heng Xiao 04:02 PM: How do you transfer data quickly from stratus to cumulus? Globus?

Zach Price 04:07 PM: Currently, rysnc is the best option as we don't have a direct connection from Stratus to Cumulus

Community Communications

Zhe Feng 03:19 PM: What is the process to get community feedback on case selections and model configurations and output variables?

William Gustafson 03:21 PM: lasso@arm.gov is a good first approach to get info to Andy and Bill

Zhe Feng 03:23 PM: Thanks. A Confluence like webpage that users can comment and have a record of the discussions will be helpful.

Scott Collis 04:09 PM Slack!

Scott Collis 04:10 PM: community slack :) ARM has one too

Adam Theisen 04:11 PM: ARM does have a slack space, but it is currently not paid. Giri has been investigating

joseph hardin 04:11 PM: Slack is good, but not good for archival. These discussions should maybe be captured in a better place (confluence, github, etc.)