# HAFS Coordination Meeting
## September 15, 2021,  2-3 pm ET
### Agenda/Minutes/Chat

**Participants:** Farida Adimi, Kyle Ahern, Gus Alaka, Curtis Alexander, Maria Aristizabel, Jian-Wen Bao, Morris Bender, Mrinal Biswas, Xiaomin Chen, Mark DeMaria, Bantwale Enyew, Kun Gao, S. Gopal, Lew Gramer, Matthew Green, Georg Grell, Lucas Harris, Andy Hazelton, Youngsun Jung, Evan Kalina, Hyun-Sook Kim, Bin Liu, Tim Marchok, Frank Marks, Avichal Mehra, Matt Morin, Kathryn Newman,  Linlin Pan, Bill Ramstrom, JungHoon Shin, Jason Sippel, John Steffen, Vijay Tallapragada, Biju Thomas, Sikchya Upadhayay, Weiguo Wang, Yonghui Weng, Chunxi Zhang, Xuejin Zhang, Zhan Zhang, Jun Zhang, Lin Zhu, Ping Zhu.

**Agenda:**

2:00-2:02 pm: Welcome

2:02-2:17 pm    T-SHiELDS Real time Experimental Results - Morris Bender, GFDL

2:17 - 2:20 pm  Q&A

2:20-2: 35 pm   HAFS related Physics Developments - Andy Hazelton/Jun Zhang, AOML

2:35-2:38 pm    Q&A

2: 38-2: 53 pm  Results from Realtime experiment on GFS Physics Schemes, Georg Grell, GSL

2: 53-2:56 pm   Q&A

2:56-2:59 pm    Wrap-up

3:00 pm         Adjourn

**Notes:**

T-SHiELDS Real time Experimental Results - Morris Bender, GFDL

- Upgrades made to the 2021 T-SHiELD greatly reduced the  unrealistic expansion of Gale Radii seen  in 2020 T-SHiELD.
- 2021 T-SHiELD Track error is comparable to the Operational GFS (the best performing model) through day 4.
- Both T-SHiELD and AOML HAFB intensity prediction was excellent during the first part of the season.
- Both T-SHiELD and AOML HAFB intensity prediction was exceptionally bad for Hurricane Larry due to a huge positive intensity bias at days 3-5.
- The simple 1d ocean coupling in T-SHiELD was very likely a major contributor to the excessive positive intensity bias in Hurricane Larry.

HAFS related Physics Developments - Andy Hazelton/Jun Zhang, AOML

- Eddy Diffusivity from All Cases - EDMF-GFS is most diffusive
- Default schemes are too diffusive, with modifications for both EDMF-GFS and EDMF-TKE, both schemes have reduced diffusivity closer to obs.
- Evaluating and improving PBL physics in HAFS - modified EDMF-GFS a little bit of an outlier, original EDMF-GFS produces worst intensity
- Reducing diffusivity produces wind peak closer to Best Track
- Comparison of 2020 HAFS-B results using MEDMF-TKE using Hybrid K-profile EDMF shows stronger PBL inflow and supergradient outflow in composites for MEDMF-TKE and produced better RI forecasts in several cases including Hurricane Delta.
- HAFS-B with MEDMF-TKE produced excellent RI forecasts for Ida
- HAFX, a parallel run using the improved EDMF-TKE PBL scheme based on LES resul ts. captured the rapid intensification as well as the track of Hurricane Ida.

Results from Realtime experiment on GFS Physics Schemes, Georg Grell, GSL

- Negative mixing ratios from GFS physics
- Impact the Thompson runs very significantly
- Initial results for track error look promising for GF runs, not enough data for any significance yet
- ACC scores look improved, but again, more verification data are needed
- Compared to GFS analysis, GF runs have a significant warm bias in the tropics the upper levels, but improved bias over CONUS, also compared to RAOBS
- Warm bias can be improved with tuning
- Work still in progress to find out why MYNN run hangs randomly with initialization.

**Chat log:**

Frank Marks - NOAA Federal2:17 PM
@Morris Was there a Larry central pressure low bias? Wondering if the Larry intensity bias was due to a pressure-wind relationship issue given Larry had a very large eye amplifying any pressure-wind relationship issue.

Sundararaman Gopalakrishnan - NOAA Federal2:19 PM
@Morris Think DA and cycling should also help to reduce biases?

Lucas Harris - NOAA Federal2:23 PM
I don't think that the positive-definite scheme is at fault here. I don't believe that horizontal diffusion is the physical cause of the large eye.

Using the mono scheme could introduce a compensating error that might improve this particular forecast but would probably lead to an overall degradation

Our (lack of) vertical diffusion in the dynamics could play a role.

Andrew Hazelton - NOAA Affiliate2:25 PM
@Lucas I tend to agree - I think it's a combination of missing the ERCs (resolution is probably partially responsible for that) and maybe some other things like environmental dry air eroding the core

Frank Marks - NOAA Federal2:25 PM
The fact that T-Shield and HAF-B did so well with Ida's RI suggests that the 100 m mixing length cutoff is a good think in those type cases. The question is does it also have a negative impact on cases like Larry, or is it caused by something else.

Lucas Harris - NOAA Federal2:27 PM
The predictability of the ERCs is itself a problem. The convective-scale prediction folks have had to develop methods to account for the predictability of short extreme events in their evaluations.

Andrew Hazelton - NOAA Affiliate2:28 PM
@Frank right. Implies our PBL physics are still incomplete - we need to be able to capture the RI but not be too strong

Morris Bender - NOAA Federal2:29 PM
Frank we need to do a couple sensitivity cases maybe the September 5th case and see if we can track down what is going on. I tend to maybe agree with Lucas the positive-definite scheme may not be at fault but it can be easy to turn it off and see. There are a number of possibilities. We will see what we can find out. The challenge of model development and the reason we are running these HAFS models.

Kun Gao - NOAA Affiliate2:30 PM
Morris, we are on the same page. I will do a few sensitivity experiments for the Larry case.

Morris Bender - NOAA Federal2:34 PM
Kun we can use this one case. Andy and I were carefully looking at the Larry forecasts in real time, and the behavior of the inner core compared to HWRF and HMON was really quite striking and e thought quite unrealistic.

**Lucas Harris - NOAA Federal** 2:39 PM
The LES modeling is a great direction to go in. We are trying to get an FV3-based LES funded so that the UFS can have an in-framework large eddy model. IIRC large-eddy scales are the direction regional modeling needs to go to.

**Andrew Hazelton - NOAA Affiliate** 2:40 PM
@Lucas that will be really interesting

**Kun Gao - NOAA Affiliate** 2:40 PM
Andy, what are the changes made in TKE-EDMF in HAFX?

**Andrew Hazelton - NOAA Affiliate** 2:42 PM
@Kun there are several. For one we're building off a slightly newer version provided by Jongil Han. It also has a different treatment of the surface layer
I don't know if Xiaomin is on but maybe he can comment further?

**Jun Zhang - NOAA Affiliate** 2:42 PM
Thanks Lucas. FV3-based LES is a new idea.

**Xiaomin Chen - NOAA Affiliate** 2:44 PM
@ Lucas  Thanks for the comment. This LES framework is combined with the a dropsonde composite of mature hurricanes and we hope to provide more robust turbulence information in realistic thermodynamic conditions. Would be interesting to see if this feature is considered in the development of FV3-based LES.

**Lucas Harris - NOAA Federal** 2:44 PM
That should be a good target for the LES

**Frank Marks - NOAA Federal** 2:47 PM
@Lucas Xiaomin Chen is the person at HRD working with the LES calibrated by observations to evaluate PBL parameterization schemes. He has been working with George Bryan and the CM-1 model. But I think developing a FV3 LES framework would be very useful for evaluating the approach. Also at EMC Wei Guo is running another LES. I think we need to work together to tackle the problem and work with a common LES, rather than have a variety of LESs competing for resources.

**Xiaomin Chen - NOAA Affiliate** 2:47 PM
@ Kun Andy is right as we worked on the new version of EDMF-TKE that includes the shear impact. We specifically improved the TKE structure in the boundary layer as we noted a notable high bias in TKE in hurricane conditions. We also made efforts to improve other issues (PBL height, mass fluxes etc.) during the evaluation.

**Lucas Harris - NOAA Federal** 2:48 PM
@Xiaomin @Frank Glad to hear there is a lot of interest in this. We had a meeting between GFDL and Princeton folks today on LES and CRMs so there is already some momentum here.

**Frank Marks - NOAA Federal** 2:49 PM
I think the key favtor is to calibrate the LES by our observations to make sure that the characterization of the kinematic and thermodynamic structure in the LES is consistent with the observed characteristics of the kinematic and thermodynamic structure.

Xiaomin Chen - NOAA Affiliate2:51 PM
@ Frank Thanks!  Agree with your thoughts.

Lew Gramer - NOAA Affiliate2:52 PM
Web site George is referring to: https://storm.aoml.noaa.gov/basin/

Ghassan Alaka - NOAA Federal2:52 PM
Thanks Lew

Morris Bender - NOAA Federal2:52 PM
Very good news  to hear there is a lot of interest in LES development.  For advancement in hurricane

physics there is no question that is the way we need to go.

Ghassan Alaka - NOAA Federal2:52 PM
And Thanks to Georg for using the web site!

Lew Gramer - NOAA Affiliate2:52 PM
+1

Jun Zhang - NOAA Affiliate2:54 PM
+1