

HFIP Annual Meeting Agenda
Day 3 (Nov 17, 2021)
Meeting Notes

12:00 pm - 1:40 pm: HFIP Funded (2018) External Research Reports

12:00 pm Using Dynamically-Based Probabilistic Forecast Systems to Improve the NHC Wind Speed Products (Alan Brammer/Andrea Schumacher)

- Adopting the operational wind speed model to use the global model
- Significant bias in WS and lack of ensemble members in the original model
- Rerun and continue to run the hybrid ensemble version this year
- 3 versions this year: operational, raw global ensemble, and Monte-Carlo global ensemble (hybrid)
- Raw ensemble: Overpredicting 34 kt, 64 kt is more reliable in 2021
- Raw ensemble bias shift to high for all thresholds
- Monte-Carlo: very reliable in 2020, high bias in 2021, mostly early lead times
- 2021 treat scores are more consistent across wind speed thresholds
- GEFS+EC are underdispersive in track spread
- New graphic for multi-model is available on CIRA website
- WS probability is currently not operationally used yet nor always available.

12:20 pm New Frameworks for Predicting Extreme Rapid Intensification (Chirs Rozoff)

- HWRF-based ML tools for intensity has been developed
- FHLO: 1000-member synthetic ensemble. It calls synthetic track model, and then simplified intensity model.
- Delta: Best track within the 1000 member envelope
- Hurricane risk calculation provide valuable information
- FHLO can be used for RI prediction. Skill similar to CTCX and COAMPS.
- ML methods tested on HWRF data for intensity. Showed skill out to 60 hours.
- HWRF-based logistic regression applied to RI probability. Good skills for T=0.
- Simple consensus of DTOPS and HLOG shows highest skills
- Generalized RI prediction (GRIP): comparable to HWRF, slightly worse than official forecasts

- Mark DeMaria: For WS probability, time continuity (no fluctuation) is important for forecasting.

12:40 pm Advanced DA Techniques for Satellite-Derived Atmos. Motion Vectors from GOES 16/17 in the HWRF (Agnes Lim)

- New quality control and updated obs errors: 20-40 % increase in observation count
- Hourly and high temporal GOES 16 AMVs: improvements in track for all forecast hours, intensity up to 72 hours, min central pressure up to 48 hours. Changes are ready for transition.
- Hourly and high temporal GOES 17 AMVs: Improvements in track for all forecast hours, min center pressure 48 hours and beyond. But degradation in intensity for the first 24 hours - dominated by one hurricane.
- Issues with BUFR files - read errors for some of the files and missing AMVs
- Manuscript in preparation on GOES-16 AMVs
- Most important factor that contributed to improvement? - overall quality for data itself

1:00 pm Rapid Intensification Changes: Improving Sub-Grid Scale Model Parameterization and Microphysical-Dynamical Interaction (Ping Zhu)

- Stability correction substantially improved skill in predicting track, intensity and structure for HAFS-B.
- Successfully capture the turbulent transport in the eyewall for HAFS-A
- Sensitivity of TC intensification to mixing ratio - EXP1 reproduced intensity of Patricia (2015), which shows sensitivity to the mixing slope. TC intensity is controlled by the large cancellation among different acceleration and deceleration of vortex, depending on how they are parameterized.
- EXP1 - Inward transport of absolute vorticity keeps increasing, supported by moisture transport and surface latent heat flux.
- EDMF TKE used in HAFS is not suitable in the eyewall. Separate treatment of the interconnected turbulence is not physically sound.
- Currently does not have TKE advection but can be added.

2:10 pm - 3:30 pm: HFIP Funded (NOFO) External Research Reports

2:10 pm Extending the Tropical Cyclone Genesis Index to Global Ensemble Forecasts (Alan Brammer)

- Tropical cyclogenesis index (TCGI) is a statistical model developed under JHT funding
- New datasets were updated and expanded on the domains for JTWC
- Can improve genesis uncertainty
- Converted the training code from fortran into python and updated fortran code base
- Both 2020 and 2021 show reasonable reliability
- The output will be shared with NHC through the JHT based real-time portal.
- Retraining stat model on expanding training dataset.
- Expanding to neural network methodologies.
- Rerunning forecast for number of years and reevaluating
- Mark Demaria: Have you looked at tracker for ensembles? Only for shorter lead times.
- Youngsun: Is there a delay in the project? Slightly.

2:30 pm Developing regional ocean modeling capabilities with MOM6 for use in the Unified Forecast System (Enrique Curchitser)

- Two north atlantic domains are considered
- NA12 model running for several years
- Trying to understand how to use this model for regional since MOM6 was a global climate model, and there is open boundary conditions
- NWA25 running from last few months for SSH and SST, not analysed yet
- MOM-NWA25 1500x1500 res, 42 vertical levels
- Evaluating with Hycom
- ESMG grid tools are available
- Working on open boundary conditions code and tuning NA12 and NWA25

2:50 pm Application of Innovation Statistics to Diagnose Biases in the HAFS system (Ryan Torn)

- Looking at model biases at TC and shear-relative for near-storm obs
- Using HAFS DA experiment data sets from HAFS DA real time project
- HAFS model is cold compared to obs all over the Atlantic, may be boundary layer is too cold
- Also HAFS has dry bias in humidity mostly
- The temp bias over conus is small but substantial warm bias in Mexico, substantial dry bias over Mexico

- Compared with satellite radiances, GFS bias correction compared with HAFS DA, HAFS DA bias is reduced
- Continue to validate HAFS DA exp., validate other near-storm obs, expanding to other applications in UFS, applying machine learning methodologies.
- Mark Demaria: Are the cold biases corrected with dry biases? Planning to use ML to look into that.
- Issue doing DA at boundary layer, not sure bias correction issue.
- Gus: Issues with steering western Atlantic, is there any hope to improve? Eastern more biased than western.

3:10 pm Evaluating Initial Condition Perturbation Methods in the HWRF Ensemble Prediction System (Ryan Torn)

- Compared raw model forecast with statistical model forecast from monte carlo to check sensitivity
- Evaluating Florence: The track variability is different for Monte Carlo from ECMWF. Not much impact on intensity
- Verification of landfalling storms for 2017-19, from ensemble system - ECMWF, GEFS and HWRF.
- Rainfall threshold shows deterministic model better than statistical models
- Project in closing stages, working on manuscript to submit in Dec 2021 WAF issue
- John Knaff: looks like problem with rainfall underestimation. Actually HWRF has an overestimation issue.
- Mark Demaria: have you stratified by latitude because Florence was mid tropical. Taking into account track, intensity, size, sheer and upslope only.
- Frank: rainfall is dependent on sample size, so hard to compare with satellite obs.

3:30 pm - 5:00 pm: HFIP Supported External Research Reports

3:30 pm Ground-based Radar DA in HWRF Hybrid Ensemble-variational (Xuguang Wang)

- Project focussed to develop radial velocity assimilation capability in HWRF,
- Assessed the impacts of assimilating GBR and TDR radial velocity observations individually
- Mathew sampled by coastal radars and TDR, four different configurations experiment were performed
- Compare the ground based and TDR, ground radar more data available

- Results: TDR has better coverage for eyewall compared to GBR where eyewall appear too far inward. The combined GBTDR shows more realistic results
- Structural forecast: wind structure captured better by GBR
- Plan to continue develop , test and document ground based radar (GBR) reflectivity data assimilation
- International student do not have access to Jet
- John Knaff: numerical models have struggled to estimate reflectivity (always higher)? Maybe a microphysics issue. Then how do you assimilate? Can be addressed by the DA to some extent but not fix it. Can look at increment data and look at the bias.
- GBR has 5 mins, DA is hourly, limit on 6 hr 3D approach.

3:50 pm FV3 Model and Ensemble-based DA for Convection-permitting Hurricane Analysis and Prediction (Xingchao Chen)

- Focus on all sky infrared radiances DA with ENKF analysis - comparing TDR DA with all-sky infrared radiances DA, all sky captured the intensity forecast in Hurricane Henry
- Goes-16 all sky infrared and TDR for Doria experiments assimilating IR observations produced high wind speeds
- Simultaneously assimilating both IR and TDR observations better capture the intensity and location of the eyewall wind and improve the intensity of forecast of Hurricane Dorian
- All-sky microwave radiances channels has better results
- Further investigated into individual cases with IR and IR+MW, IR+MW captured the intensity better
- Most milestone completed, the last milestone not in the original proposal
- Frank: how the microwave and IR temp compared? What variables are most sensitive? Strongly correlated with IR for variable vertical wind, weak is hydrometeors.
- Linus: what is the resolution used? Every four hr 20 km domain.

4:10 pm DTC Updates (Kathryn Newman)

- Evolving role of DTC includes both HWRF and HAFS and transition of HAFS activities to EPIC. Also expanding role in testing and evaluation activities
- HWRF Code management is focussed in centralised HWRF repository
- HWRF codes still available but user support is being ramping down
- HWRF Developer support is ongoing
- For HAFS code management, developed governance plan for HAFS repository

- Created pull request and issue templates
- Contribute to the HAFS workflow regression testing on Orion and Hera
- For HAFS developer support, added it to the HWRF developers committee that increased attendance and participation from a broader group of developers
- Exploring Github training for HAFS
- DTC visitor program supports visitors to work with DTC, recently funded HAFS and HWRF projects
- Avichal: after HAFS first implementation, we may need to do the public release, is it discussed with EPIC? Yes, ongoing discussion with Epic for funding that work.

4:30 pm Display and Diagnostics (Paul Kucera)

- Open source web based system supporting NHC for operational system and post hurricane season
- Designed for modular and flexible technology
- Improved menu functionality, overlay options, historical storm analysis, annual bug fixes
- Support for NHC internally and publicly available
- Diagnostics tools developed for intensity forecast
- Editing tool developed to edit best track points and fix data points that are stored in a separate database
- New seasonal tools are stratified by time period, years, basins and storms
- Historical forecast can be evaluated in the new evaluation tool
- Next planned updates are to work with NHC to come up with a list of new updates and features
- Open to suggestions from HFIP community
- Dave Jones: do you have the ability to transport layer of data from models such as GFS? Can be developed but not in yet.
- Mark Demaria: What is the time frame for the updates? Jan-May (before the hurricane season).
- Mark Demaria: Can you add RMW now? Yes
- Maria: What SST product are you displaying? Will get back on that.
- John Knaff: can we do it in the secure http? Yes.
- Alan: can you add wind speed? Yes

Chat Messages:

Frank Marks - NOAA Federal 12:10 PM

@Alan could you do probability matching of the observed distribution with the global model distributions to correct for the radii bias?

Alan Brammer - NOAA Affiliate 12:22 PM

@Frank, we tried similar approaches to that but ran into the issue of 0nm radii for 50 and 64 kts due to the significant intensity bias. For this we take a "size" parameter in radii cliper and then recompute the windfield with the corrected intensity. In the future, we would likely just lean on wtcn for the windfield

Frank Marks - NOAA Federal 12:24 PM

Thanks @Alan

Alan Brammer - NOAA Affiliate 12:42 PM

@Linus if you're low resolution ensemble still had good spread it would definitely fit well in our framework. Either on it's own or with the high res as extra multi-model inputs

Linus Magnusson 12:42 PM

@Alan Thanks!

Jiayi Peng - NOAA Affiliate 12:43 PM

@Chris Did you do the machine learning for track forecast?

Xuguang Wang - NOAA Affiliate 12:48 PM

@Agnes, how does the error profile look like? How do you determine that?

Jason Sippel - NOAA Federal 12:49 PM

@Agnes - you delivered some changes to EMC in the summer of 2020. were there other changes on top of those?

Xuguang Wang - NOAA Affiliate 12:55 PM

@Agnes, what is the most important contributor toward the improvement? better height assignment, better error assignment?

Linus Magnusson 12:55 PM

@Agnes - For 2020 season, do you have Laura in your cases? I would be interested to see the AMV for 27 Aug 00UTC from your new processing.

Linden Wolf - NOAA Affiliate 1:01 PM

@Jennifer It seems your computer lags when you are presenting slides in a format other than google slides. That might just be a coincidence.

Christopher Rozoff 1:01 PM

@Jiayi (Sorry for the delayed response.) We did not use machine learning in this particular project for track.

Agnes Lim - NOAA Affiliate 1:01 PM

@Linus Magnusson - Yes I have Laura 13L. I will need to know what information you need as I do not retain all outputs from the storms I ran.

Linus Magnusson 1:03 PM

@Agnes - Great. We can take it offline. If you send me you e-mail to linus.magnusson@ecmwf.int I can give a bit more information.

Jiayi Peng - NOAA Affiliate 1:03 PM

Thank you @Chris.

Frank Marks - NOAA Federal 1:17 PM

@Ping in your simulations was TKE advection allowed?

Frank Marks - NOAA Federal 1:19 PM

I am pretty sure that TKE advection is available in HAFS.

Ping Zhu - NOAA Affiliate 1:19 PM

I think so, thanks

Andy Hazelton 1:20 PM

Yes @Frank it is

chunxi zhang - NOAA Affiliate 1:20 PM

@Frank @Ping, Yes, TKE advection is included by default in HAFS/GFS.

Sundararaman Gopalakrishnan - NOAA Federal 1:21 PM

@frank think that is the default in hafs.. tke is advected

Frank Marks - NOAA Federal 1:23 PM

It would be good to compare Ping's suggested changes to TKE based mixing length to those that Andy, Jun, and you developed and the one that Andy and Xiaomin are working on. We need to include all of the potential changes to EDMF-TKE scheme for HAFS v0.3

Xiaomin Chen - NOAA Affiliate 1:23 PM

@Ping When the TKE advection is included, the vertical transport in the eyewall is enhanced. Any idea of how to balance this effect with your efforts of improve mixing length above the inflow layer?

@ Frank Good suggestion!

Sundararaman Gopalakrishnan - NOAA Federal 1:25 PM

@frank yes! Yes! Yes! Think with advection of tke, some of our results with simple 1d gfs schemes may need to be validated because this is no longer one on one comparisons..

Frank Marks - NOAA Federal 1:27 PM

We need to get an apples to apples comparison for all the suggested changes using tke advection of r all of them.

John Knaff - NOAA Federal 2:18 PM

@alan how are brier skill scores calculated (i.e., what is the reference)? why not Pierce Skill Score (discrimination)?

John Knaff - NOAA Federal 2:25 PM

@alan, Thank you. This is really nice work!

Ping Zhu - NOAA Affiliate 2:38 PM

@frank, @gopal, @andy, @xiaoming, @chunxi, I'll response to you all about the TKE advection in 1D TKE scheme in an email shortly

Andrew Hazelton - NOAA Affiliate 2:38 PM

@Ping sounds good!

Frank Marks - NOAA Federal 2:39 PM

Thanks @Ping

Maria Aristizabal - NOAA Affiliate 2:39 PM

What are the main differences between the hybrid vertical coordinates in Hycom and the ALE (Arbitrary Lagrangian -Eulerian) vertical coordinates in MOM6?

Frank Marks - NOAA Federal 2:55 PM

@Ryan Excellent progress and summary!

Mark DeMaria - NOAA Affiliate 2:56 PM

@Ryan - Are the cold biases correlated with dry biases?

Xuguang Wang - NOAA Affiliate 2:57 PM

@Ryan, what about doing the o-b verification for GFS model? To see the bias is just for HAFS or cross the board

Xuguang Wang - NOAA Affiliate 2:58 PM

@Ryan, Given AMUS has bias, how would this affect your o-b using AMUS as the verification?

[Don't know if the bias is in instrument or elsewhere](#)

Frank Marks - NOAA Federal 3:00 PM

@Ryan HAFSB has both nest and global fields. Maybe @Andy Hazelton could discuss using those results for this analysis

Lew Gramer - NOAA Affiliate 3:01 PM

@Frank, Andy and I were just discussing that: @Ryan, have you thought of a way to extend this analysis to direct comparison vs. analyzing DA innovations?

Andrew Hazelton - NOAA Affiliate 3:01 PM

@Frank yeah would be interesting to see. The global data doesn't have the same vertical resolution but if we can find a way to compare it would be useful

Jonathan Poterjoy - NOAA Affiliate 3:01 PM

@Xuguang, I see this result as more of 'sanity check' rather than a verification.

Xuguang Wang - NOAA Affiliate 3:02 PM

@Ryan, I would be careful to use AMSU to evaluate the impacts of online or offline bias correction.

Using in-situ obs would be better as you mentioned.

John Knaff - NOAA Federal 3:12 PM

@ryan, do you know where the details of ePHRAM can be found.. What's it based on? Comment: looks like you have a warm rainfall underestimation problem... at least to me.

Frank Marks - NOAA Federal 3:13 PM

@John EPHRAM is in the extended abstract at

https://drive.google.com/file/d/1pDhzUBXhZ7XjriGv_gNmSt44uEU61nb/view?usp=sharing

John Knaff - NOAA Federal 3:15 PM

@Frank... yes MI rain rates....the smoking gun.

Frank Marks - NOAA Federal3:54 PM

@Xingchao what prognostic model variables are most correlated with the IR observations in the autocorrelation matrix of the ENKF system? Are they kinematic variables (u,v,w), thermodynamic (T,qv, ql, qs), or other prognostic variables?

Jonathan Poterjoy - NOAA Affiliate3:59 PM

@Frank, Yunji Zhang wrote a nice paper on this topic recently. See

<https://journals.ametsoc.org/view/journals/mwre/149/7/MWR-D-20-0369.1.xml>

Frank Marks - NOAA Federal3:59 PM

Thanks @Jon.

Dave Jones4:31 PM

@Paul Do you have the ability to export data layers or fields in GIS-friendly formats such as KML or as web services? Thanks.

Maria Aristizabal - NOAA Affiliate4:34 PM

What SST product are you displaying?

Dave Jones4:36 PM

https was my next question... :)

Mark DeMaria - NOAA Affiliate4:36 PM

@Paul If it is not already there, it would be good to have the source of the SST listed on the application.

Alan Brammer - NOAA Affiliate4:38 PM

@paul Wind speed "probabilities". I might have not said the probabilities bit. Thanks.