

# Progress Report: 2021 GFDL T-SHiELD

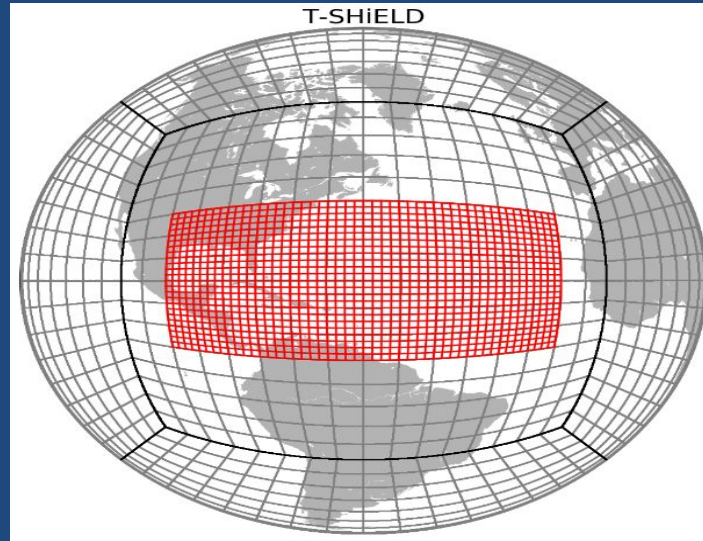


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Timothy Marchok**

**HAFS Coordination Meeting  
March 31<sup>st</sup>**

# Key features of 2020 T-SHIELD

- Updated FV3 Dynamical Core
- Updated in-line GFDL Microphysics
- Reconfigured horizontal advection schemes (hord=6 for dynamical and positive-definite -5 scheme for tracers)
- Deep convection disabled and shallow convection retuned in the nest
- YSU PBL with GFDL stability/efficiency modifications
- Retuned 1-D mixed-layer ocean for simple ocean coupling
- New ocean surface drag scheme under high wind conditions



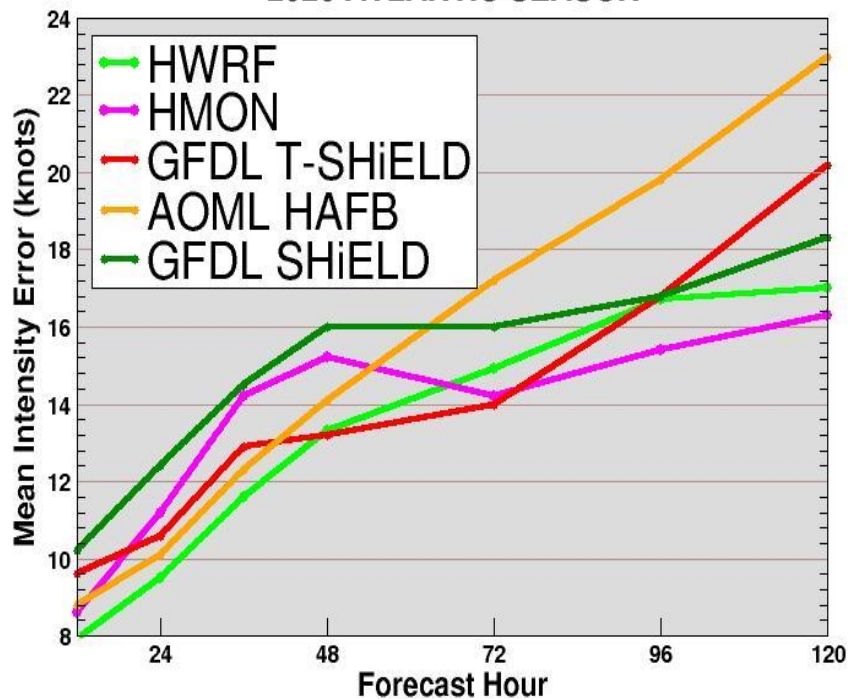
# 2021 T-SHiELD Work in Progress

- **Comparison of YSU PBL with TKE-EDMF scheme**
- **Evaluation of 100m mixing length cap vs. Shear-Dependent Mixing length in TKE-EDMF**
- **Evaluation of improved ice/radiation interaction**
- **Revisit disabling of Deep convection in inner nest**  
(Evaluation to be made over multiple seasons)
- **Ongoing evaluation of differences between AOML HAFB and 2020 T-SHiELD**  
(Trying to better understand differences in intensity error, intensity bias and storm size, etc.)

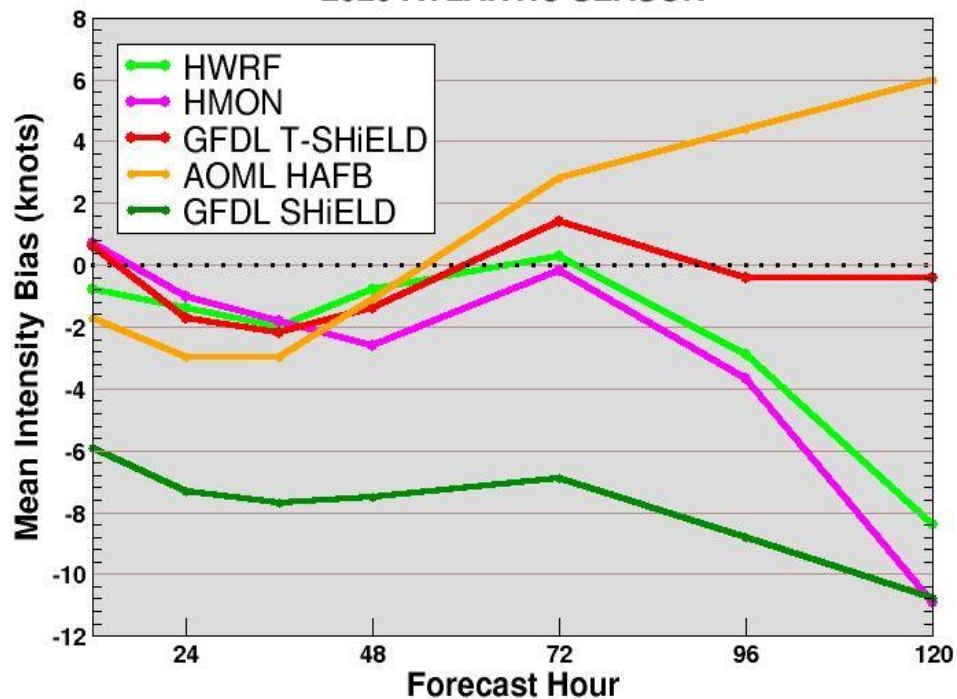


# 2020 Intensity Verification

2020 ATLANTIC SEASON



2020 ATLANTIC SEASON



**HAFB had much larger positive intensity bias compared to other high-resolution models.**

**Was this entirely due to lack of ocean coupling or did other physics differences also play a major role ?**

**Collaborative Investigation at AOML and GFDL continuing.**

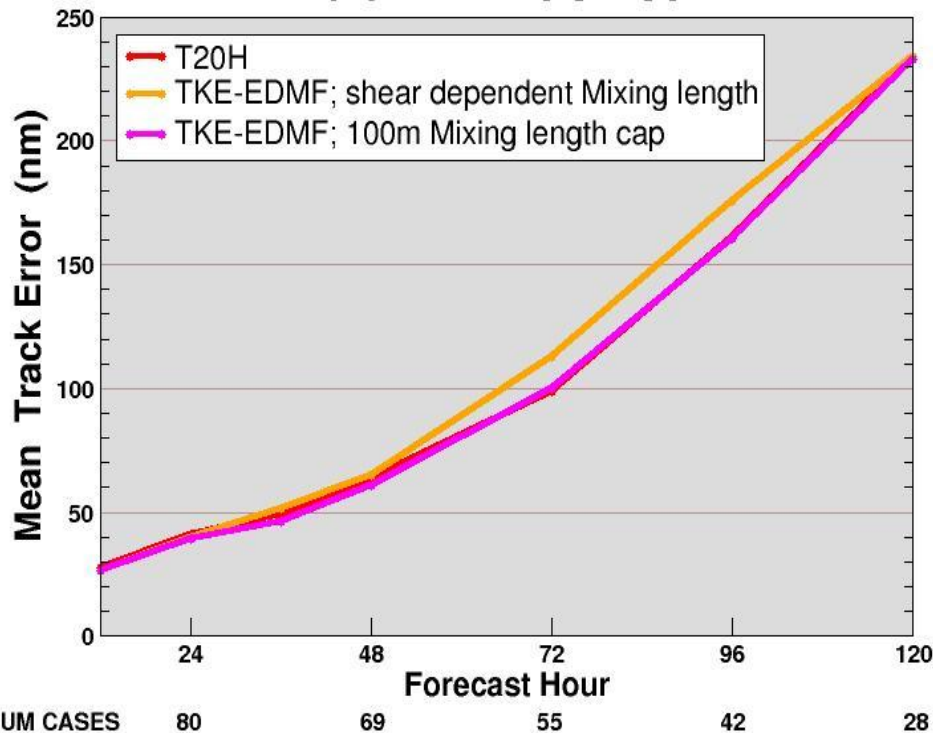
**Understanding may help in HAFS physics development !**

# Impact of TKE-EDMF on Track and EW Bias in 2021 T-SHiELD

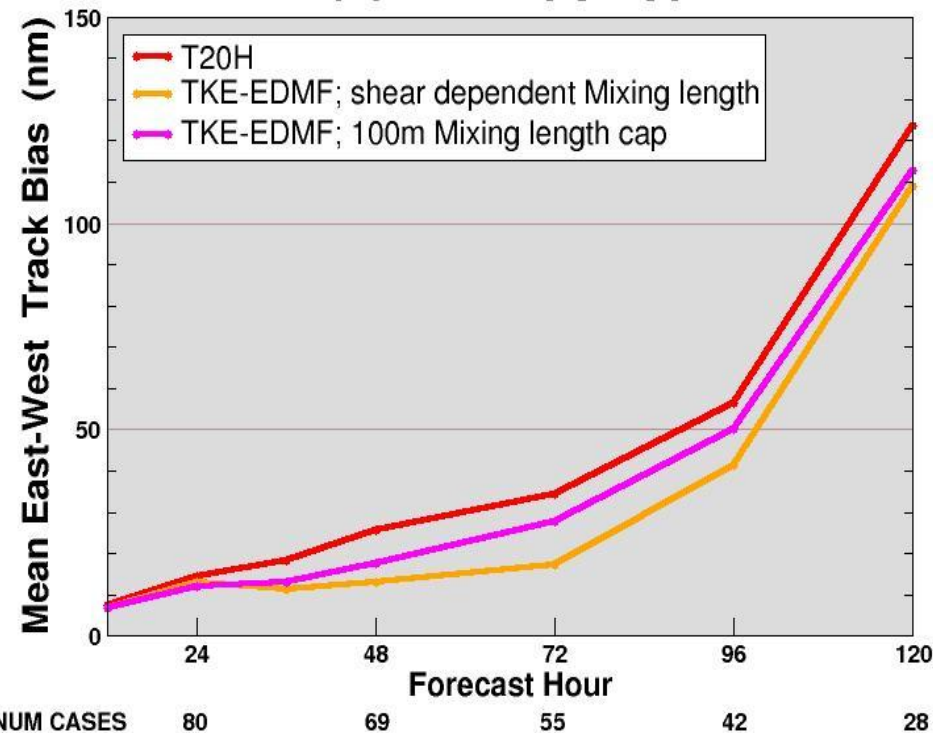
## Track Errors (nm)

## East-West Track Bias (nm)

TKE-EDMF SIMULATIONS WITH T-SHiELD  
2020 ATLANTIC SEASON



TKE-EDMF SIMULATIONS WITH T-SHiELD  
2020 ATLANTIC SEASON

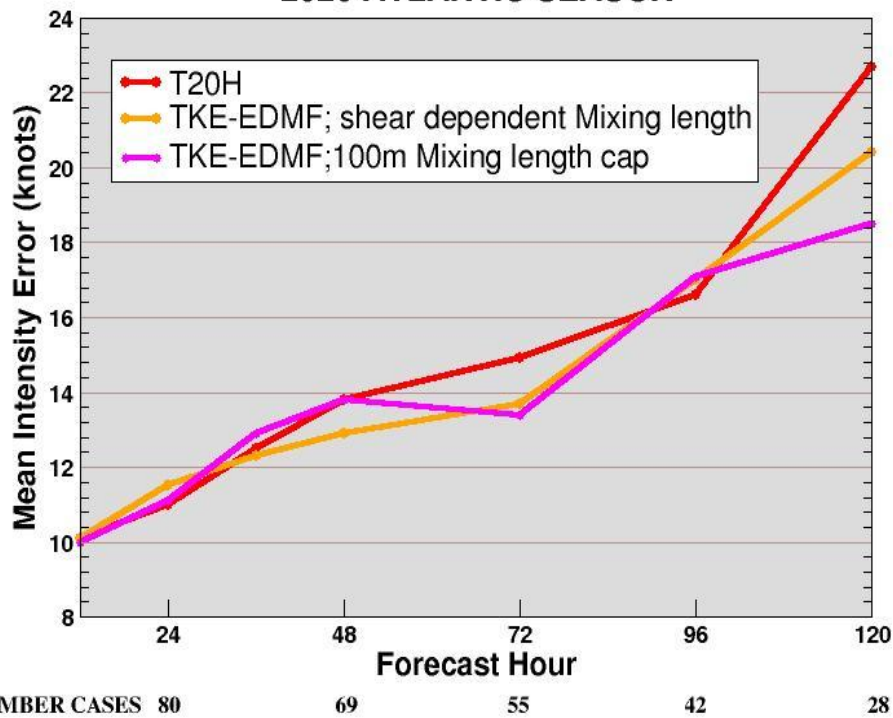


# Impact of TKE-EDMF on Intensity and Bias in 2021 T-SHIELD

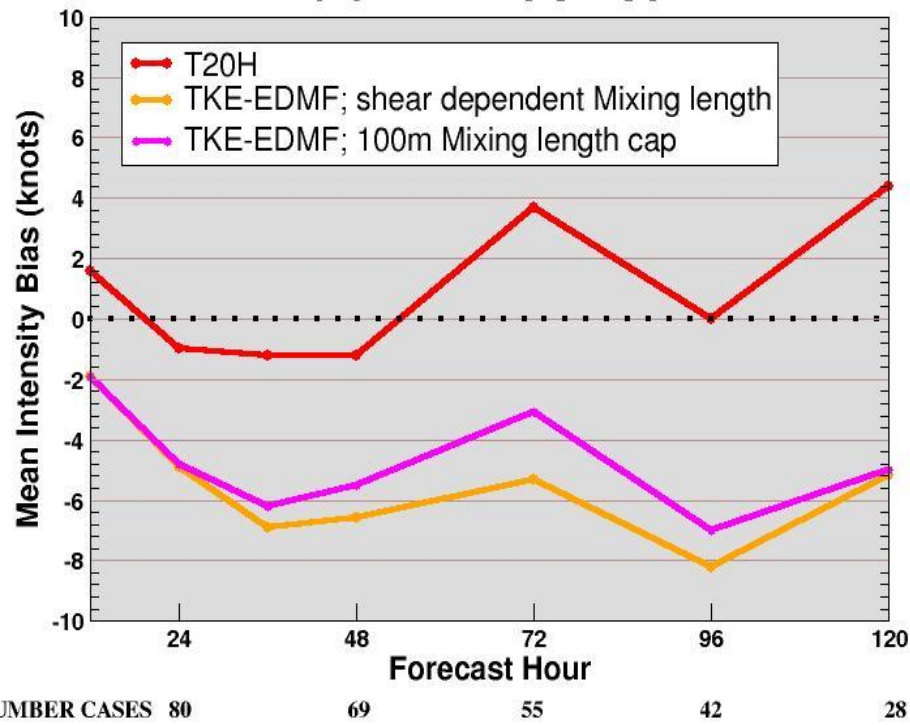
## Intensity Errors (knots)

## Intensity Bias (knots)

TKE-EDMF SIMULATIONS WITH T-SHIELD  
2020 ATLANTIC SEASON



TKE-EDMF SIMULATIONS WITH T-SHIELD  
2020 ATLANTIC SEASON



Some Improvement in Intensity Error with TKE-EDMF

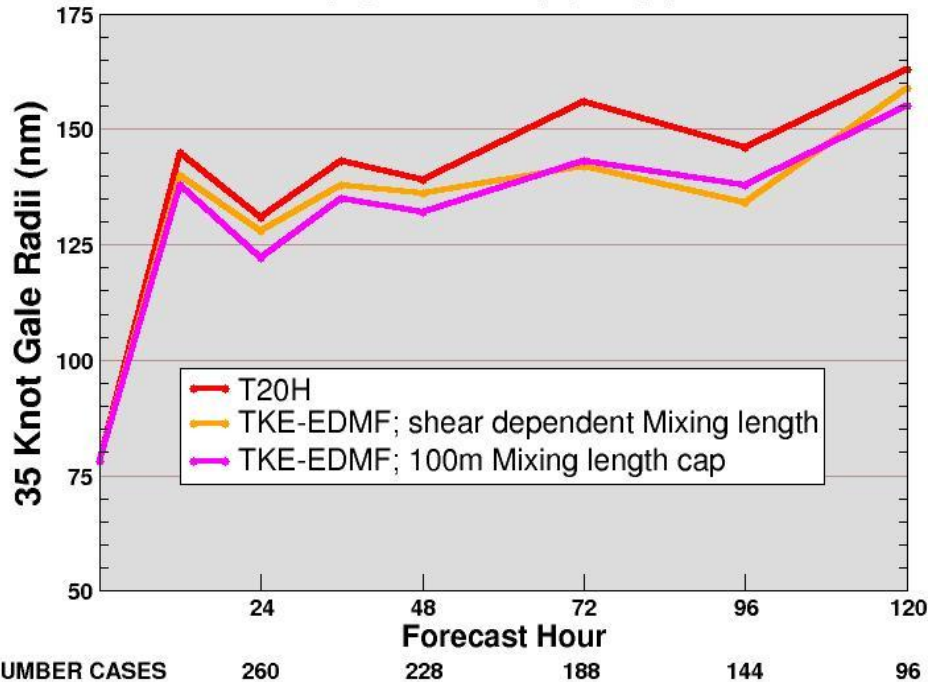
TKE-EDMF PBL Scheme producing significant negative bias

# Forecasted 35 Knot Gale Radii

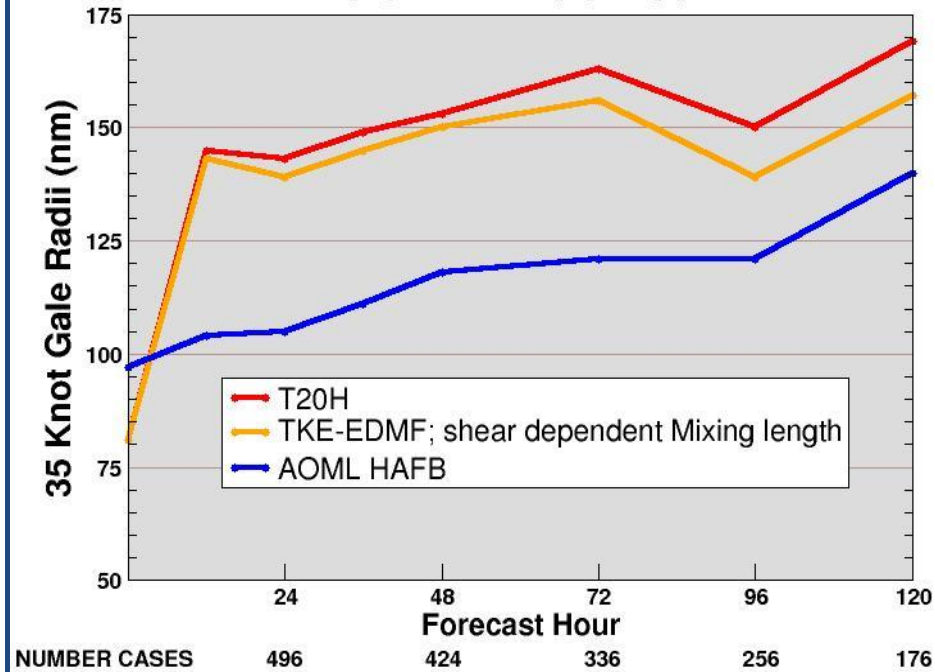
## Forecasted Radii of Gale Winds

## Forecasted Radii of Gale Winds: Comparison with HAFB

**TKE-EDMF SIMULATIONS WITH T-SHIELD  
2020 ATLANTIC SEASON**



**TKE-EDMF SIMULATIONS WITH T-SHIELD  
2020 ATLANTIC SEASON**

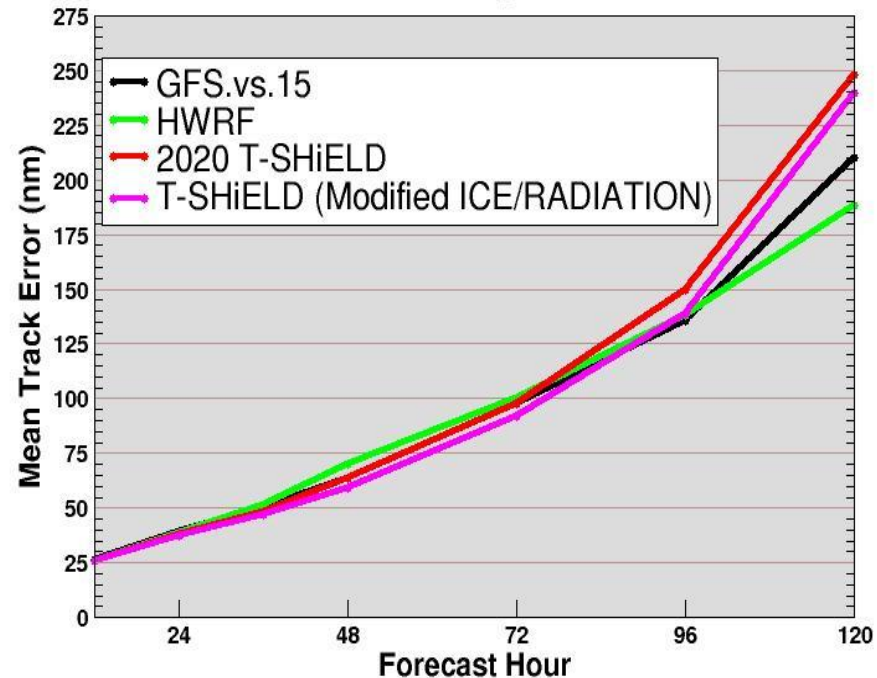


**Forecasted Radii of Gale winds Reduced  
in T-SHIELD with TKE-EDMF but still  
significantly larger than 2020 HAFB**



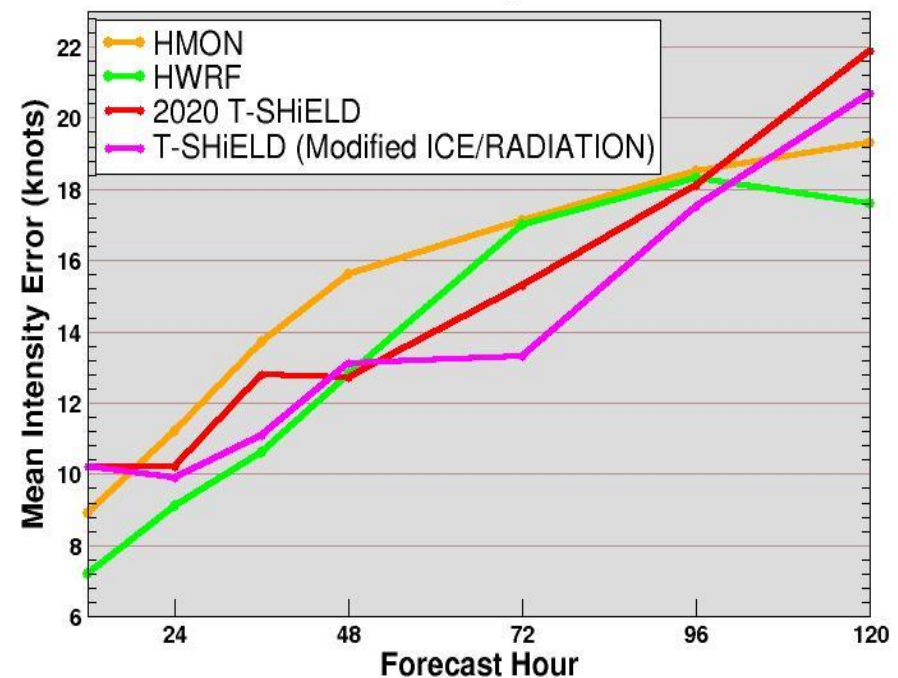
# Impact of Improved Ice-Radiation Scheme for 2020 Atlantic Season Selected Cases

COMPARISON of New ICE/RADIATION INTERACTION  
AL13 through AL28



NUM. CASES	133	111	84	60	39
% IMP EXP9/T20H	1%	6%	6%	8%	4%

COMPARISON of New ICE/RADIATION INTERACTION  
AL13 through AL28



NUM CASES	133	111	84	60	39
% IMP EXP9/T20H	4%	-3%	13%	3%	5%

**New ice-radiation scheme gives modest track improved at 4-5 day forecast time & significantly improved intensity skill at 3-5 day forecast lead times.**



# Summary

- Evaluation of TKE-EDMF PBL in T-SHiELD shows neutral impact on track with 100m capped mixing length but some track degradation with EMC Shear Dependent mixing length.
- Evaluation of TKE-EDMF PBL in T-SHiELD shows some reduction in intensity error but significantly more negative intensity bias.
- TKE-EDMF PBL in T-SHiELD resulted in slightly reduced expansion of gale radii but not nearly as much as HAFB.
- Multi-Season Evaluation of Impact of SAS Deep Convection in T-SHiELD will shortly begin.  
At 3km is it really a good idea to disable deep convection ???
- Evaluation of differences between AOML HAFB and T-SHiELD is ongoing particularly regarding large differences in intensity bias.