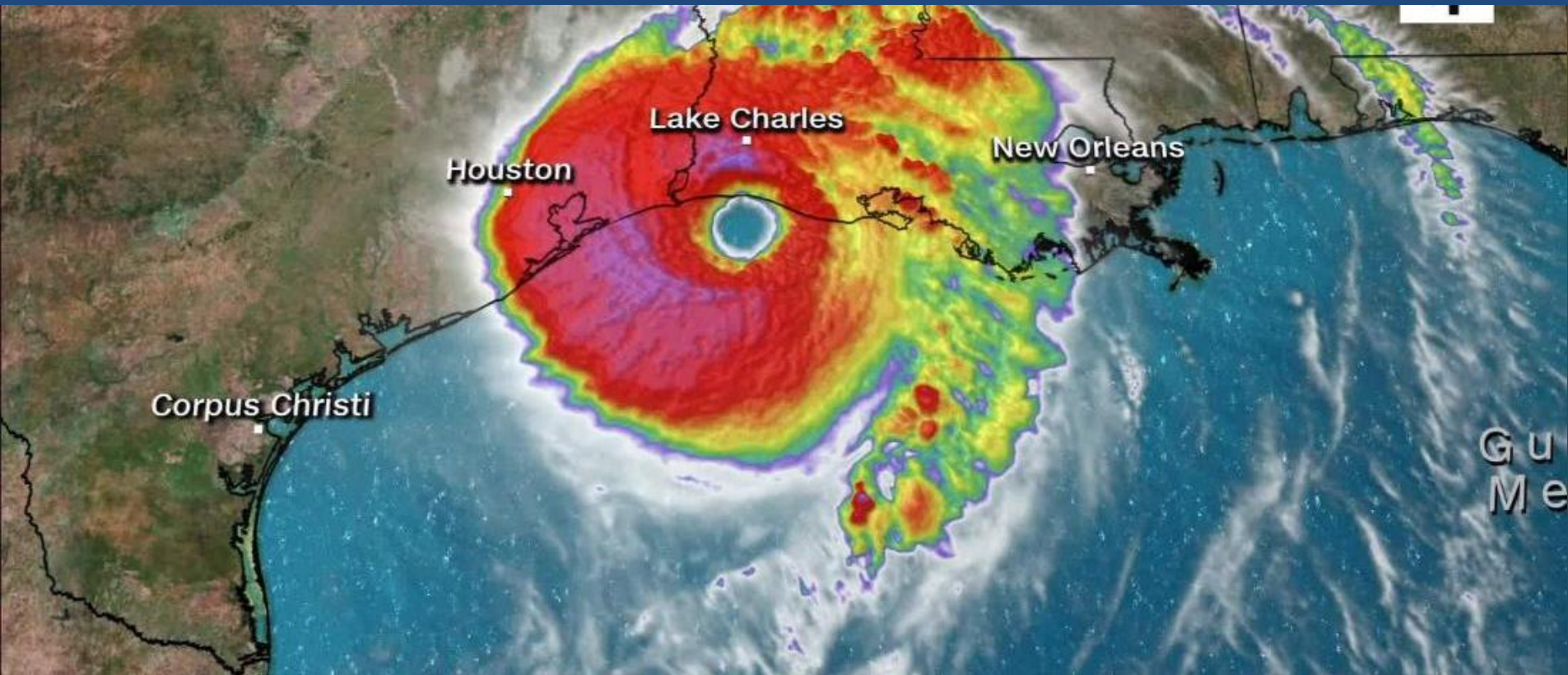# Proposed 2021 GFDL  T-SHiELD  Near Real-Time System



## Morris Bender, Kun Gao, Matthew Morin, Lucas Harris, Timothy Marchok

### HAFS Coordination Meeting
### May 26th, 2021

# Key features of Upgraded 2021 T-SHiELD

- **YSU PBL Replaced with EDMF-TKE Scheme (100m mixing length cap).**

- **New Cd and Ch (Based on HWRF surface exchange coefficients).**

- **Improved Cloud Ice/Radiation Interaction.**

- **Refined the entrainment and detrainment parameters in the shallow convection to reduce low-level cloud bias *(K21D)* . Also tested with parallel version *(K21B)* with the previous shallow convection settings.**

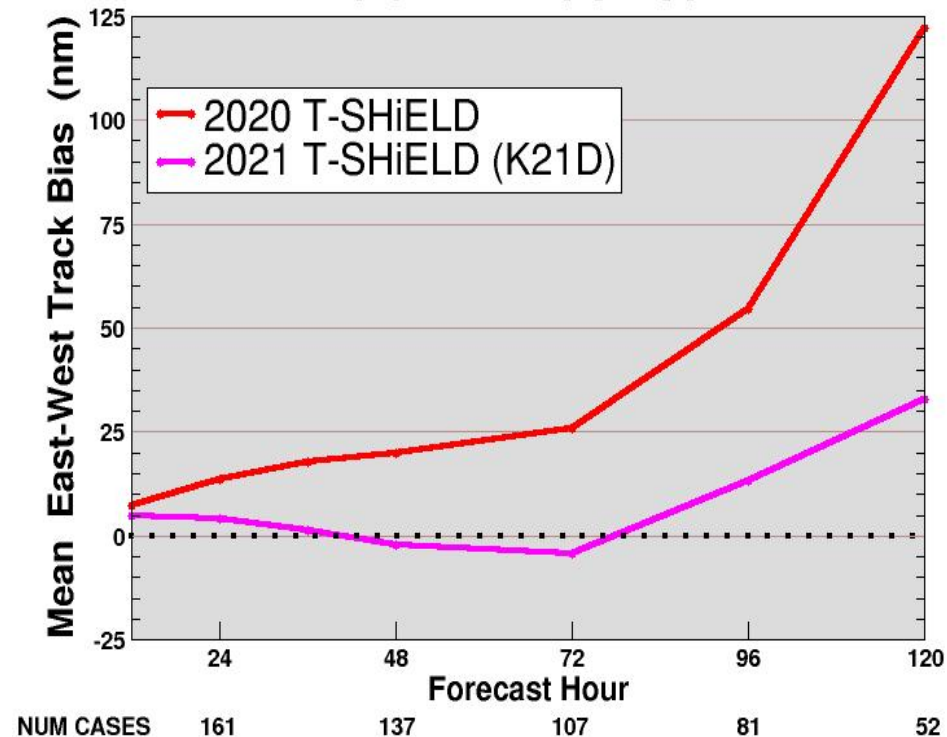- **2021 T-SHiELD being configured for 75 vertical levels in nested region.**
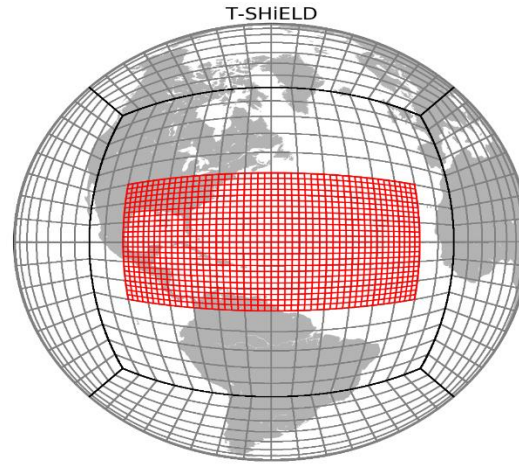
T-SHiELD

# 2020 Track Error (nm)
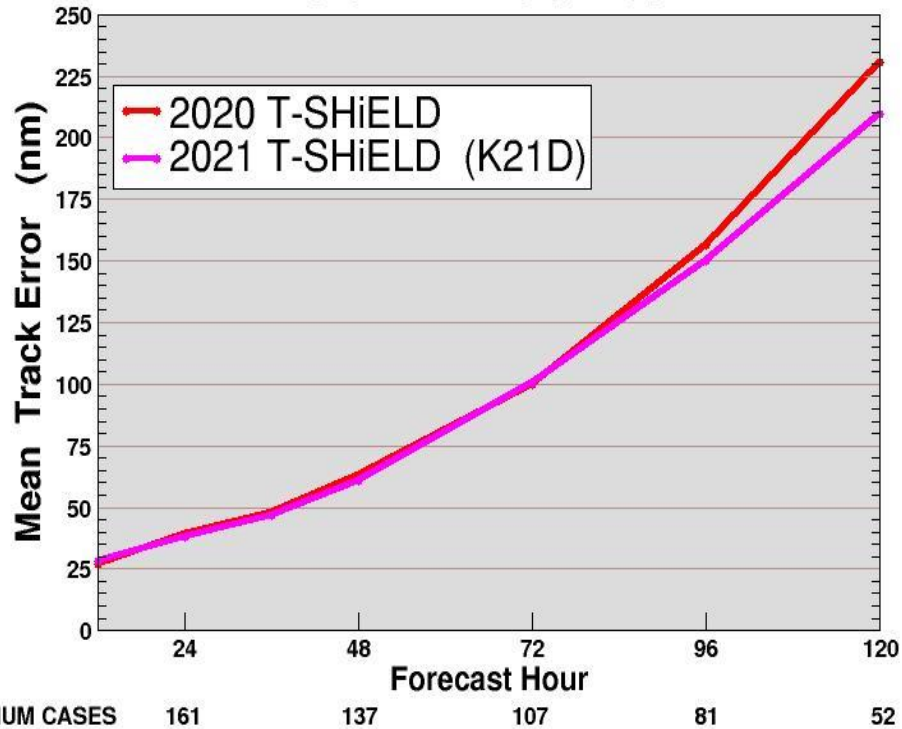
# 2020 East-West Track Bias (nm)



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

2020 T-SHiELD
2021 T-SHiELD (K21D)

NUM CASES     161     137     107     81     52



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

2020 T-SHiELD
2021 T-SHiELD (K21D)

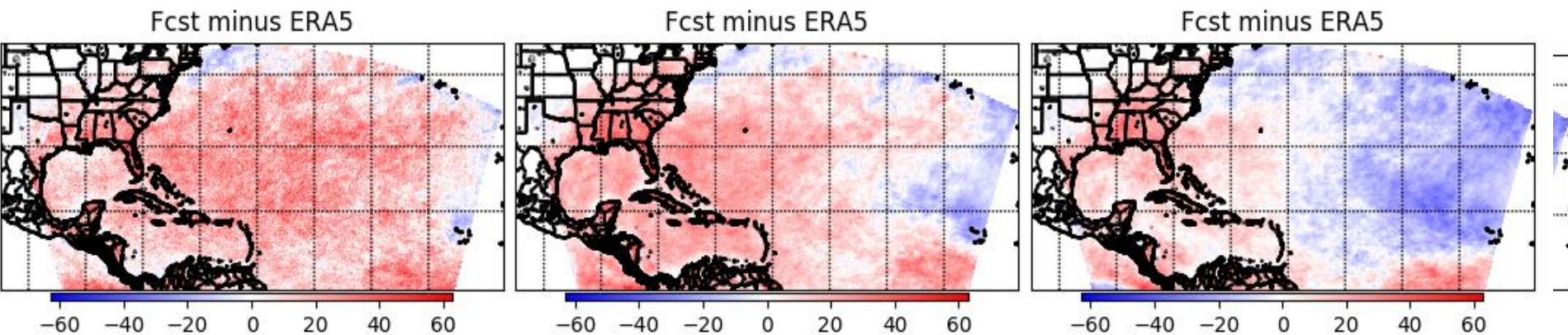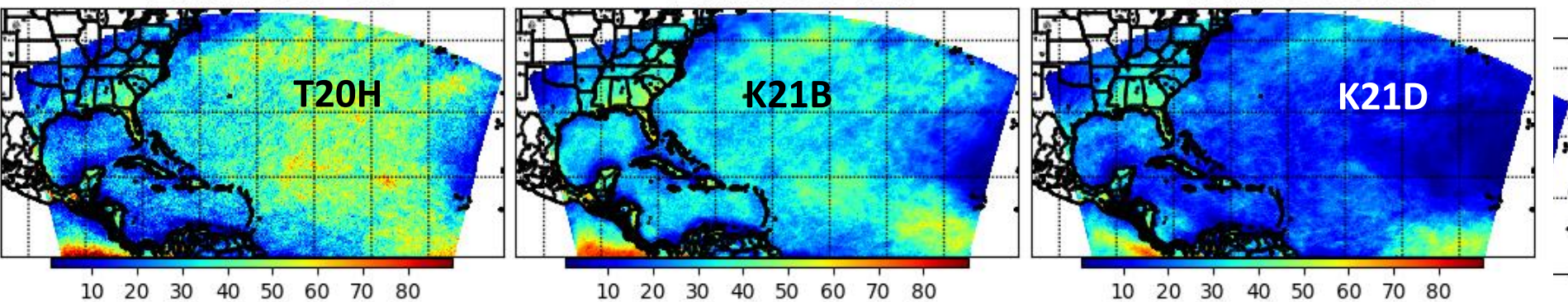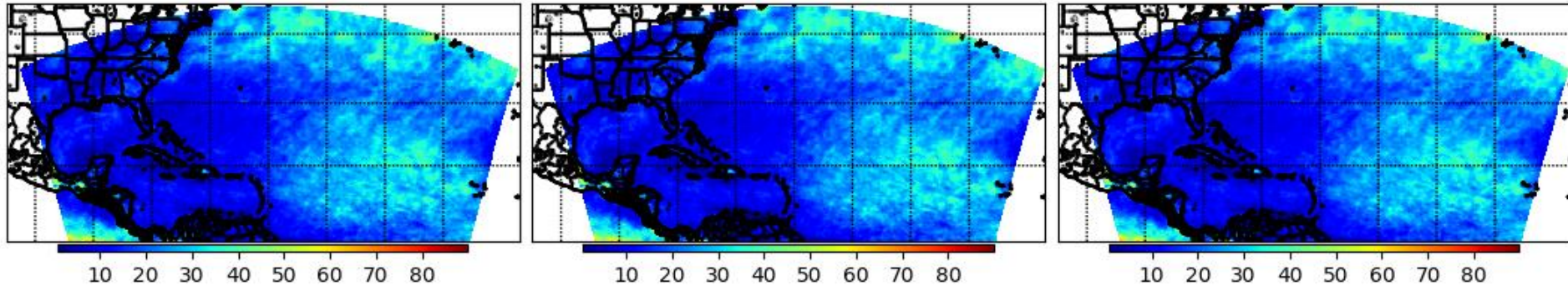NUM CASES     161     137     107     81     52

**Large East Track Bias for T-SHiELD that persisted throughout the 2020 Atlantic Season significantly reduced in 2021 version of T-SHiELD with modified shallow convection.**

# 5 Day Mean Low-Level Cloud Cover

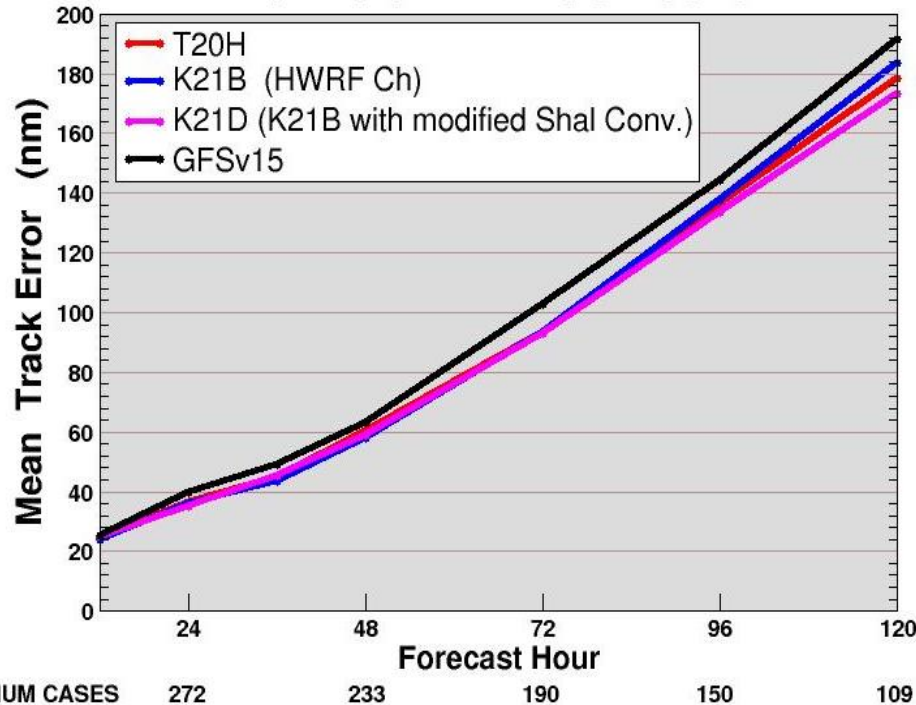## (*August 20th, 2020 – September 20th, 2020*)

### OBSERVED

**2021 T-SHiELD (ATCF-ID: "K21B/K21D") being presently evaluated on selected cases from past 4 hurricane seasons for a more robust sample of 300+ cases**

- **2020    (0z and 12z): All storms from AL09 through AL29**

- **2019   (0z and 12z):  Dorian, Erin, Fernand, Gabrielle, Humberto, Jerry, Imelda, Karen, Lorenzo)**

- **2018  (September 1st-16th, 0z only) :   Florence, Gordon, Helene, Isaac, Joyce**

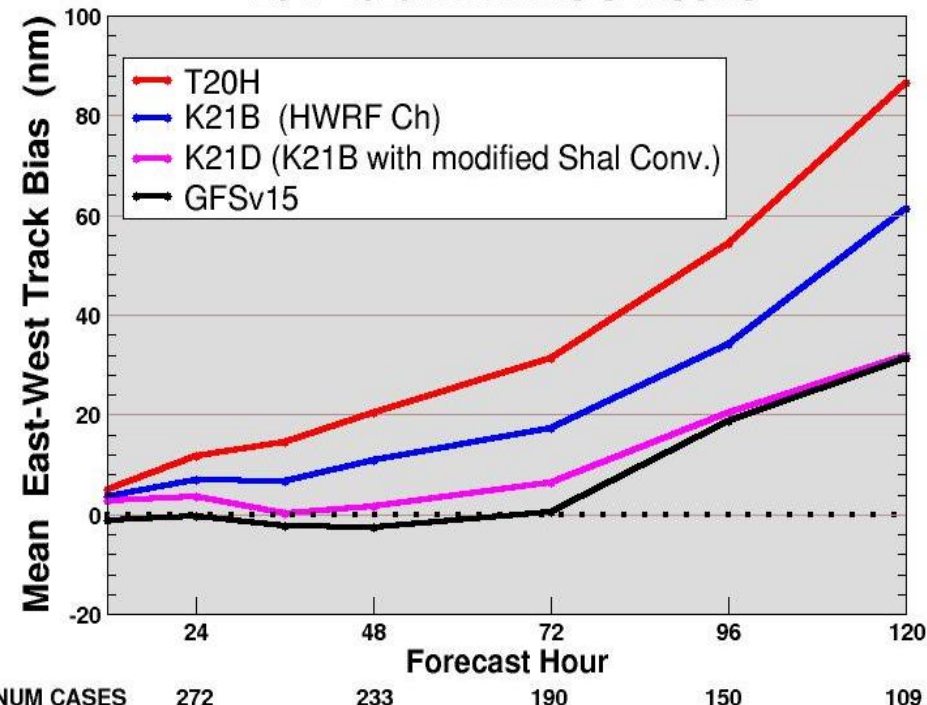- **2017 (September 1st- 29th,  0z only) :   Irma, Jose, Katia, Lee, Maria**

# Track Verifications and East-West Track Bias Multi-Season Evaluation



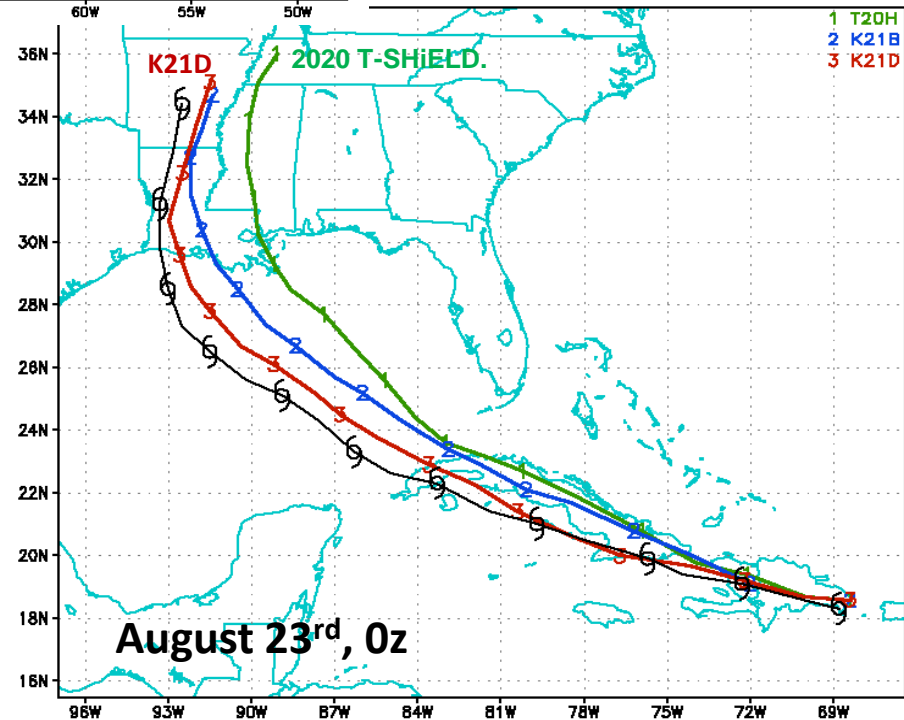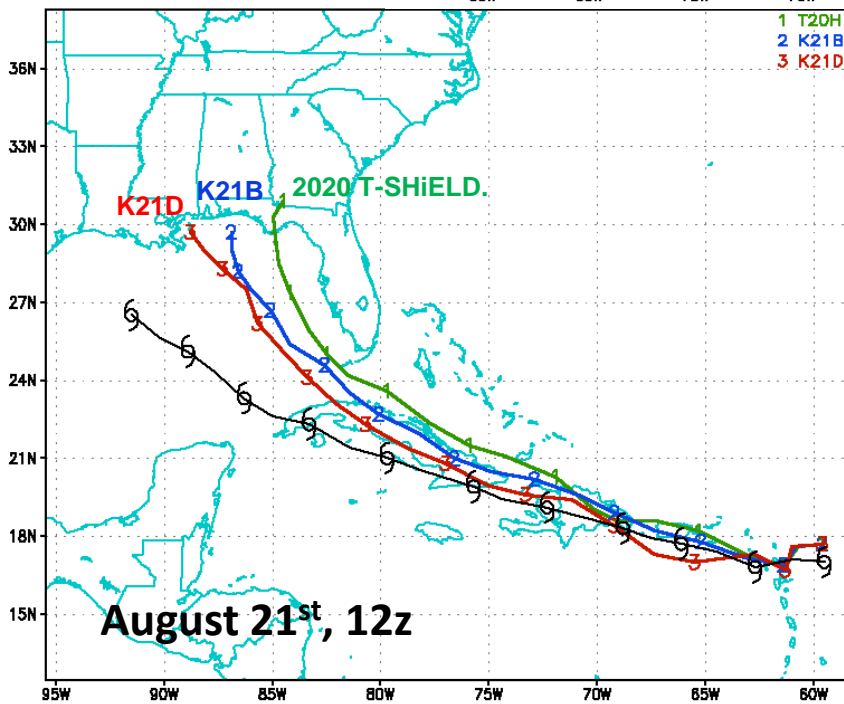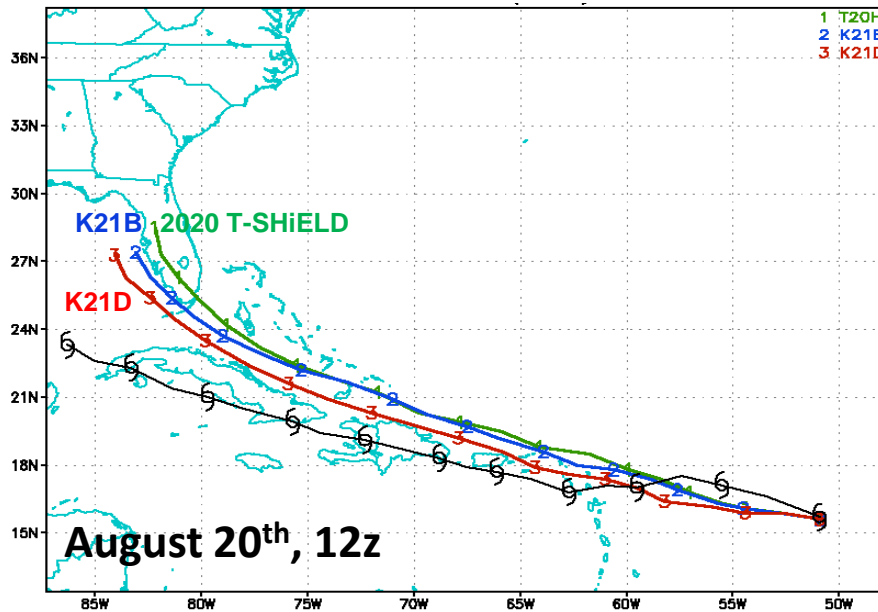TKE-EDMF SIMULATIONS WITH T-SHiELD
2017-2020 ATLANTIC SEASONS

**At 3-5 Days, Track Error of 2021 T-SHiELD with modified Shal. Conv. was reduced 3% compared to 2020 version & 10% compared to GFS**

**East-West Positive Track Bias in Multi-Season evaluation is greatly reduced in 2021 T-SHiELD with modified Shal. Conv.**
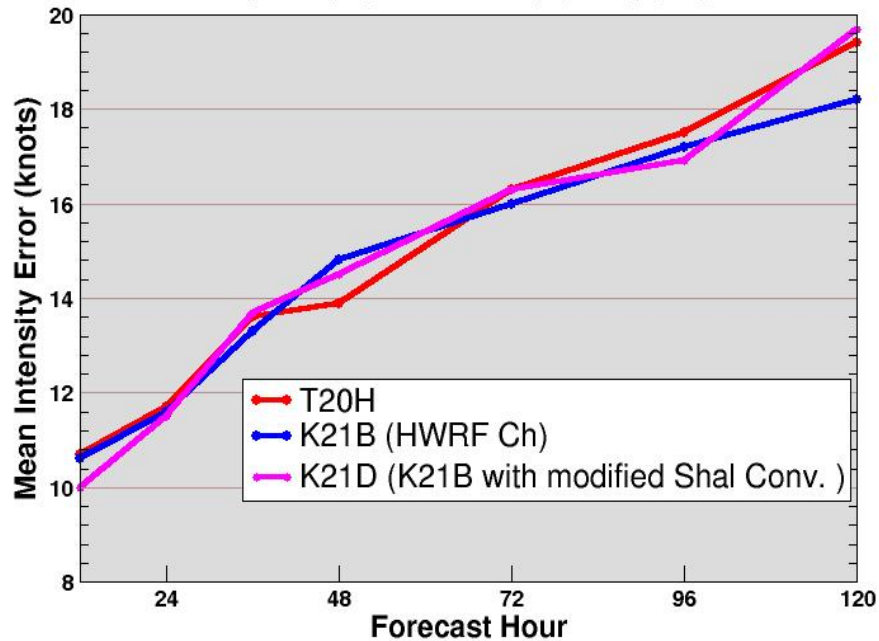
August 20th, 12z

August 21st, 12z

August 23rd, 0z

**Reduced east bias for K21D in Hurricane Laura in 2021 T-SHiELD**

# Intensity Errors and Bias
# Multi-Season Evaluation
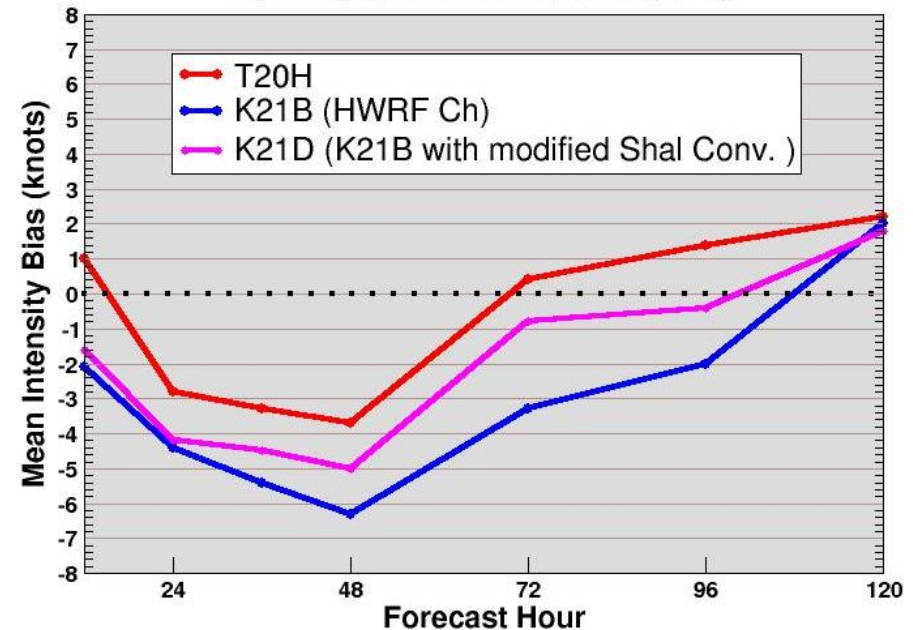
## Intensity Error

## Intensity Bias



**Mostly neutral impact on intensity errors for 2021 T-SHiELD**

# Summary

- **2021 T-SHiELD with modified entrainment/detrainment in shallow convection scheme, significantly reduced excessive cloudiness found in 2020 T-SHiELD at the lower model levels.**

- **2021 T-SHiELD demonstrated much reduced positive east-west track bias with modified shallow convection. (This east track bias was very significant in 2020.)**

- **2021 T-SHiELD demonstrated small improvement in overall track skill (~3%) over a multi-season evaluation but 10% reduction in track error compared to the Version 15 GFS.  Reduction in track error was larger for 2020 season (~10% at day 5).**

- **2021 T-SHiELD had mostly a neutral impact on Intensity Skill.  However 2020 version was already producing very skillful intensity forecasts.**