DTC Update on Hurricane Supplemental Projects

Evan Kalina[1,2,3]
Man Zhang[1,2,3]
Grant Firl, Mrinal Biswas, Mike Ek[3,4]

June 24, 2020

[1]CIRES [2]NOAA/GSL [3]DTC [4]NCAR

Outline

- HAFS Infrastructure – Evan Kalina
- HWRF Physics in CCPP at NOAA/GSL – Man Zhang
- HWRF Physics in CCPP at NCAR – Mrinal Biswas/Mike Ek

HSUP Resources

$135 K (PoP: Jul 2019-Jun 2021)

HAFS Infrastructure

PI: Evan Kalina

Deliverables:

Establish an authoritative UFS workflows repository in GitHub with CROW code as the starting point (HU 12/2019)

Review the design and implementation of CROW with community partners (HU 06/2020)

Demonstrate that CROW or a CROW alternative can interact with the Common Infrastructure for Modeling the Earth (CIME) for building and running simple forecast model configurations (HU 09/2020)

Plan and document the design of the transition-to-operations workflow for the UFS hurricane application based on collected requirements and review with technical and scientific partners (HU 09/2020)

Demonstrate a workflow for a HAFS configuration that is suitable for simplified benchmarking that is part of a transition to operations, including the ability to do cycling without full DA (HU 06/2021)

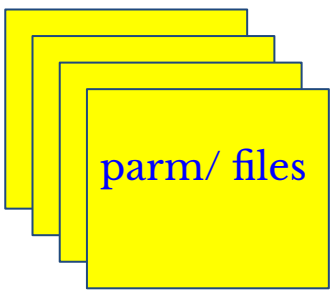
CROW review report

- Shared with EMC partners, Hurricane app leads on June 8.
- Posted to the DTC website on June 24: LINK
- One anticipated outcome of report is to facilitate a decision by EMC on whether to use CROW in HAFS
  - Suggest decision by September 1, preferably sooner.
  - A delayed decision will make it harder to complete the next milestone:

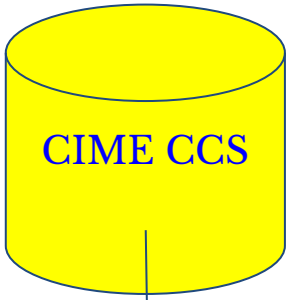
"Demonstrate that CROW or a CROW alternative can interact with CIME for building and running simple forecast model configurations."

Including CIME Case Control in HAFS

Led by NCAR/CGD, collaborative with NOAA/GSL.
Proposed plan: Use CIME CCS to configure and build the HAFS forecast.

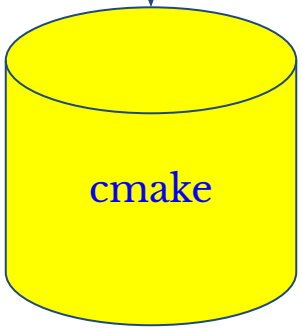


Configures all non-forecast related settings



Controls forecast namelists for UFS atmosphere, HYCOM, WW3
All forecast configuration options kept here

Configuration-*independent* build
Builds all components other than forecast



Configuration-*dependent* build
Builds forecast only

Note: Tentative plan. Subject to change.

HSUP Resources

$62 K (PoP: Aug 2019-Jul 2021)

HWRF Physics in CCPP (GSL)

PI: Man Zhang

Deliverables:

- HWRF F-A, saSAS, and RRTMG parameterizations in CCPP (Jan 2020)
- HWRF Physics Suite Test Plan (Apr 2020)
- Successful HAFS v0.a runs using the HWRF suite (Apr 2020)
- **DTC HWRF physics test on Orion (Mid-Jun 2020)**

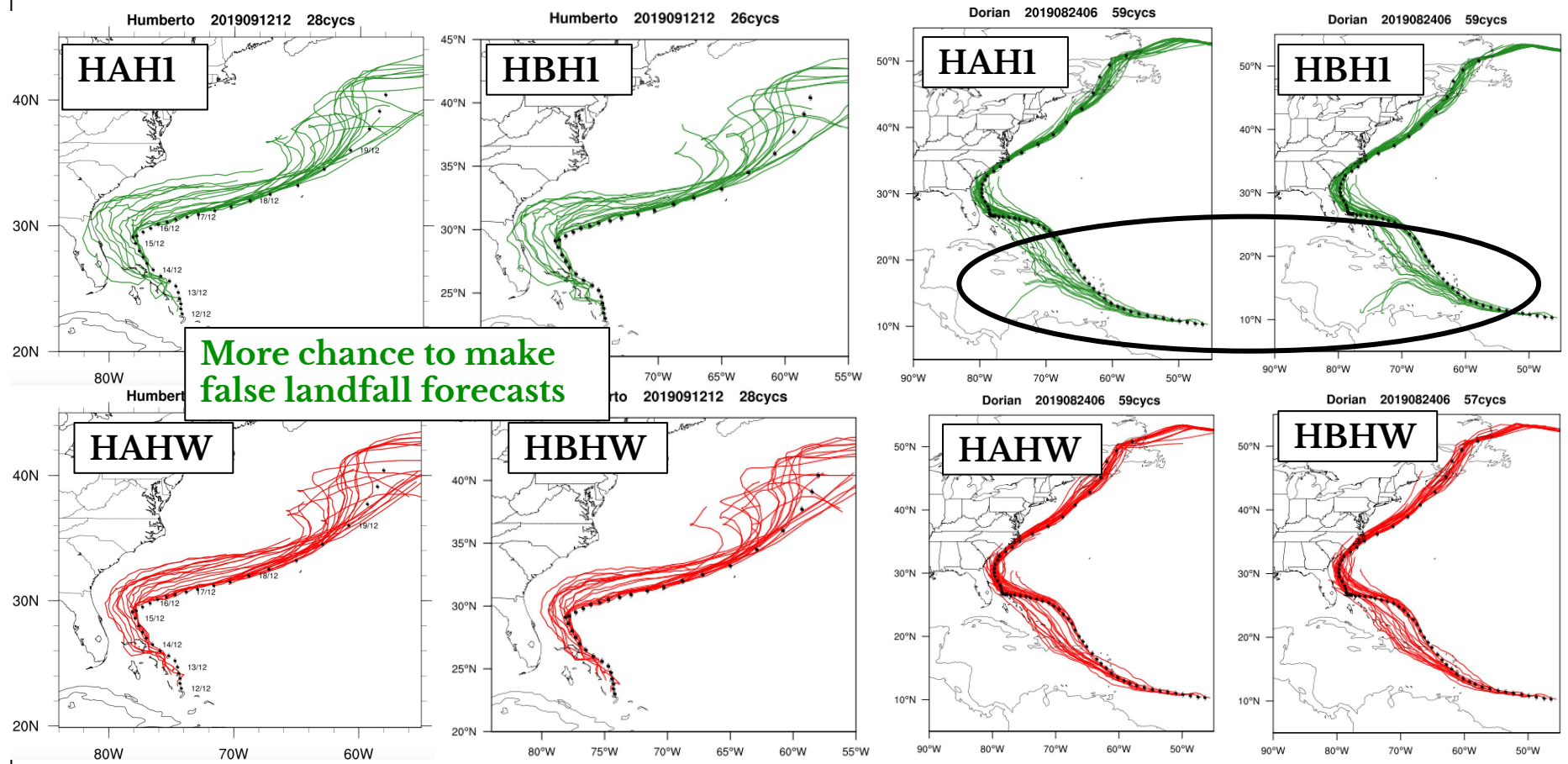
	Physics Suite HWRF	Physics Suite HAFS_p0.1
Domain HAFS v0.a (regional)	HAHW	HAH1
Domain HAFS v0.b (global + nest)	HBHW	HBH1

- **Transitioning dtc/hwrf-physics branch from NCAR to hafs-community Github**

Composite Track Forecasts

Humberto 09L2019

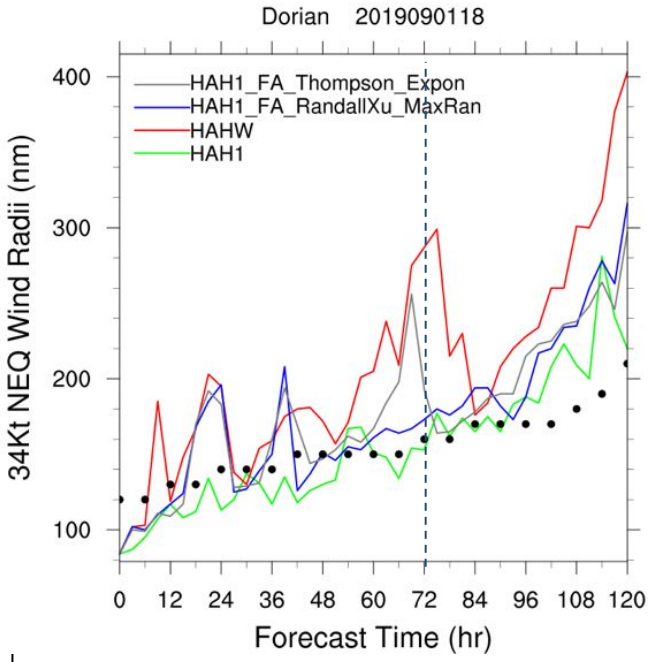
Dorian 05L2019



HWRF suite produces encouraging track results with both regional and globnest configuration

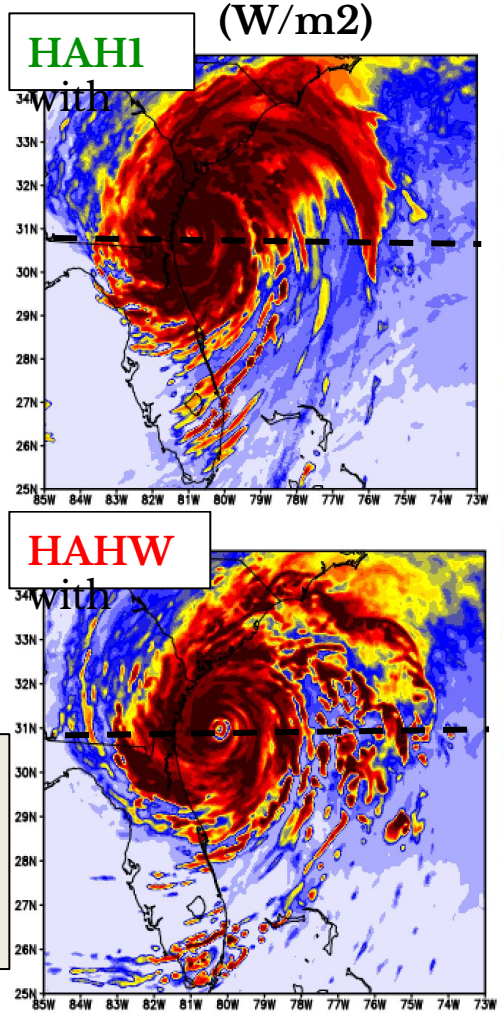
Sensitivity of Storm Structure to Cloud Treatment

larger storm in HAHW

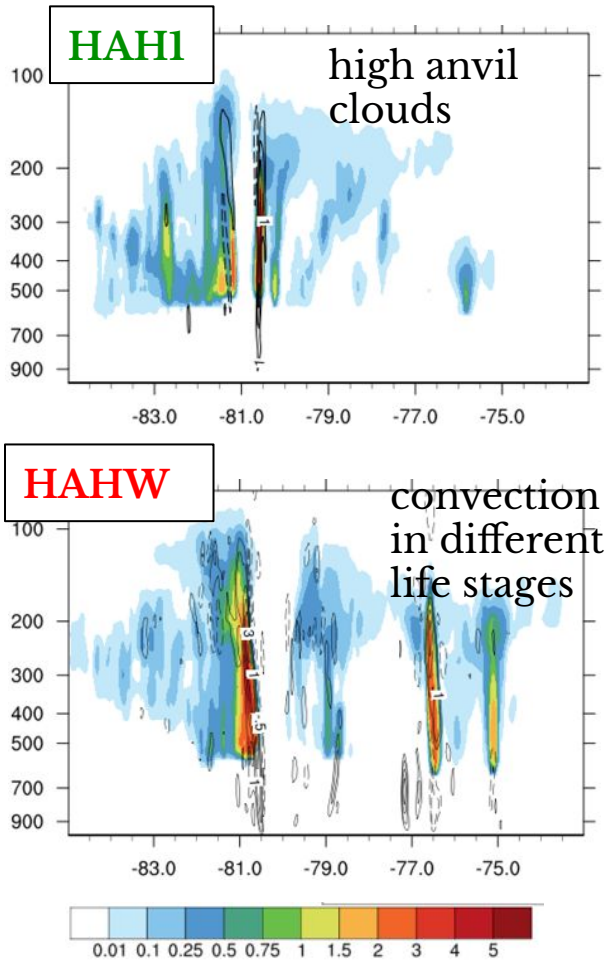


- **HAHW:** FA+Thompson-cld+Exp
- **HAH1:** GFDLmp+incore-cld+MaxRan

surface DW SW flux at 72h (W/m2)



Cloud ice (k/kg) and w(m/s)



- **HAH1:** the decreased downward solar radiation directly induces a reduction in surface fluxes, so buoyancy could be decreased and convection could be reduced.
- surface cooling->PBL mixing weak->weak convection in rainband

HSUP Resources

$86K (PoP: Aug 2019-July 2021)

HWRF Physics in CCPP (NCAR)

PI: Mrinal Biswas, Mike Ek

Deliverables:

(1) Implement parameterizations from NOAA WRF model physics suite into the Common Community Physics Package (CCPP): EDMF PBL, GFDL surface-layer, and Noah land model schemes.

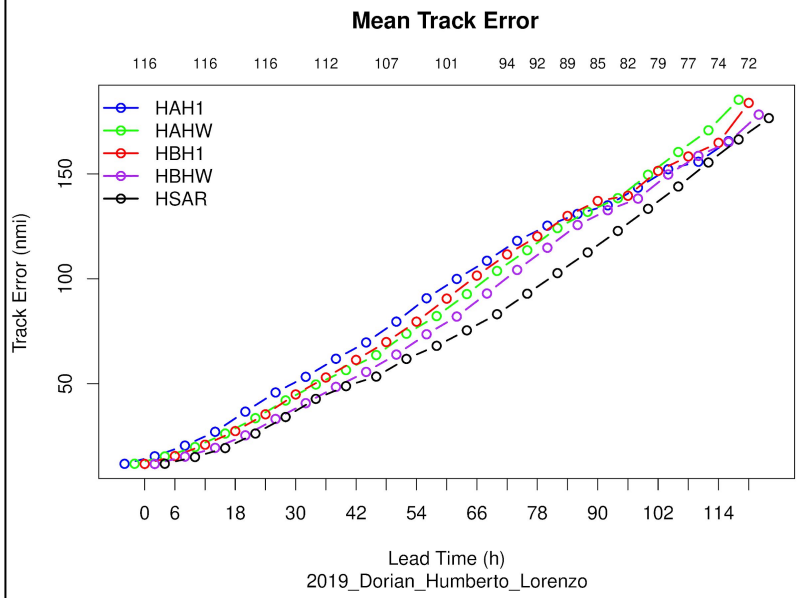
(2) Test this suite in a prototype configuration of the Hurricane Analysis and Prediction System (HAFS), for a number of test case hurricanes.

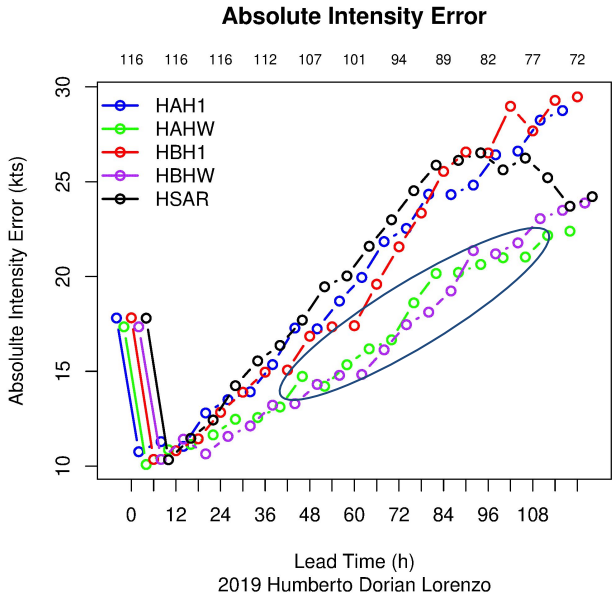
(3) Run HAFS v0.b using the HWRF suite on Orion

(4) Report on test results

(5) Communication of results at conference

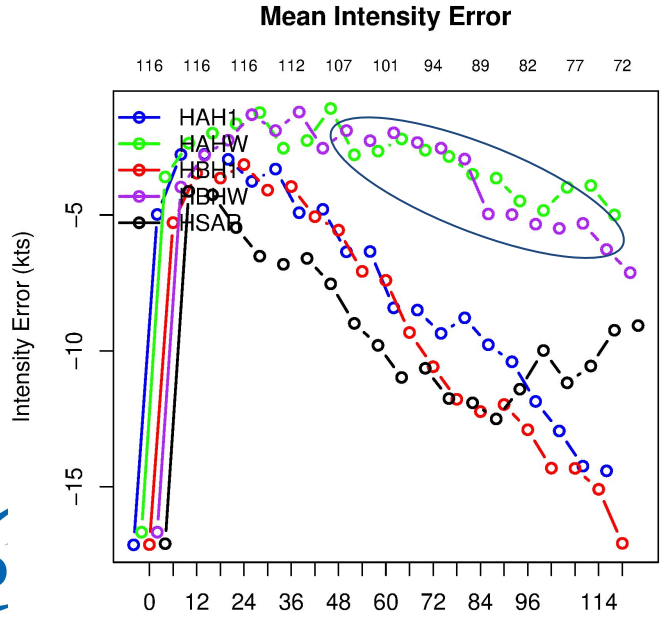
Track and intensity verification

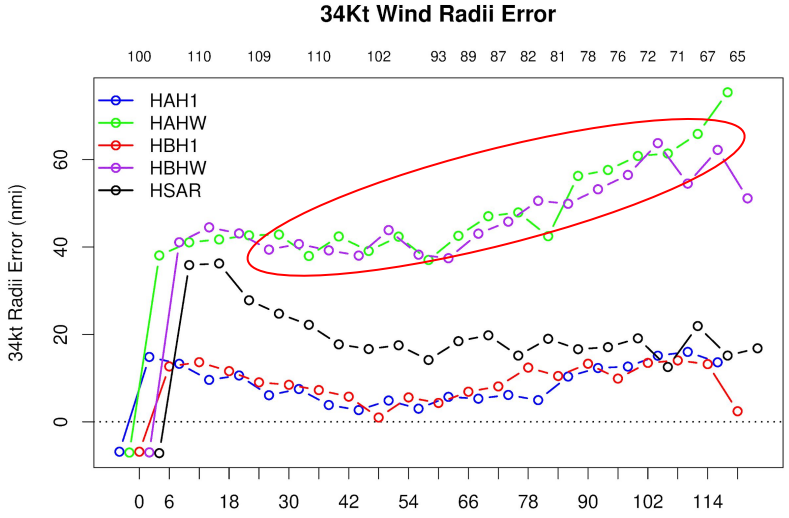




Overall encouraging results from the HWRF physics

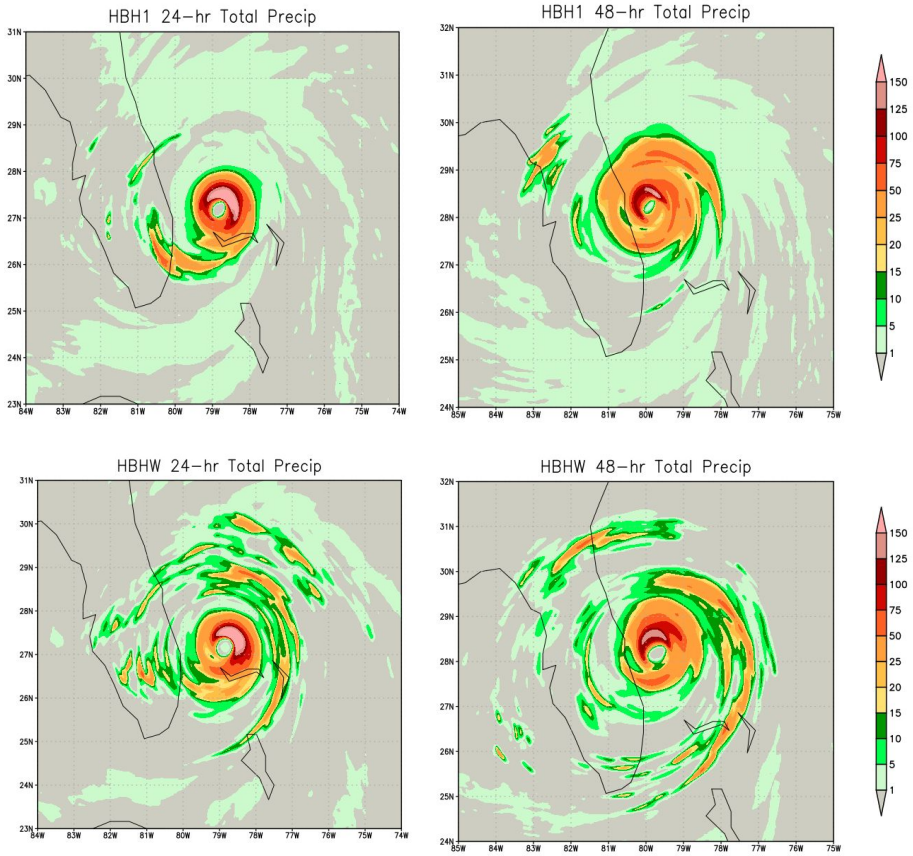
HAFS v0.0A (HAFS-SAR) produces better track forecasts

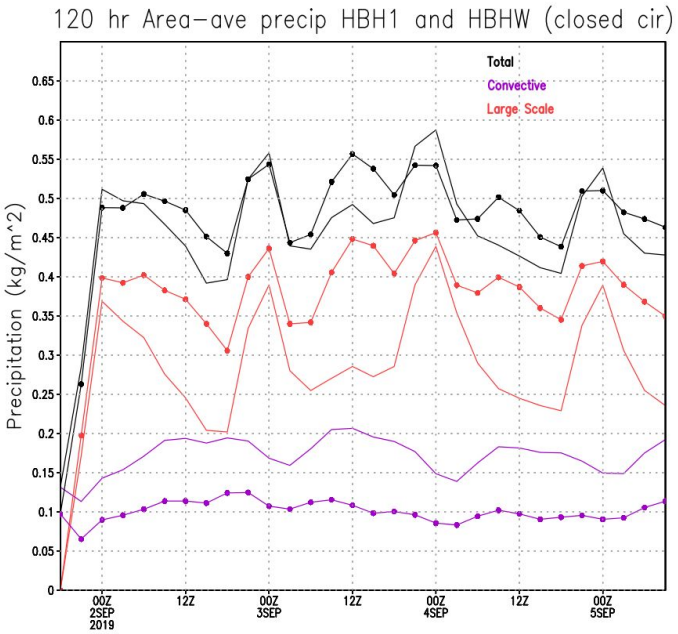




Concern: HWRF physics produces large storms

Total Precip and time series





Rainbands are more prominent in HBHW.

Area-averaged (over entire 3-km domain) precip time series indicates same trend as the storm environment