

D2013 PSU Cycling WRF-EnKF Real-time System

1. ATCF ID

APSU: stream 1.5; **A**hw deterministic forecast initialized by **PSU** wrf-enkf system with GTS conventional data, Recon data, NOAA TDR and satellite derived winds assimilation. Four times per day. Available before +5:45.
PS01-PS10: stream 2.0; Penn State ensemble forecasts initialized with APSU perturbations. Four times per day. Available after +7:00.

2. System configurations

- ARW-WRF version 3.4.1
 - 1) 3 mercator-projected domains: 379x244x27km, 304x304x9km, 304x304x3km. The outer domain is fixed and covers almost of the Atlantic and the North American; while the inner domains are movable by following the vortex center during the forecast and following the TCvital data during the analysis;
 - 2) 43 vertical levels, and model top 50 mb;
 - 3) Time step: 90 s;
 - 4) Cumulus: Grell-Devenvi ensemble scheme for 27 km domain only;
 - 5) Microphysics: WSM 6-class graupel;
 - 6) PBL: YSU scheme;
 - 7) Surface Layer: Monin-Obukov;
 - 8) Land Surface: thermal diffusion;
 - 9) Radiation: Rrtm/Dudhia for longwave/shortwave
 - 10) Ck, Cd formulation for TC: Green and Zhang (2013)
 - 11) 1D ocean model initialized with HYCOM dataset.

- EnKF
 - 1) 60 members;
 - 2) mixing = 0.60;
 - 3) ROI: 30 grids for up-air, while 15 grids for surface, SCL with 15 grids for TDR;
 - 4) 3-hr assimilation window;

- Data source
 - 1) GFS: Jet HPSS: /BMC/fdr/YYYY/MM/DD/grib/ftp/7/0/96/0_259920_0, grib2.
 - 2) HDOB data: <http://www.nhc.noaa.gov/archive/recon>
 - 3) MADIS: Jet: /misc/public/data/madis
 - 4) Tcvitals: Jet: /misc/public/data/nhc
 - 5) TDR: JET: /lfs2/projects/hfip-psu/yweng/Data/Airborne/SO/YYYY.

- Working flow

- 1) Initialize the system when CLP5 or OFCL provides forecast for this storm and the storm presents to the west of 30W, or NHC announces an aircraft mission. 1 deterministic run initialized with operational GFS and its 60 perturbations are integrated for 12 hours.
- 2) The environment fields (out of 600km of the TC vital center) of the 12h deterministic forecast is replaced by the operational GFS analysis, then the combined field is used as the ensemble mean of the 60 members, and the perturbation is added to the combined fields to generate 60 new ensemble members.
- 3) All conventional observations from GDAS within 3-h window over the fine domain (900km x 900km) are assimilated in all 3 domains; minimal sea level pressure data in the correspond TC vital file, flight-level and dropsonde observations, and TDR SOs are also assimilated in them.
- 4) With the 1st EnKF analysis and perturbations, 3-h free ensemble forecasts are performed. The 2 inner domains of all ensemble members follow the TC vital center with the preset moving technique in WRF ARW.
- 5) After 2nd 3-h assimilation window, 126-h deterministic forecast initialized with the EnKF analysis is performed as the control experiment. Also, the 3-h deterministic and ensemble forecasts will be forward to another assimilation cycle.
- 6) Perform steps 2-5 till the end of the storm or the storm moves to the north of 45N or the east of 30W.

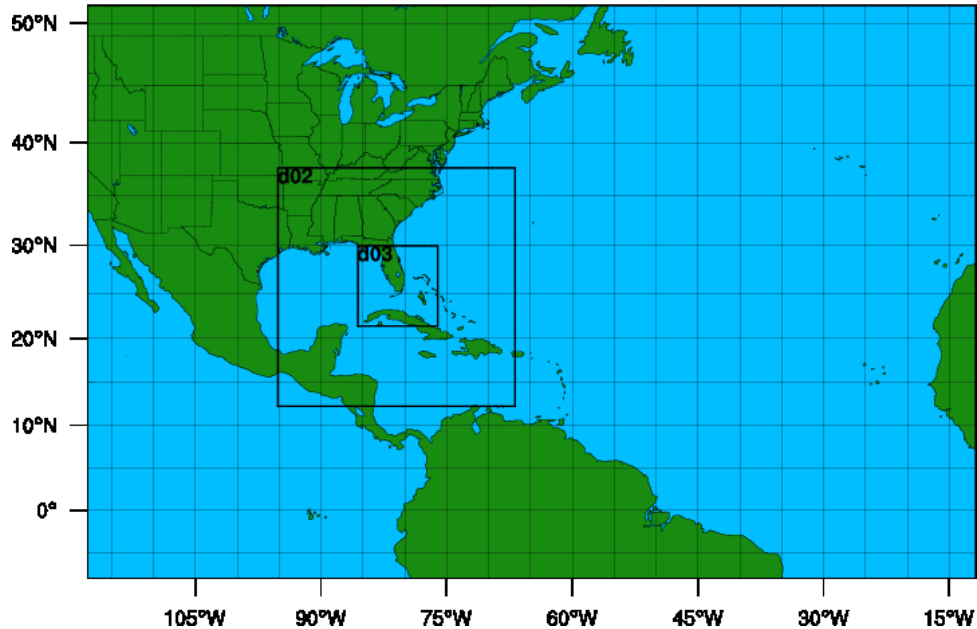


Fig.1, An example of domains

Irene2011 Track and EnKF domains

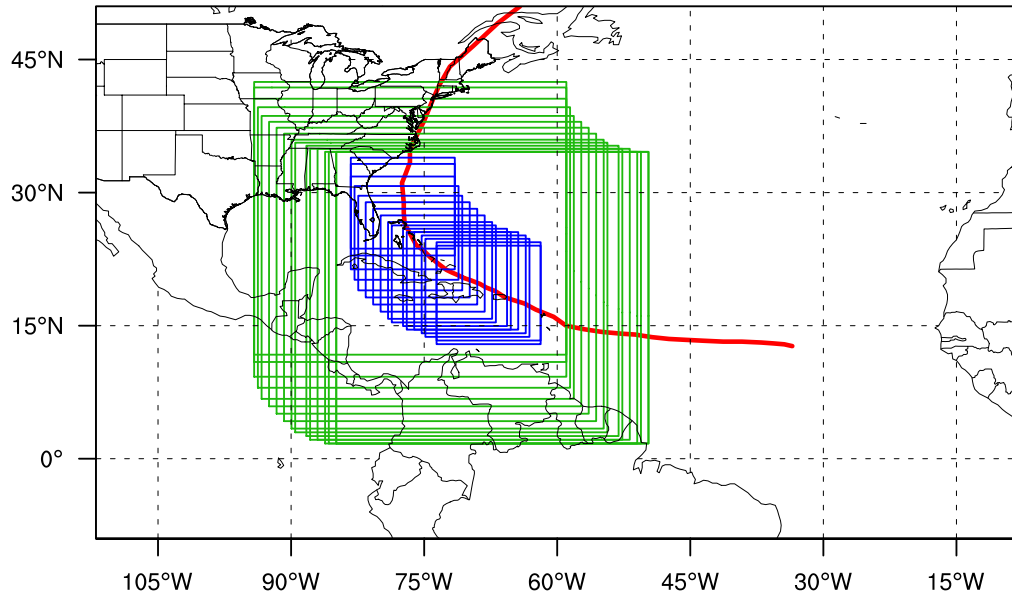


Fig. 2, an example of movable domains following tc/vitals.

APSU D2013 work-flow

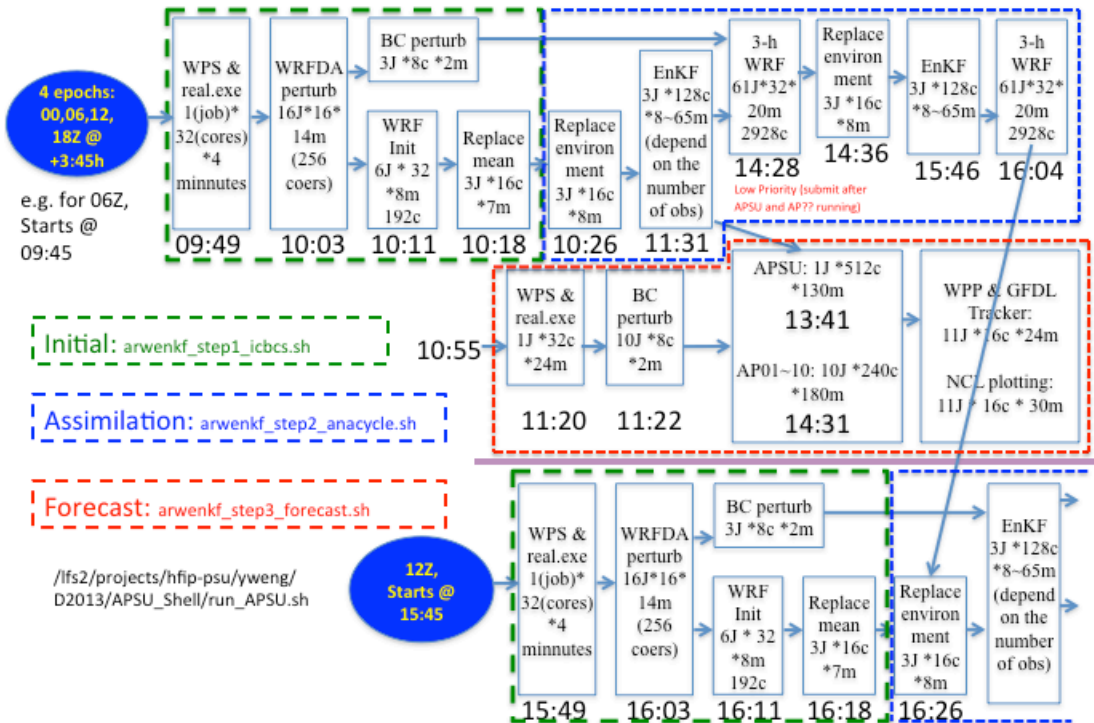


Fig. 3, work flow.