# Modifying cases for user-specific needs

Case studies are great, but...

- How do I modify the provided cases or run a different case?
  - Great question!
  - In this lecture / hands-on activity, we will provide helpful tips on…
    - Modifying an existing case
    - Creating a new case
    - Changing case-specific details and namelist options (domain, physics, etc.)
    - Using data on a filesystem
    - Accessing publicly available data sets on Amazon Simple Storage Service (S3)
  - In addition, the online tutorial provides information for changing the output of UPP, modifying or creating new NCL plots, and modifying the MET verification output

Modifying an existing case

- Let's start with the Hurricane Sandy case. We will modify:
  - Domain size
  - Physics namelist options
  - Location of output to avoid overwriting original data

Hurricane Sandy case domain
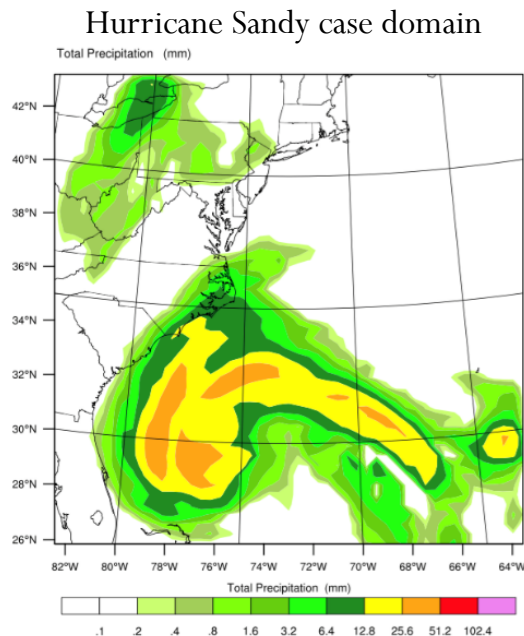

Physics namelist options for Sandy case

```
&physics
mp_physics              = 4,
ra_lw_physics           = 4,
ra_sw_physics           = 4,
radt                    = 30,
sf_sfclay_physics       = 1,
sf_surface_physics      = 2,
bl_pbl_physics          = 1,
bldt                    = 0,
cu_physics              = 1,
cudt                    = 5,
isfflx                  = 1,
ifsnow                  = 1,
icloud                  = 1,
surface_input_source    = 1,
num_soil_layers         = 4,
num_land_cat            = 24,
sf_urban_physics        = 0,
do_radar_ref            = 1,
/
```

Modifying an existing case
Changing domain size

- Let's say you want to make your domain larger and shift it westward to include more land. We will need to modify:
  - *namelist.wps*
  - *namelist.input*

Original Domain

New Domain
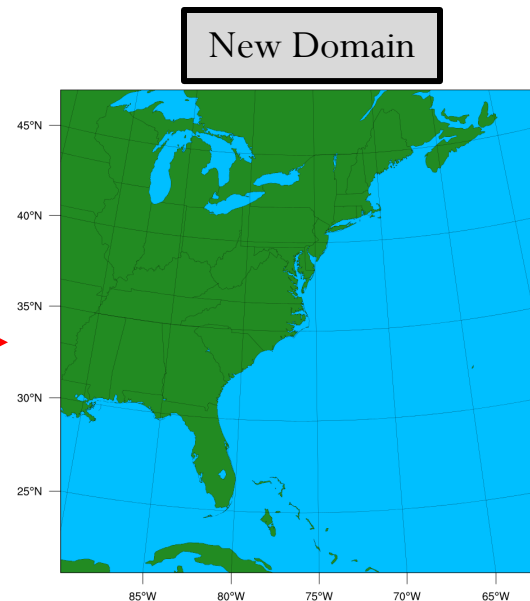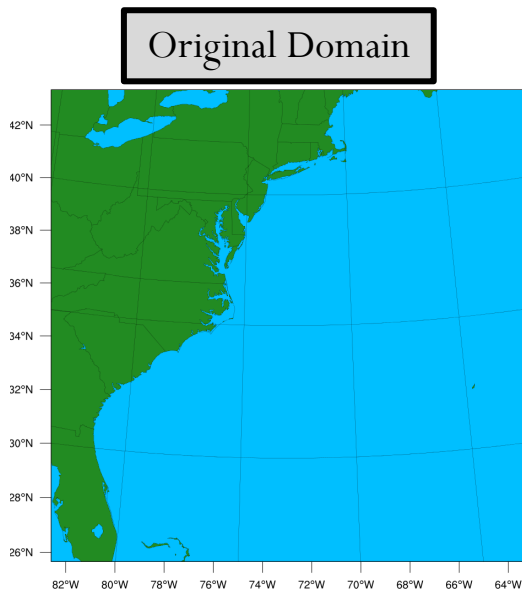
Modifying an existing case
Changing domain size

- First, let's create a new case directory and associated output directories, so we don't overwrite the output from the original run:

```
> export CASE_DIR=${PROJ_DIR}/sandy_run2
> mkdir -p ${CASE_DIR}
> cd ${CASE_DIR}
> mkdir -p wpsprd wrfprd gsiprd postprd nclprd metprd metviewer/mysql
```

- Next, we need to modify the *namelist.wps*:

```
> cd ${PROJ_DIR}/container-dtc-nwp/components/scripts/sandy_20121027
> vi namelist.wps
```

```
Edits to namelist.wps:
e_we: 50 → 75 (line 15)
e_sn: 50 → 75 (line 16)
ref_lon: -73. → -76. (line 22)
stand_lon: -73.0 → -76.0 (line 25)
```

```
&geogrid
 parent_id          =   1,   1,
 parent_grid_ratio  =   1,   3,
 i_parent_start     =   1,  31,
 j_parent_start     =   1,  17,
 e_we               = 75, 112,
 e_sn               = 75,  97,
 geog_data_res      = '2deg+gtopo_10m+usgs_10m+10m+nesdis_greenfrac',
 dx = 40000,
 dy = 40000,
 map_proj = 'lambert',
 ref_lat   = 35.
 ref_lon   = -76.
 truelat1  =  30.0,
 truelat2  =  60.0,
 stand_lon = -76.0,
 geog_data_path = '/data/WPS_GEOG/',
 opt_geogrid_tbl_path = '/comsoftware/wrf/WPS-4.1/geogrid',
/
```

Modified namelist.wps

Modifying an existing case
Changing domain size

- Now, let's take a look at the new domain to make sure it is set up how we want. We will do this by running an NCL script to plot the new domain.

- First, run the **dtc-ncl** container to plot the new domain:

```
> docker run --rm -it -e LOCAL_USER_ID=`id -u $USER` \
-v ${PROJ_DIR}/container-dtc-nwp/components/scripts/common:/home/scripts/common \
-v ${PROJ_DIR}/container-dtc-nwp/components/scripts/sandy_20121027:/home/scripts/case \
-v ${CASE_DIR}/nclprd:/home/nclprd dtc-ncl /home/scripts/common/run_ncl_domain.ksh
```

- The previous step will create *wps_show_dom.png*. To visualize the new domain:

```
> display /home/ec2-user/sandy_run2/nclprd/wps_show_dom.png
```

Modifying an existing case
Changing domain size & namelist options

- Now that we have successfully changed the domain size in *namelist.wps*, we also need to change the domain in *namelist.input*. We also want to change some physics options:

```
> cd ${PROJ_DIR}/container-dtc-nwp/components/scripts/sandy_20121027
> vi namelist.input
```

```
Edits to namelist.input for domain:
e_we: 50 → 75 (line 38)
e_sn: 50 → 75 (line 39)
```

```
Edits to namelist.input for physics options:
mp_physics: 4 → 8 (WSM5 to Thompson; line 57)
cu_physics: 1 → 3 (KF to Grell Freitas; line 65)
```

Modified physics namelist options

```
&physics
mp_physics                  = 8,
ra_lw_physics               = 4,
ra_sw_physics               = 4,
radt                        = 30,
sf_sfclay_physics           = 1,
sf_surface_physics          = 2,
bl_pbl_physics              = 1,
bldt                        = 0,
cu_physics                  = 3,
cudt                        = 5,
isfflx                      = 1,
ifsnow                      = 1,
icloud                      = 1,
surface_input_source        = 1,
num_soil_layers             = 4,
num_land_cat                = 24,
sf_urban_physics            = 0,
do_radar_ref                = 1,
/
```

Modifying an existing case
Running the case

- To run your case with modified domain size and physics options, the commands will be exactly the same as the commands in the tutorial (as long as *CASE_DIR* is set correctly!)

- WPS:

```
> docker run --rm -it -e LOCAL_USER_ID=`id -u $USER` \
--volumes-from wps_geog --volumes-from sandy \
-v ${PROJ_DIR}/container-dtc-nwp/components/scripts/common:/home/scripts/common \
-v ${PROJ_DIR}/container-dtc-nwp/components/scripts/sandy_20121027:/home/scripts/case \
-v ${CASE_DIR}/wpsprd:/home/wpsprd \
--name run-sandy-wps dtc-wps_wrf /home/scripts/common/run_wps.ksh
```

- Real:

```
> docker run --rm -it -e LOCAL_USER_ID=`id -u $USER` --volumes-from sandy \
-v ${PROJ_DIR}/container-dtc-nwp/components/scripts/common:/home/scripts/common \
-v ${PROJ_DIR}/container-dtc-nwp/components/scripts/sandy_20121027:/home/scripts/case \
-v ${CASE_DIR}/wpsprd:/home/wpsprd -v ${CASE_DIR}/wrfprd:/home/wrfprd \
--name run-sandy-real dtc-wps_wrf /home/scripts/common/run_real.ksh
```

Modifying an existing case
Running the case

- WRF:

```
> docker run --rm -it -e LOCAL_USER_ID=`id -u $USER` \
-v ${PROJ_DIR}/container-dtc-nwp/components/scripts/common:/home/scripts/common \
-v ${PROJ_DIR}/container-dtc-nwp/components/scripts/sandy_20121027:/home/scripts/case \
-v ${CASE_DIR}/wpsprd:/home/wpsprd -v ${CASE_DIR}/gsiprd:/home/gsiprd \
-v ${CASE_DIR}/wrfprd:/home/wrfprd \
--name run-sandy-wrf dtc-wps_wrf /home/scripts/common/run_wrf.ksh
```

- You can then follow the steps on the online tutorial to run UPP, NCL, MET, and METviewer to post-process, verify, and visualize your modified case!

Total accumulated precipitation for Hurricane Sandy case w/ modified physics options
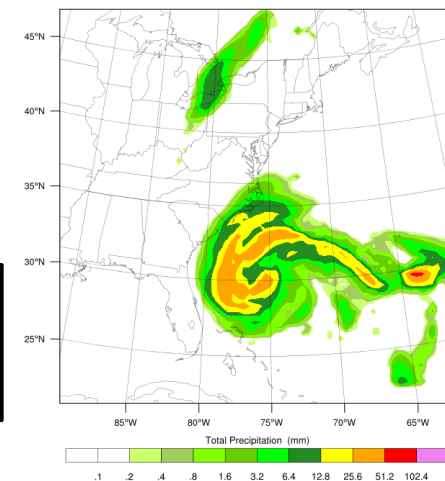
Creating a new case

- Now that you have mastered changing options in the canned cases, let's create a new case!

- New case: 24-h forecast initialized at 00 UTC on 5 Jan. 2020

- We will:

  - Create case-specific scripts and namelists

  - Acquire necessary data from Amazon S3 and mount for use in Docker-space

Creating a new case
Creating necessary files

- To run a new case, the case-specific scripts, namelists, and other files will need to be populated under the **/scripts** directory. The most straightforward way to ensure you have all necessary files to run the end-to-end system is to copy a preexisting case to a new case directory and modify as needed. We will use the **snow** case as a template for our new case, **winter_wx**:

```
> cd ${PROJ_DIR}/container-dtc-nwp/components/scripts
> cp –r snow_20160123 winter_wx
> cd winter_wx
```

Creating a new case
Modifying necessary files

- At a minimum, if you are running the end-to-end system, the *set_env.ksh, namelist.wps, namelist.input*, and XML files under **/metviewer** will need to be modified to reflect the new case. For this example, the only modifications from the **snow_20160123** case will be the date and time.

- Note: for this example, we are only going to run through WRF, so we will not be changing the METviewer XMLs.

- Let's start with *set_env.ksh* (all edits are for changing init time):

```
> vi set_env.ksh
```

```
Edits to set_env.ksh:
Change date in OBS_ROOT: 2016012300 → 2020010500 (line 10)
Change startdate: 2016012300 → 2020010500 (line 19)
Change START_TIME: 2016012300 → 2020010500 (line 36)
```

Creating a new case
Modifying necessary files

- Next, let's edit *namelist.wps*:

```
> vi namelist.wps
```

```
Edits to namelist.wps:
Change start_date: '2016-01-23_00:00:00' → '2020-01-05_00:00:00' (line 4)
Change end_date: '2016-01-24_00:00:00' → '2020-01-06_00:00:00' (line 5)
```

- Then, let's edit *namelist.input*:

```
> vi namelist.input
```

```
Edits to namelist.input:
Change start_year: 2016 → 2020 (line 6)
Change start_day: 23 → 05 (line 8)
Change end_year: 2016 → 2020 (line 12)
Change end_day: 24 → 6 (line 14)
Change num_metgrid_levels: 27 → 34 (due to more current GFS data; line 42)
```

Creating a new case
Creating case directories & pulling data

- Similar to running Hurricane Sandy, we need to set up the variables and directories for the new case:

```
> export CASE_DIR=${PROJ_DIR}/winter_wx
> mkdir -p ${CASE_DIR}
> cd ${CASE_DIR}
> mkdir -p wpsprd wrfprd gsiprd postprd nclprd metprd metviewer/mysql
```

- To run our new case, we will use publicly available GFS data via NOMADS and Amazon S3. We have provided a script that will pull the files necessary to initialize the model. The script, *pull_aws_s3_gfs.ksh*, requires the initialization time and forecast length:

```
> mkdir -p gfs_data
> cd ${CASE_DIR}/gfs_data
> ${PROJ_DIR}/container-dtc-nwp/components/scripts/common/pull_aws_s3_gfs.ksh 2020010500 24
```

Initialization time

Forecast length

In addition to GFS data, we have also provided a script to pull HRRR data from S3!

Creating a new case
Running the case

- To run the new case, the commands will be very similar as the commands in the tutorial, with exception to the new case name and mounting the data from the local filesystem

- WPS:

```
> docker run --rm -it -e LOCAL_USER_ID=`id -u $USER` --volumes-from wps_geog \
-v ${CASE_DIR}/gfs_data:/data/model_data/gfs \
-v ${PROJ_DIR}/container-dtc-nwp/components/scripts/common:/home/scripts/common \
-v ${CASE_DIR}/wrfprd:/home/wrfprd -v ${CASE_DIR}/wpsprd:/home/wpsprd \
-v ${PROJ_DIR}/container-dtc-nwp/components/scripts/winter_wx:/home/scripts/case \
--name run-dtc-nwp-winter_wx dtc-wps_wrf /home/scripts/common/run_wps.ksh
```

- Real:

```
> docker run --rm -it -e LOCAL_USER_ID=`id -u $USER` \
-v ${CASE_DIR}/gfs_data:/data/model_data/gfs \
-v ${PROJ_DIR}/container-dtc-nwp/components/scripts/common:/home/scripts/common \
-v ${CASE_DIR}/wrfprd:/home/wrfprd -v ${CASE_DIR}/wpsprd:/home/wpsprd \
-v ${PROJ_DIR}/container-dtc-nwp/components/scripts/winter_wx:/home/scripts/case \
--name run-dtc-nwp-winter_wx dtc-wps_wrf /home/scripts/common/run_real.ksh
```

Creating a new case
Running the case

- WRF:

```
> docker run --rm -it -e LOCAL_USER_ID=`id -u $USER` \
-v ${PROJ_DIR}/container-dtc-nwp/components/scripts/common:/home/scripts/common \
-v ${PROJ_DIR}/container-dtc-nwp/components/scripts/winter_wx:/home/scripts/case \
-v ${CASE_DIR}/wpsprd:/home/wpsprd -v ${CASE_DIR}/gsiprd:/home/gsiprd \
-v ${CASE_DIR}/wrfprd:/home/wrfprd \
--name run-winter_wx-wrf dtc-wps_wrf /home/scripts/common/run_wrf.ksh
```

- You can then follow the steps on the online tutorial to run
  UPP and NCL to post-process and visualize your new
  case! If you would like to verify the model run, you will
  need to pull the necessary verification data.

For more information...

- The online tutorial has more information on case customization:

  https://dtcenter.org/tutorial-version-3/customization

- There are a number of publicly available data sets to get you up and running your own cases. A list of data sets is collected here:
  https://dtcenter.org/tutorial-version-3/customization/publicly-available-data-sets