UFS Land-DA Workflow

- Day 3: JEDI-bundle & Pre/post-processing -

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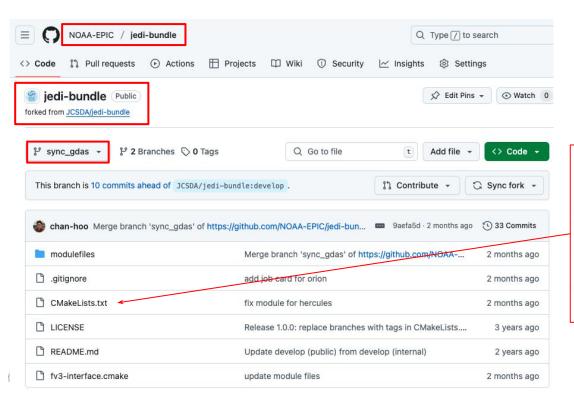
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JEDI-bundle Synced with GDAS App

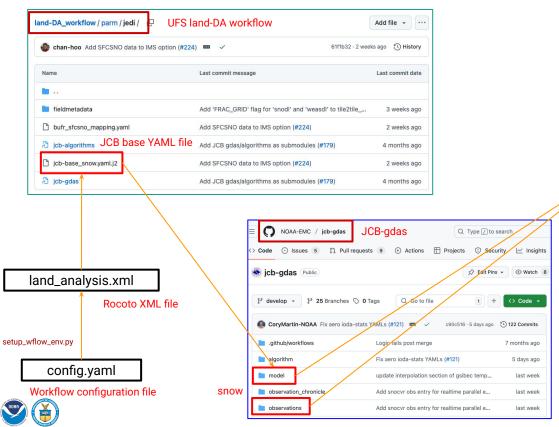
 The JEDI bundle synced with GDAS (NOAA/EMC) is provided in the 'sync_gdas' branch under the NOAA-EPIC fork of the JCSDA/jedi-bundle repository:

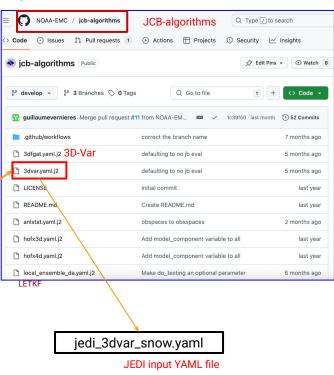




JEDI Configuration by JCB

The JEDI input configuration YAML is created by JCB in the 'jcb' workflow task.





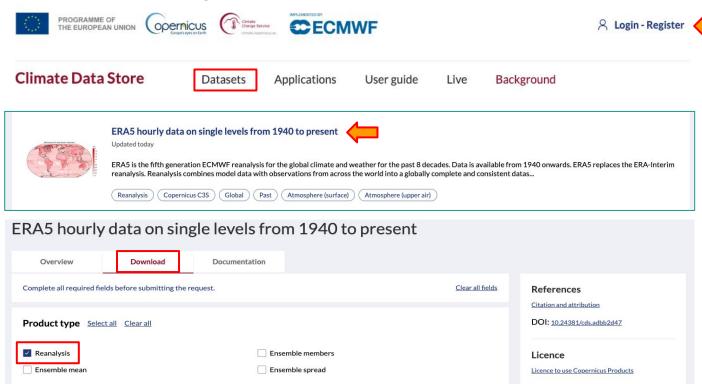
Pre-processing: IODA Converters for Snow Observation Data

- IODA (Interface for Observation Data Access) converters: convert the external data into the format of UFO and OOPS in JEDI.
 - \circ UFO (**U**nified **F**orward **O**perator): Computes the simulated observations H(x) and performs the quality control (QC) and filtering of the observation data.
 - OOPS (Object-Oriented Prediction System): provides data assimilation algorithms.
- IODA converter scripts used in the 'prep_data' task of the UFS land-DA workflow:
 - GHCN data: 'land-DA_workflow/ush/ghcn_snod2ioda.py'
 - Input: {year}.csv, ghcnd-stations.txt
 - Output: ghcn_snwd_ioda_{date}.nc (JEDI format)
 - IMS data: 'land-DA_workflow/ush/imsfv3_scf2ioda.py'
 - Input: ims_{date}.asc (ASCII file) obtained from the archive of GFS/GDAS.
 - Intermediate converter 'calfIMS.exe': Convert the raw ASCII file to NetCDF file
 - Output: obs_{date}.ims_snow.tm00.nc (JEDI format)



Pre-processing: ERA5 (DATM Forcing Data)

The ERA5 forcing data can be downloaded from the Climate Data Store (CDS):



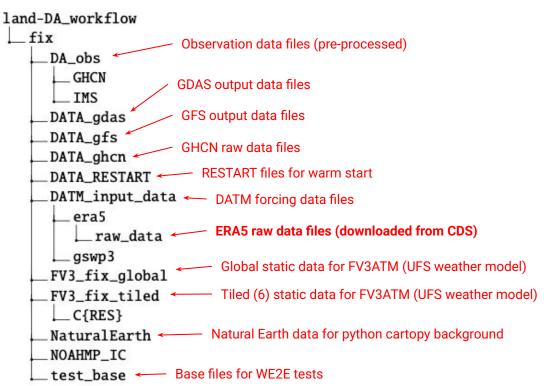
Variables:

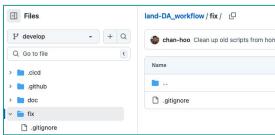
- 1. 10m u-component of wind
- 2. 10m v-component of wind
- 3. 2m dewpoint temperature
- 4. 2m temperature
- 5. Surface pressure
- **6.** Mean surface downward long-wave radiation flux
- 7. Mean surface downward short-wave radiation flux
- 8. Mean total precipitation rate



Static Data (FIX) Directory

The input static data (fix) files are soft-linked into the 'fix' directory by the build script.

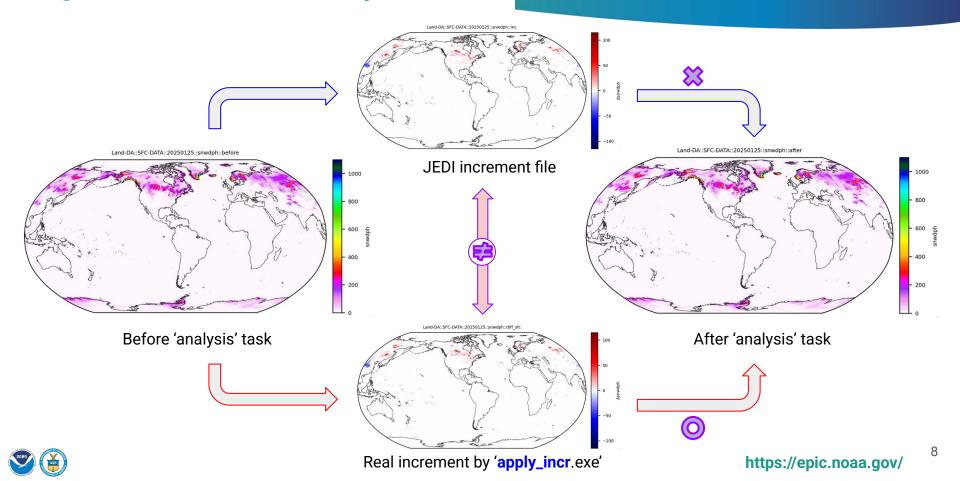




Initially empty in GitHub repository



Diagnostic Plots in Analysis Task



Tile-to-tile Converter

• Two key variable names do not match between two main components of the land model (Noah-MP) of the UFS weather model and JEDI:

Variable name in 'tile2tile_converter'	Description	Land model (Noah-MP)	JEDI (sfc_data)
swe	Snow water equivalent	weasd	sheleg / weasdl
snow_depth	Snow depth over land	snwdph	snwdph / snodl

- The built-in tool 'tile2tile_converter' changes the variable names in two workflow tasks:
 - o In 'pre_anal' task: change from the variable names of UFS Weather Model to those of JEDI
 - In 'post_anal' task: change from the variable names of JEDI to those of UFS Weather Model.
- Source code: land-DA_workflow/sorc/tile2tile_converter.fd



Post-processing: 'plot_stats'

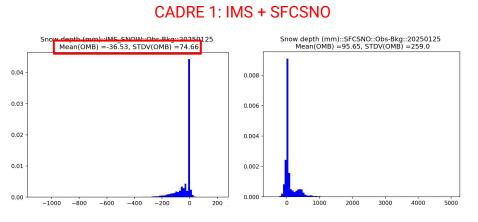
Result file of JEDI: 'diag.{obs_type}_{cycle_date}.nc'

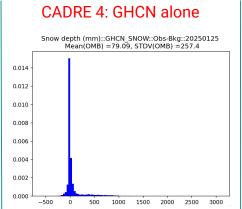
Group name	Description	LETKF	3D-Var
EffectiveError0	UFO's computed effective ObsError value	0	0
EffectiveQC0	UFO's final QC value given by 'QCflags.h'	0	0
MetaData	Ancillary data such as stationElevation, longitude, and latitude	0	0
ObsBias0	Bias correction of observation data	0	0
ObsError	Observation errors from upstream data sources	0	0
ObsValue	Directly measured observation values	0	0
hofx0	End product of the forward operator; H(x)		0
hofx0_1	H(x) of Ensemble member 1	0	
hofx0_2	H(x) of Ensemble member 2	0	
hofx_y_mean_xb0	Mean of H(x)	0	
ombg	Observation - H(Background)	0	0

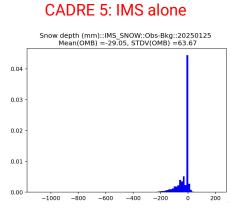


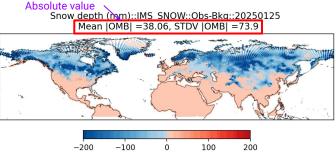
Post-processing: Histogram and Scatter Plots

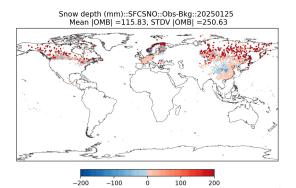
Task 'plot_stats': plots of 'ombg' from JEDI output (histogram / scatter plot)

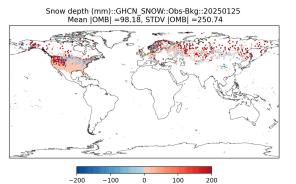
















Post-processing: Time-history Plot

Task 'plot_stats': Time-history plots of ombg over cycles

com_dir/landda.{date}/hofx/{time_history_data}.txt

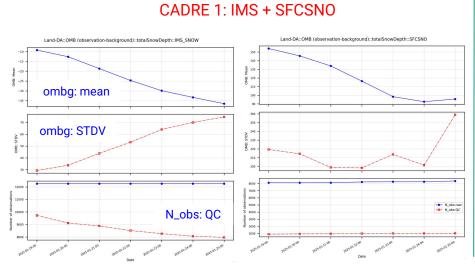
epic 1084787 May 1 20:57 diag.ghcn_snow_2025012500.nc

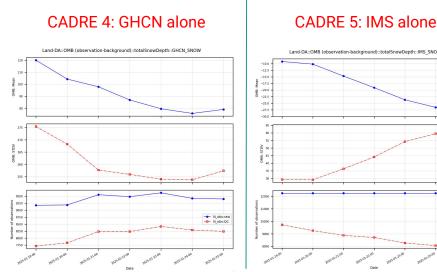
epic 277 May 1 21:04 hofx_omb_timehis_abs_ghcn_snow.txt

epic 301 May 1 21:04 hofx_omb_timehis_ghcn_snow.txt

log_dir/analysis_{date}.log

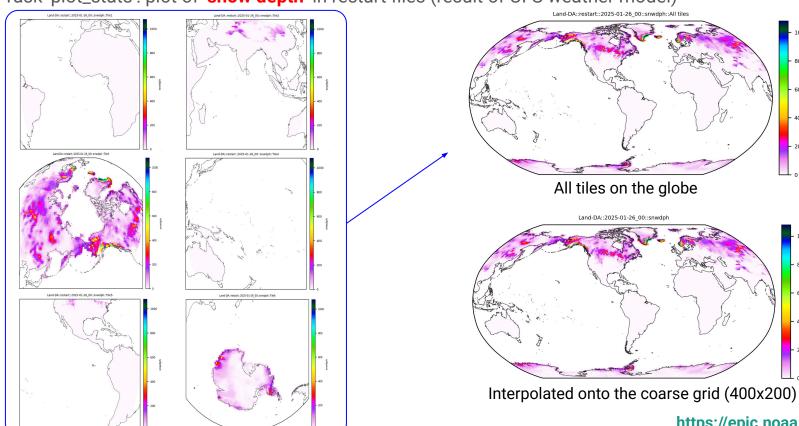
```
QC ims_snow snowCoverFraction: 12254 rejected as processed but not assimilated. QC ims_snow snowCoverFraction: 0 passed out of 12254 observations. QC ims_snow totalSnowDepth: 3 missing values. QC ims_snow totalSnowDepth: 3272 out of bounds. QC ims_snow totalSnowDepth: 319 black-listed. QC ims_snow totalSnowDepth: 43 rejected by first-guess check. QC ims_snow totalSnowDepth: 8617 passed out of 12254 observations.
```





Post-processing: Plots of Restart Files

Task 'plot_stats': plot of 'snow depth' in restart files (result of UFS weather model)

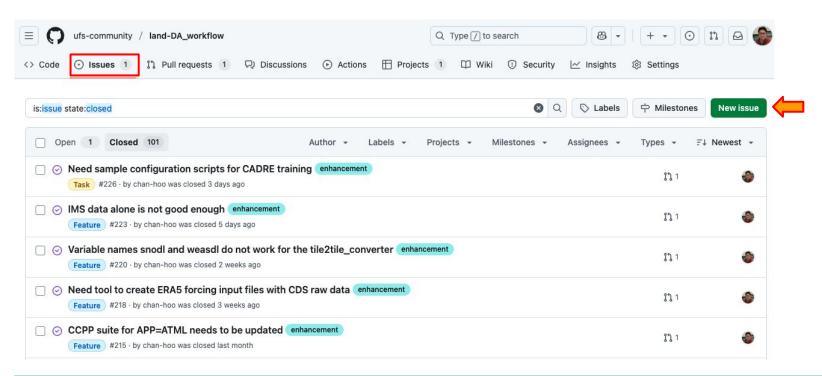






Git Issues to GitHub Repository

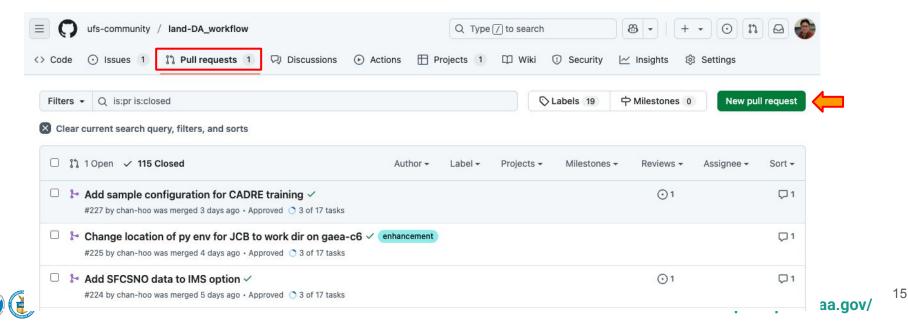
You can open any issues on the land-DA workflow to the GitHub repository:





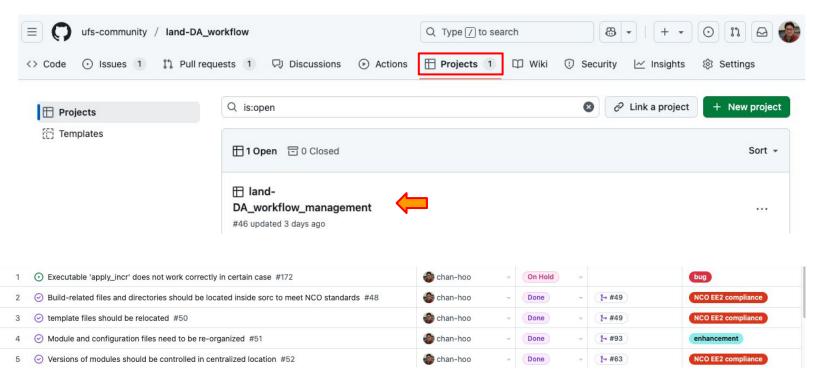
Pull Request (PR) to GitHub Repository

- Every update/development is integrated into the repo through a pull request (PR).
- PRs are reviewed by the code managers and should be approved by at least one.
- All PR commit history can be checked in the GitHub repository.



Project Management in GitHub Repository

The GitHub issues and PRs are managed in the GitHub projects.





Future Plan

- Enhance the coupling option of Noah-MP (land) and FV3ATM (atmosphere).
- Match the configuration/data variables with those of GFSv.17.
- Add another snow observation 'snocvr_snow' used in GFS/GDAS to the workflow.
- Add high-resolution capability (current: C96 = 1 degree ≈ 100km).
- Enhance the post-processing such as limited-area analysis.
- Add another JEDI algorithm to JCB.
- Resolve the hard-coded file name issue on the restart file for the DATM coupling.



Q/A

