NU-WRF Development and Support at NASA GSFC

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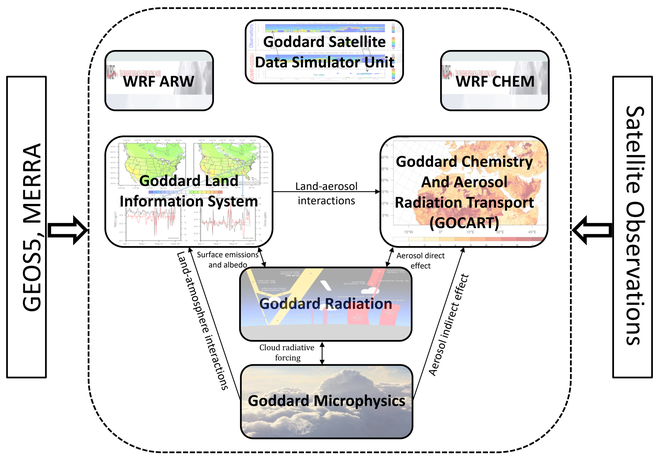
What is NU-WRF?

The **NASA-Unified Weather Research and Forecasting (NU-WRF) model** is an observation-driven regional earth system modeling and assimilation system at satellite-resolvable scale.



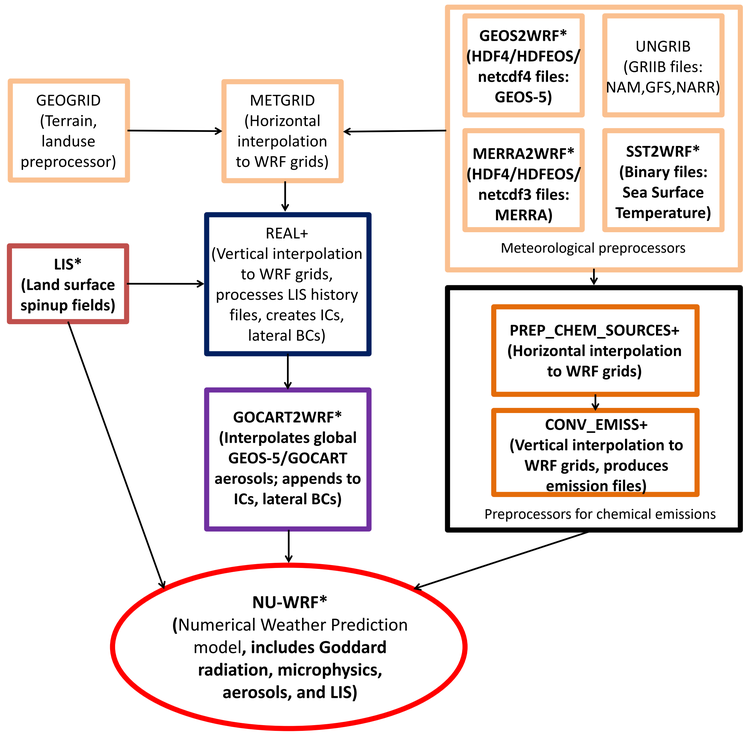
NU-WRF has been developed by integrating
- Goddard Bulk Microphysics
- Goddard SW/LW radiation
- WRFchem GOCART model
- GSFC Land Information System
- G-SDSU

NU-WRF can be driven by GEOS-5 forecasts and/or MERRA global analyses

NU-WRF Components

NU-WRF contains the following components and utilities:
- ARWpost (WRF ARW post processor)
- GSDSU (Goddard Satellite Simulator)
- MET (Model Evaluation Tools)
- RIP4 (Read/Interpolate/Plot version 4)
- UPP (Unified Post Processor)
- WPS (WRF Preprocessing System)
- WRF
- LIS (Land Information System)
- LDT (Land Data Toolkit)
- LVT (Land Visualization Toolkit)
- Utilities → NU-WRF preprocessors:
  - casa2wrf
  - geos2wrf
  - gocart2wrf
  - lis4scm
  - lisWrfDomain
  - ndviBareness4Wrf
  - prep_chem_sources
  - sst2wrf

NU-WRF Preprocessing Steps

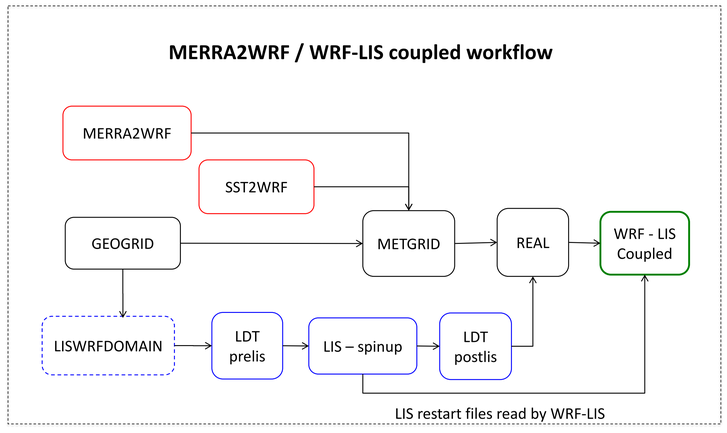


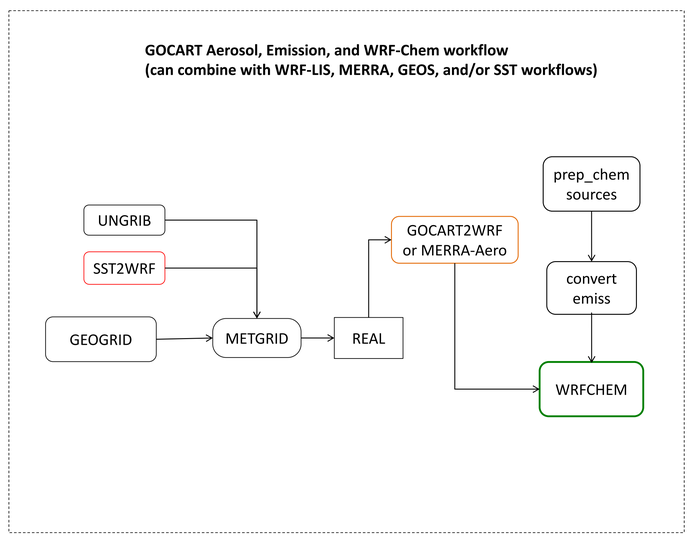
Software Engineering

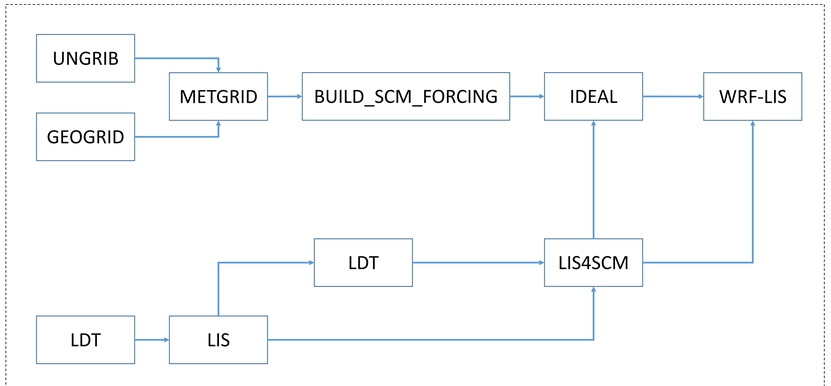
This project involves multiple teams from different organizations with evolving research goals. Therefore, software engineering best practices are needed for software life-cycle management and testing, and to ensure reliability of the data being generated.
- NU-WRF uses **Git** for revision control. Repository is on a NASA machine but there are plans to move project to GitHub.
- **Python-based regression testing framework** is used on 40 use cases to test if any code changes have unintentionally changed the science results or made the software unstable.
- **Python-based build mechanism** facilitates the compilation of model components and portability of the model.
- **System requirements**: Linux, Intel compiler, SGIMPT or Intel MPI. Compiles/runs on MAC with some modifications to scripts/configuration files.

```
Regression testing of NU-WRF Charney patch 1 code base
Repository: /gpfsm/dnbd02/ccruz/devel/nu-wrf/code/nu-wrf.git
-------------------------------------------------------------------------------
Branch: develop  --  Build type: release
-------------------------------------------------------------------------------
          BUILD and/or RUN NAME                 COMPILER        RESULT   BASELINE
-------------------------------------------------------------------------------
                    chem                        intel-sgimpt      b+       -
                    kpp                         intel-sgimpt      b+       -
                    scm                         gnu-mvapich2      b+       -
                    scm                         intel-sgimpt      b+       -
                    wrf                         intel-sgimpt      b+       -
         chem_3iceg_2014rad_gocart              intel-sgimpt      r+       +
         chem_3iceh_2014rad_gocart              intel-sgimpt      r+       +
          chem_4ice_2014rad_gocart              intel-sgimpt      r+       +
                chem_casaco2                    intel-sgimpt      r+       +
               chem_erod_dyn                    intel-sgimpt      r+       +
chem_erod_dyn_noah36_modis_merra2_lis_spinup    intel-sgimpt      r+       +
              chem_gfed4_gocart                 intel-sgimpt      r+       +
               chem_qfed_gocart                 intel-sgimpt      r+       +
           kpp_gfed4_gocartracm                 intel-sgimpt      r+       +
           kpp_qfed_gocartracm                  intel-sgimpt      r+       +
             wrf_3iceg_2014rad                  intel-sgimpt      r+       +
          wrf_3iceg_2014rad_lake                intel-sgimpt      r+       -
             wrf_3iceh_2014rad                  intel-sgimpt      r+       +
              wrf_4ice_2014rad                  intel-sgimpt      r+       +
              wrf_4ice_2017rad                  intel-sgimpt      r+       +
               wrf_arw_katrina                  intel-sgimpt      r+       +
                wrf_arw_simple                  intel-sgimpt      r+       +
   wrflis_noah36_justsk_modis_merra2            intel-sgimpt      r+       +
       wrflis_noah36_modis_gdas                 intel-sgimpt      r+       +
      wrflis_noah36_modis_merra2                intel-sgimpt      r+       +
 wrflis_noah36_modis_merra2_lis_spinup          intel-sgimpt      r+       +
    wrflis_noah36_modis_merraland               intel-sgimpt      r+       +
      wrflis_noah36_umd_merra2                  intel-sgimpt      r+       +
     wrflis_noah36_usgs_merra2                  intel-sgimpt      r+       +
          wrflis_scm                            intel-sgimpt      r+       +
-------------------------------------------------------------------------------
Time taken = 03:12:53
-------------------------------------------------------------------------------
Legend:
------
+   : task success
F   : task failure
C   : created baseline
b   : _build_ task
r   : _run_ task
v   : _verification_ task
-   : Not available
Notes:
------
intel compiler version: 17.0.4.196
gnu compiler version: 6.3
Results in: /discover/nobackup/projects/nu-wrf/regression_testing/gitrepo/results/
-------------------------------------------------------------------------------
Commits from last day:
-------------------------------------------------------------------------------
```

NU-WRF Workflows







New WRF-LIS Single Column Model workflow
WRF-LIS runs with horizontally homogeneous fields with unstaggered 2x2 grid

Software Availability

NU-WRF Source is available from GSFC via a Software Usage Agreement. See:
https://nuwrf.gsfc.nasa.gov/software
Email to: carlos.a.cruz@nasa.gov
For more information about NU-WRF see:
https://nuwrf.gsfc.nasa.gov

Acknowledgments

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