

**NBD-PWG**  
**Making Analytics as Services Use Case Template**  
October 13, 2020, v1

**Case Study Title: Numeric Weather Prediction**

*Wo Chang, Daniel Keirouz* (former summer intern), NIST, US

**Background**

Large amounts of weather data are produced continually and stored in many different databases. Accurate weather predictions require large amounts of processing power to accurately simulate conditions worldwide at a high resolution and frequent intervals. One of the most computationally consuming parts of a reliable weather model is the microphysics scheme. The current microphysics scheme, Weather Research and Forecasting (WRF) Single Moment 6-class Microphysics (WSM6), simulates the processes in the atmosphere that lead to the formation and precipitation of rain, snow, and graupel and requires complex floating-point operations needing to be performed on vast amounts of data for accurate simulations. As computer performance improves, so does the Numerical Weather Prediction (NWP) models' resolution and accuracy. However, there is still much progress to be made, as simulation accuracy still falls off significantly for predictions more than 36 hours in advance. Figure 1 shows the general WRF modeling system flow chat.

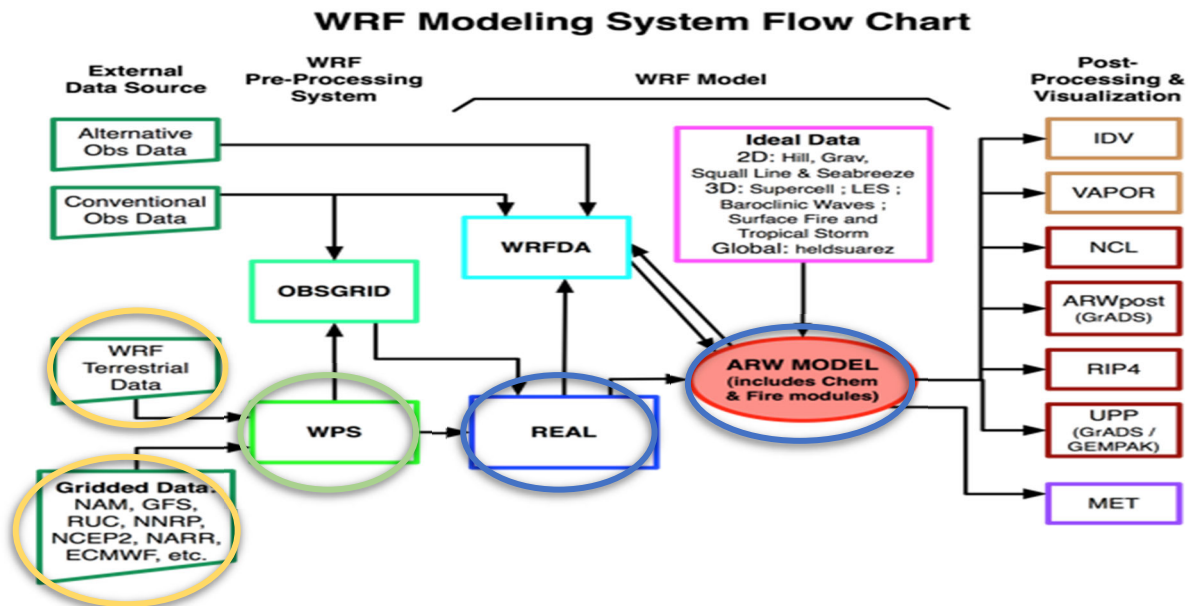


Figure 1: WRF Modeling System Flow Chart with Various Configuration.

**Functionalities and Activities (based on Big Data Application Provider of NBDIF Ref. Architecture)**

In this case study, we only focus on two main functionalities, namely WPS and WRF, and their activities. Figure 2 shows the cross-functional diagram for their actions.

WPS Activities:

1. *geogrid* – defines simulation domains and interpolate various terrestrial data sets to the model grids. Input data available at [1].
2. *ungrib* – extracts needed meteorological data and packs it into an intermediate file format. Input data available at [2]
3. *metgrid* – prepares horizontally interpolate the meteorological data onto the model domain. Input data from the output of *geogrid* and *ungrib*.

WRF Activities:

1. *real* – prepares vertically interpolates the output from *metgrid*, and creates a boundary and initial condition files with some consistency checks.
2. *wrf* – generates a model forecast.

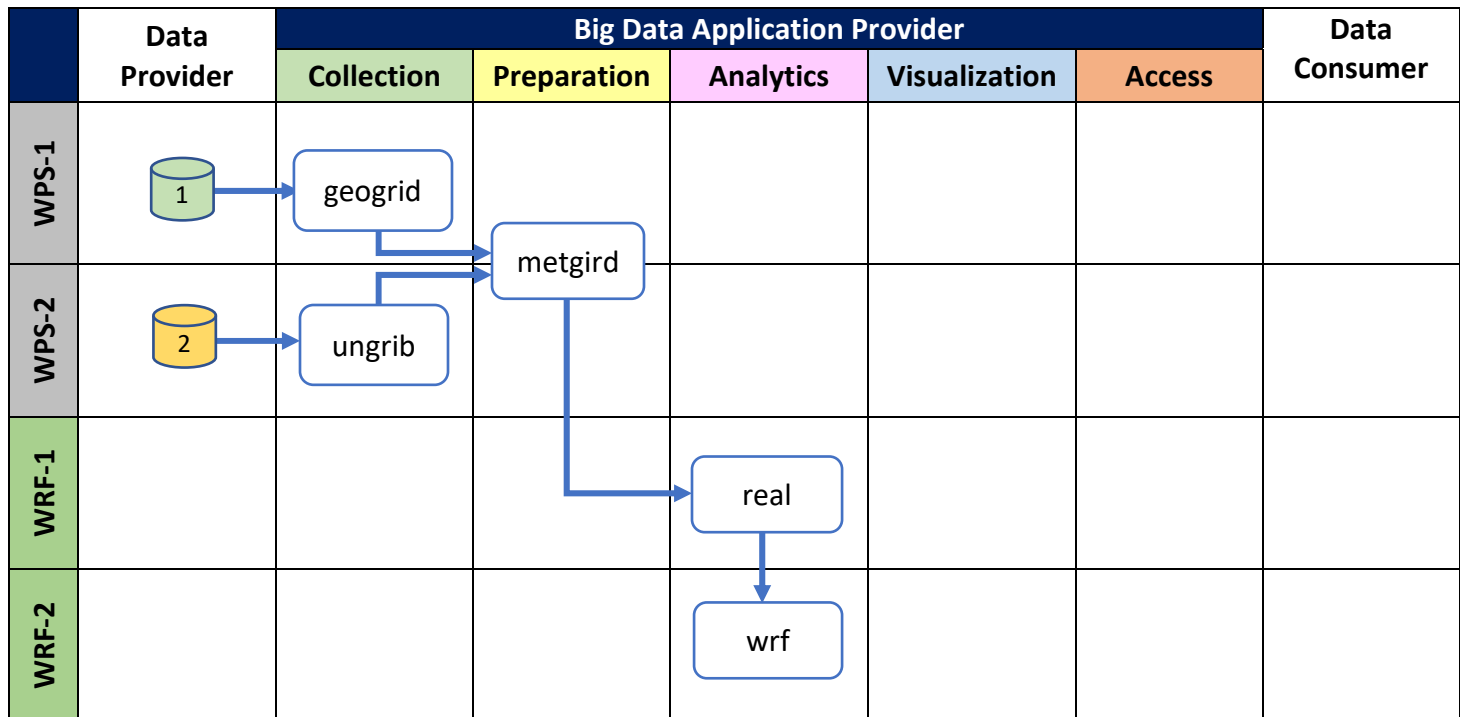


Figure 2: Cross-Functional Diagram

Datasets:

- [1] [http://www2.mmm.ucar.edu/wrf/users/download/get\\_sources\\_wps\\_geog.html](http://www2.mmm.ucar.edu/wrf/users/download/get_sources_wps_geog.html)
- [2] <https://rda.ucar.edu/datasets/ds083.2/#!access>