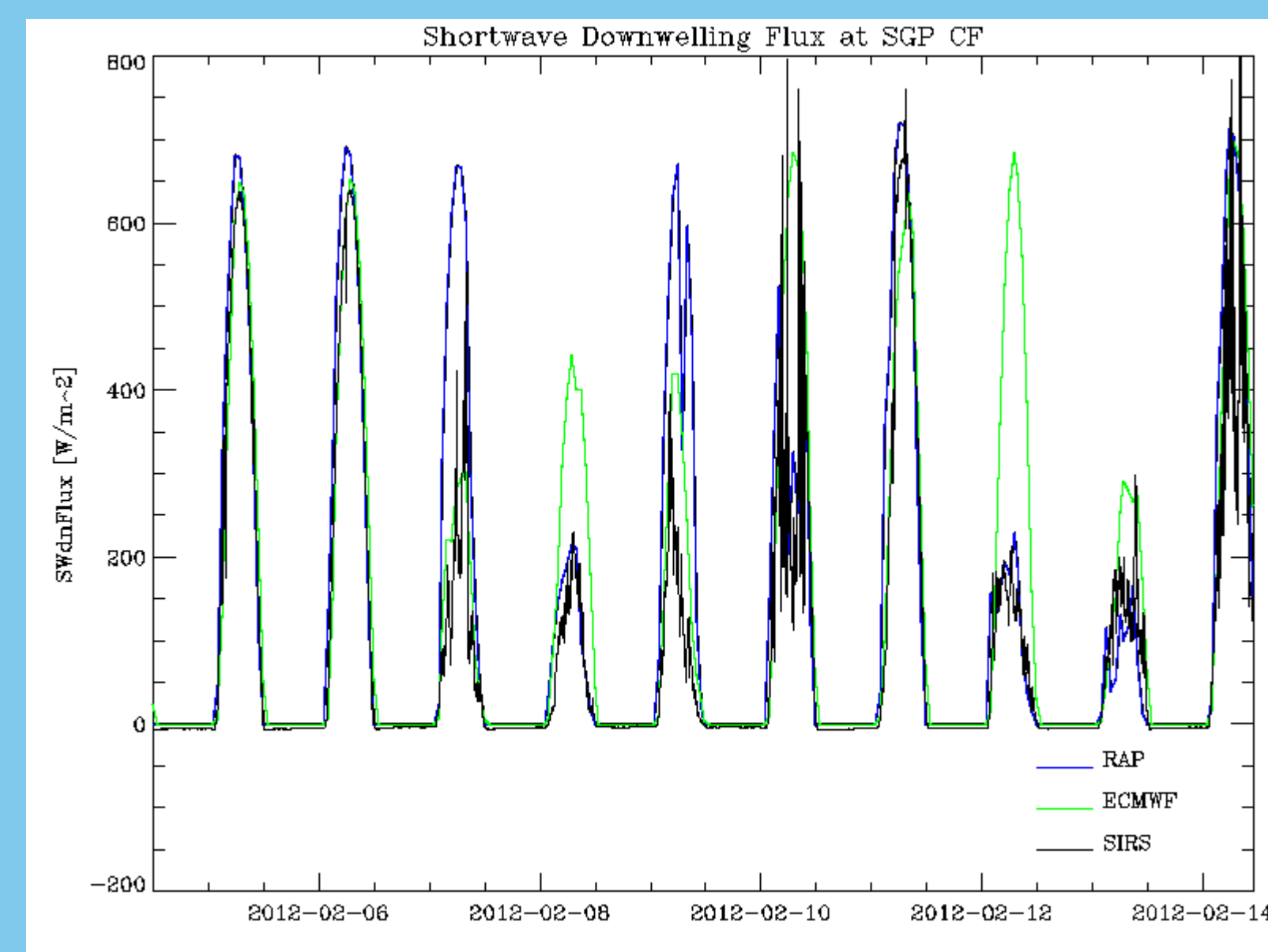# An introduction to the NCEP Rapid Refresh model data: The next-generation replacement for RUC

Richard Wagener, Laurie Gregory, and Lynn Ma
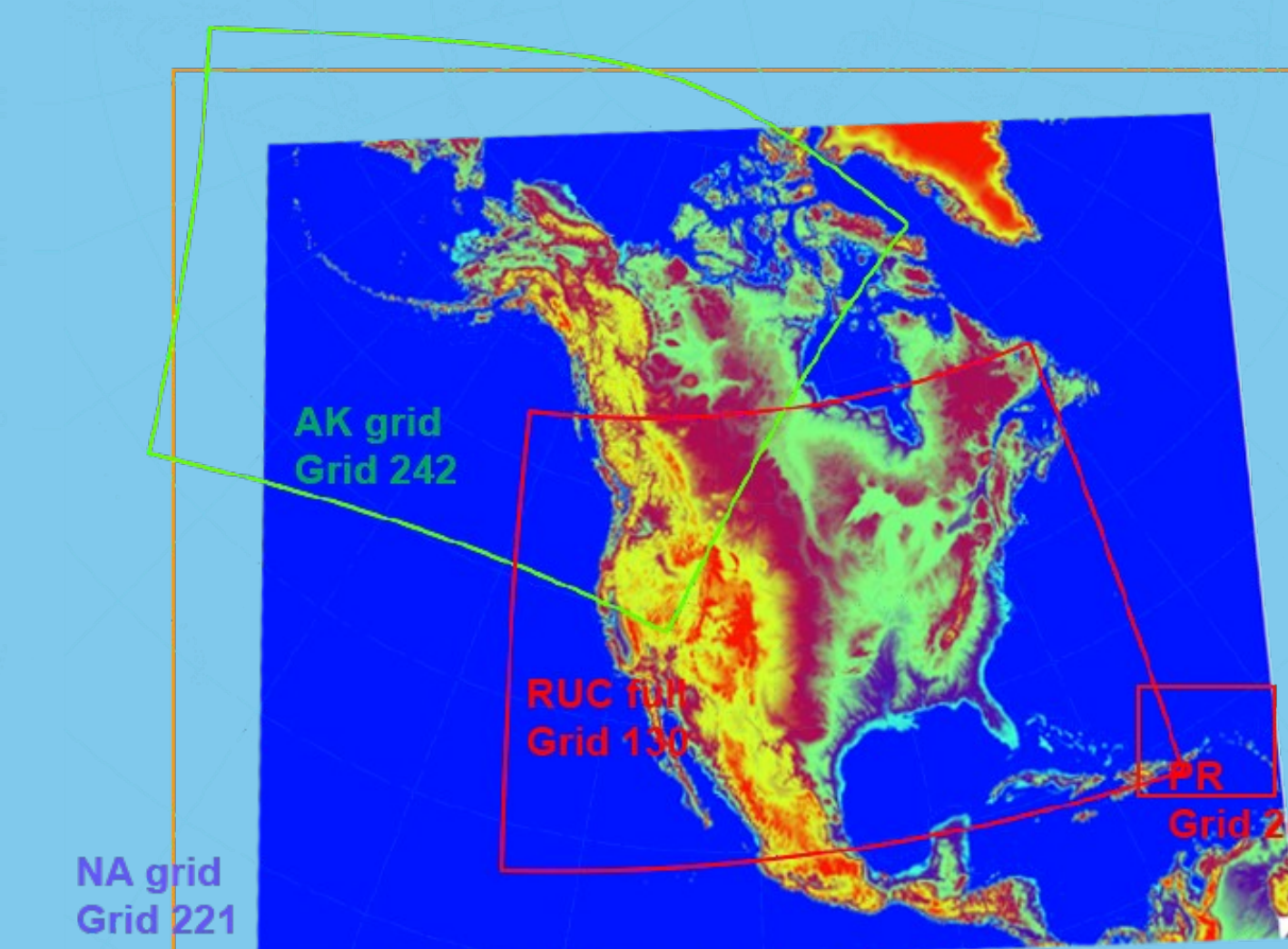*Brookhaven National Laboratory, Upton, New York*

RUC

The Rapid Update Cycle (RUC), developed by NOAA's Forecast Systems Laboratory and run operationally at the National Centers for Environmental Prediction (NCEP), is an atmospheric prediction system comprised primarily of a numerical forecast model and an analysis system to initialize that model. ARM, via the External Data Center, has collected and archived the hourly analysis data since 1994. Data are available to users in both Grib and netCDF formats. This data-set in the ARM Archive is the only long-term archive of this model. It has attracted a large variety of users and applications, has found its way into a number of VAPs, and is one of the most requested ARM data-sets. Here we want to alert the ARM community of the impending changes in progress at NCEP.

RAP

On 2012-03-20, the RUC model is expected to be replaced with the next generation model called Rapid Refresh (RAP). This model is based on a rapidly refreshing configuration of the Weather Research and Forecasting (WRF) model. The RAP model output products differ from the RUC data in horizontal resolution, domain size, grid type, and variables.
• Larger domain (all of North America)
• GFS boundary instead of NAM
• Sigma vertical coord. instead of hybrid
• Pressure top 10 hPa instead of 40/70 hPa.
• Native grid: rotated lat/lon.
• Additional observations assimilated:
  • AMSU-A/B radiances
  • Aircraft moisture (UPS, SWA)
  • 915-MHz wind profilers
  • GOES cloud top pressure from NASA/Langley
• Model Upgrade: Advance Research WRF (ARW)
  • Updated cloud microphysics
  • Grell convection
  • land-surface schemes
• New products:
  • Full domain 32-km (AWIPS grid 221)
  • Alaska 11-km (AWIPS grid 242)

New RAP Variables

RAP now includes downwelling shortwave and longwave fluxes at the surface. The shortwave flux is shown here in comparison to the ECMWF diagnostic values and the SIRS observations.
There are many more variable changes, additions, and improved definitions for CAPE and CIN. See References below for detail.
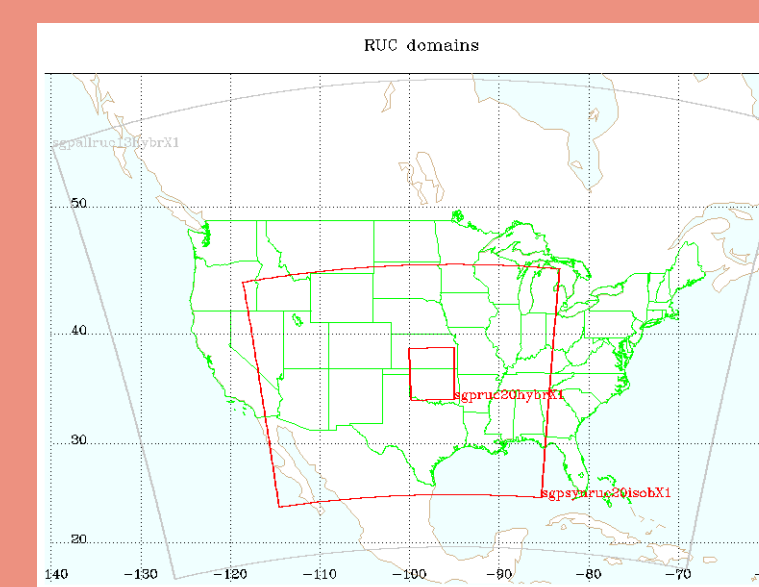
ARM RUC Products

ARM archives only analysis (0h forecast) data on both the model layers (hybr) and on pressure levels (isob). The full domains (Grids 130 (13-km) and 252 (20-km)) are only archived in GriB format and available on special request. 24 hourly files are subsetted around the SGP and merged into a single daily netCDF file.
•sgpruc20isobX1.c1
•sgpruc20hybrX1.c1
In addition, hourly netCDF files are produced on a larger synoptic domain, but averaged to an effective grid resolution of 40 km.
•sgpsynruc20isobX1.c1
The basic state variables (u,v,w,T,RH) from a single grid-cell of the sgpruc20isobX1.c1 over the SGP are also included in sgpcmbe_atm.

NCEP RAP Grids

Because of bandwidth limitations NCEP will not distribute the full resolution model on the whole NA domain Grid 221, but instead produce 13-km CONUS Grid 130 (like RUC-13) and Grid 242 at 11-km resolution centered over Alaska. The full domain will be made available only at 32-km resolution on Grid 221 (similar to the NAM).

Options for new ARM RAP Products

NCEP will continue to produce the Grid 130 and 252 products.
• Continue producing daily merged netCDF around SGP but at 13-km resolution instead of 20-km, and rename to "rap13" because of significant DOD changes.
• Stop collecting Grid 252, but instead collect 11-km Grid 242 for NSA.
• Add a subset netCDF product for NSA covering the immediate area around Barrow, Atqasuk, and Oliktok

Requested Feedback to xdc_oper@arm.gov:
• Should ARM archive RAP data?
• What size domain for NSA?
• Do we need a synoptic scale lower resolution domain for NSA?

References:
http://rapidrefresh.noaa.gov/
Stan Benjamin et al. NOAA/ESRL/GSD/Assimilation and Modeling Branch:
http://ruc.noaa.gov/pdf/RAPbrief.NWS-22Feb2012-FINAL-b.pdf

More Information:
ARM XDC RUC data-stream details:
http://www.arm.gov/xdc/xds/ruc