

**Criteria for Upgrades to NCEP's Global and Regional Atmospheric Data
Assimilation Systems**

Jan 19, 2007

IT Compatibility

- General system configuration and functionality criteria
 - Must work properly on NCEP operational and research computers.
 - Uses all operationally available observations in operational formats
 - Analyzes all operational variables
 - Applicable to global and regional domains
 - Applicable to hurricane initialization
 - Capable of initializing forecast model at operational horizontal and vertical resolution
 - Produces all operationally required diagnostic information and output fields in NCEP file formats and visualization requirements
 - Inputs all operationally required input fields and data in NCEP standard formats
 - Uses standard NCEP utility routines and software packages wherever possible
 - Run-time (scripting) environment consistent with NCEP Central Operations (NCO) best practices
 - Code structure and usage conforms to current operational codes whenever possible
 - Impacts of any proposed changes to operational formats, codes and systems must be considered across all of NCEP's numerical forecast systems; changes must be negotiated with NCEP staff and changes must be propagated and tested across NCEP's system as needed

Forecast benefits

- General performance testing criteria for models
 - Period of testing
 - At least 6 weeks from each of two separate seasons (summer and winter)
 - Objective forecast verification criteria - global
 - Produces forecasts at least as skillful as operations in standard scores at lead times from 6 h to 15 days
 - 500 hPa Anomaly Correlation (AC) – Northern and Southern Hemisphere (NH and SH)
 - 850 hPa and 200 hPa Root Mean Square (RMS) vector wind error
 - RMS fits to temperature and wind observations at standard pressure levels in NH and SH and various subregions out to 48 hours
 - maintains skill of ozone latitudinal mean bias and rms error
 - Produces equivalent
 - Hurricane track error performance (see hurricane criteria)

- CONUS precipitation threat and bias for 0-84 h
 - Acceptable performance for secondary variables such as stratospheric ozone and temperature, tropospheric moisture
 - Does not produce any substantial degradation in the forecast skill of any other operational field.
- Subjective evaluation using model output fields for
 - 0-5 days by HPC
 - Week 2 performance by CPC
 - 0-3 day performance by SPC
 - Global aviation performance by AWC
 - Tropical performance by TPC
 - Ocean cyclogenesis by OPC
- Objective verification criteria – regional
 - Produces forecasts at least as skillful as operations in standard scores (RMS and bias) versus observations at lead times from 3-84 h
 - Majority of pressure levels from 850-200 hPa
 - 2 m temperature and dew point and 10 m wind
 - Produces equivalent scores on CONUS precipitation equitable threat and bias for 0-84 h
 - Acceptable performance for secondary variables such as cloud amount, visibility, CAPE/CINH, daytime maximum temperature, nighttime minimum temperature, the height/pressure of PBL depth, freezing level and tropopause, and threats to aviation (turbulence, icing and convection)
- Subjective verification criteria – regional
 - 0-3 day performance evaluation by
 - HPC
 - SPC
 - AWC
 - TPC and OPC (surface winds)
- Specific performance testing criteria for data assimilation impacts on model performance
 - Meet specific criteria for specialized model applications (e.g. Coupled Hurricane System, Climate Forecast System, Real-Time Ocean Forecast System, Air Quality Forecast System). See, e.g., associated document: NCEP Hurricane Forecast System Requirements Document
 - Meet specific criteria for associated global and regional atmospheric, ocean and land data assimilation systems. See associated document: NCEP.data.assimilation.t2o.criteria

Efficiency

- Computation performance

- Computational performance applies to all major components of the NCEP Production Suite, including
 - Global Data Assimilation System (GDAS)
 - Global Forecast System (GFS)
 - Regional Data Assimilation System (RDAS)
 - North American Model (NAM)
 - Rapid Refresh (RR)
 - Coupled Hurricane System (HUR)
 - Climate Forecast System (CFS), including the Global Ocean Data Assimilation System (GODAS)
 - Air Quality Forecast System (AQFS)
 - Real-Time Ocean Forecast System (RTOFS)
 - Global and Regional ensemble systems
 - Fits into NCEP Production Suite resource window for each of the following computer resources
 - Processors
 - Memory
 - Timing
 - Efficient use of computing resources through message-passing, threading and other standard High Performance Computing protocols
 - Scales well with anticipated future NCEP computing hardware
- ← - - - Formatted: Indent: Left: 54 pt
- In cases where additional computing resources are required to execute the upgrade operationally, the value-added by the upgrade will be weighed against the increased computing resources. In the event additional resources are not available on the NCEP operational computer, the upgrade has sufficient value-added to warrant implementation and other criteria are met, the upgrade will be scheduled for implementation when a new operational computer is available.

Sustainability

- Software Management and Capabilities
 - Meets (negotiated) requirements for response to emergencies (e.g. system failures)
 - Capable of progressive future upgrades by NCEP/EMC and partners
 - Written in standard languages (Fortran, C, C++ and other languages with mutual arrangement)
 - Uses minimum code structure complexity to meet operational mission and anticipated future requirements
 - Code is sustainable by NCEP staff and can be fully understood, navigated and modified without excessive difficulty
 - Contains inline documentation in NCEP standard format (e.g. docblock)
 - Adaptable to NCEP's changing computing environment and portable to major computing architectures
 - Conforms to the NCEP code management system (e.g. "Subversion")