World Area Forecast System

- Created in 1984 to consolidate Significant Weather Chart production.
- Wind/Temp/Rh/Height grids began in 1990s
- Hazard grids for Cb, Turbulence and Icing approved by ICAO in 2013.
WAFS Current Products
Significant Weather Charts

High Level FL240–630 (Latest: 06Z updated at 1252Z)
Click on the region for a larger view, hover to see extent

North Polar Stereographic
- ICAO Area H [Color | B&W]
- ICAO Area I [Color | B&W]

Central Mercator
- ICAO Area A [Color | B&W]
- ICAO Area B1 [Color | B&W]
- ICAO Area F [Color | B&W]
- ICAO Area M [Color | B&W]

South Polar Stereographic
- ICAO Area J [Color | B&W]
WAFS Current Products
Global 1.25 Degree Grids
Limits of Current WAFS Turbulence Grid

• Only provides uncalibrated turbulence potential.
• Output of blend with UK is simple:
  – Max
  – Mean
• No indication of severity.
• 1.25 degree resolution.
WAFS Roadmap

accepted by joint WMO/ICAO MET Division meeting

• Based on Discussions at Joint IATA/WAFC Meeting in Feb, 2013 and again in Feb 2014.
• Probability of Exceeding Severity Thresholds for Aviation Hazards.
• Increased Resolution.
• Three Step Plan that Follows Aviation System Block Upgrade (ASBU) Plan.
ASBU 0 – today thru 2018

• Implement improved turbulence algorithms, including the replacement of turbulence potential with turbulence severity (i.e. eddy dissipation rate (EDR))

• Implement improved icing algorithms, including the replacement of icing potential with icing severity

• Global and regional verification of WAFS forecasts by utilizing data provided by States and user organizations
ASBU 1 2018 thru 2023

- Implement cumulonimbus cloud ensemble based prediction system
- Implement turbulence type forecasts (e.g. convection, jet-stream shear, terrain) utilizing
- Implement finer grid resolution for WAFS data
- Implement calibrated probabilistic forecasts for icing, turbulence and cumulonimbus cloud
- Provide partial datasets of meteorological information suitable for integration into flight planning, flight management and air traffic management (ATM) decision support systems for en-route weather
- Implement significant weather forecasts (SIGWX) in XML/GML format as a replacement to SIGWX in BUFR format
- Make available WAFS data via the System Wide Information Management (SWIM)
ASBU 3 2028+
note there is no ASBU 2 for MET

- Fully integrated multi-member/multi-State global ensemble hazard forecasts
- Implementation of high spatial and temporal resolution models resulting in improved representations of meteorological information
- Provide full dataset of meteorological information covering en-route weather suitable for integration into flight planning for en-route operations, flight management and air traffic management (ATM) decision support systems
- Fully automated gridded and significant weather forecast (SIGWX) output
- Full implementation of system wide information management (SWIM) for access to WAFS data
- Retirement of legacy WAFS products and dissemination systems
Probability

• Created by multi-center ensemble
  – Calibrated against observations, not blended.
  – Initially limited to U.S. and U.K. global ensembles.
  – Could incorporate grids from other states.
• User selectable severity thresholds
SREF Total Precip in NE Oklahoma
SREF Prob 3hr precip > 0.25”
Ensemble Pro/Con

• Pro
  – Diversity in models and initialization
  – Good at locating area of hazard
  – Ensemble spread provides valuable information about range of possibilities
  – Smarter way of blending multiple models
Ensemble Pro/Con

• Con
  – Computationally expensive
  – Requires more data exchange
    • Maybe just exchange probabilities
  – Requires verification data to tune
    • As does any method of producing probabilities
    • Can use reforecasting to tune
  – Max and Min values can get washed out
    • Can use probability matched mean to restore extremes
Cumulative Probability Along Flight Path

- Prob EDR >6
- Prob EDR >4
- Prob EDR >2

Distance:
- 500 KM
- 1000 KM
- 1500 KM
- 2000 KM
Benefits of Higher Resolution
Current WAFS 1.25 Degree Cb Grid
0.5 Degree Cb Grid
WAFS 1.25 Degree Max Turbulence
0.12 Degree Turbulence (from GTG)
Costs of Higher Resolution

• File Size Increases
  – 0.5 degree is 23 percent larger
  – 0.12 degree is xx percent larger

• Can be Mitigated by
  – Keeping the lower resolution data available.
  – Allowing selective downloading
Selective Downloading

You may select some or all levels and variables. The selections below represent common choices which may or may not be relevant to the files that you have selected. For example, choosing RH (relative humidity) would be pointless in file of sea-surface temperatures. In addition, not all possibilities are allowed. For example, suppose you only want the virtual temperature at the tropopause at 01Z. In this case you would have to transfer the entire file.

For GRIB 2 data only.

Select the levels desired:

Select the variables desired:

File transfer times can be reduced by only transferring a subregion. You can use this section to extract a geographic subsection from a GRIB file. Use negative numbers for south and west.

Above Selections Return This URL to Use for Scripts =

http://nomads.ncep.noaa.gov/cgi-bin/filter_gfs_hd.pl?file=gfs.t00z.mastergrb2f09&lev_surface=on&var_ACPCP=on&subregion=&leftlon=0&rightlon=-180&toplat=90&bottomlat=0&dir=%2Fgfs.2014012700%2Fmaster
Future Thoughts

• What if the WAFS Global Ensemble included grids from all qualified providers?
• What if the WAFS Global Ensemble was available at multiple resolutions?
• Could the WAFS Global Ensemble become the world’s digital weather data source?
  — Seamless
  — Because it is calibrated against observations, it would provide the best data available, regardless of the original source.