P2.12 ACCESS TO GLOBAL RADIOSONDE AND SURFACE STATION OBSERVATIONS INCLUDING ERA-40 ASSIMILATION MODEL METADATA FROM NCAR

Douglas C. Schuster*, Joseph L. Comeaux II, and Steven J. Worley
National Center for Atmospheric Research, Boulder, Colorado

1. INTRODUCTION

Uncertain confidence in observational data quality and consistency presents a continuing challenge in atmospheric research. Investigations of long-term climate trends provide one example where this uncertainty needs to be mitigated (Seidel, et al. 2004). Global atmospheric reanalysis projects also require the highest possible input data quality to produce the best representative analyses. In order to do this, various quality control (QC) and data assimilation schemes are used (Kistler et al, 2001). Metadata derived from these schemes include observation quality information and observation versus model field departures. These metadata add value to the data and are helpful in understanding the analysis.

The ECMWF 45-year Re-Analysis (ERA-40) project has produced a set of output records (feedback) containing QC and model comparison metadata. The Data Support Section (DSS) of the Scientific Computing Division (SCD), Computational and Information Systems Laboratory at NCAR has reformatted the radiosonde and surface station feedback records into an easy to use ASCII format. The feedback metadata includes QC flags for entire reports and individual data values, and differences between observed values and interpolated six-hour forecasts and final model analyses. Further, in the case where the QC report leads to data rejection some details on why the rejection occurred are given.

Web interfaces provide direct access to online files and options to create spatial and temporal subsets and selectable output formats. Through the same interfaces users have access to complete dataset documentation and software to decode the data. These data are available only for non-commercial research in the U.S. and some locations in Canada. The radiosonde feedback dataset can be found at http://dss.ucar.edu/datasets/ds366.0 and similarly, the land surface station feedback dataset is at http://dss.ucar.edu/datasets/ds476.0.

2. ACCESS

The complete archive is nearly 570 Gigabytes (GB), with the radiosonde archive totaling 380 GB, and the surface station archive totaling 190 GB. The web interfaces provide multiple data access options for both archives. Users may directly download individual weekly files via the web or select a data subset for delayed mode File Transfer Protocal (FTP) download. Sub-setting options include time period, horizontal spatial coverage, and output format selection. Output formats include the DSS created ASCII format, and a spreadsheet compatible format.

In cases where access to the feedback record archive through the Internet is not practical, the data may be copied to writeable media. Media options will be commensurate with the data request size and will be arranged by the data specialist listed on the web interface.

Finally, the entire feedback record archive is also available on the NCAR Mass Storage System (MSS). Access to the MSS is restricted to users with NCAR computer accounts as provided by SCD. To apply for an account, please contact Database Services at dbs@ucar.edu or visit the web page at http://www.scd.ucar.edu/docs/access/accounts.html.

3. DATA PRODUCTS

Radiosonde and surface station feedback record products include metadata information gathered during the ERA-40 data assimilation process. Metadata are included describing the status of the entire report, and individual variables within a report. Model comparative metrics are also included for individual report variables. Both sets are global in coverage and are derived from multiple source datasets. All reports include sets of input variables and analysis variables. ECMWF model Integrated Forecast System (IFS) cycle CY23R4 was used for variational analysis in producing the ERA-40 feedback metadata (ECMWF, 2003).

3.1 Input Variables

Input variables are retrieved directly from the ECMWF observation database that has been built from multiple data sources. Rudimentary QC is done and includes checks for observation format and station position, climatological and hydrostatic limits, and internal and temporal consistency. A confidence value is assigned to each variable indicating data quality based on these rudimentary checks. Lower quality input variables are more likely to be rejected by the subsequent variational analysis system (VAS).

3.2 Analysis Variables and Feedback Parameters

Analysis variables are a converted version of the input variables. The conversion is required to make a uniformly formatted dataset that is compatible with the VAS (e.g. wind direction and speed are converted to U-wind and V-wind speeds in m/s). Analysis variables are run through the VAS and assigned various feedback parameters. These parameters include Variational Analysis Final Flag (VAFF), Variational Analysis Blacklist Flag (VABF), Variational Analysis Datum Status (VADS), Variational Analysis Datum Events (VADE), Final Observation Error (FOE), First Guess

* *Corresponding author address:* Douglas C. Schuster, Nat'l Ctr. for Atmospheric Research, Boulder, CO 80307-3000; email: schuster@ucar.edu.

Departure (FGD), and Final Simulation Departure (FSD).

VAFF and VABF describe whether an analysis variable was accepted or rejected by the VAS. VADE describes why a variable was accepted or rejected.

FOE is a parameter used in the variational analysis process, and is dependent on the VAS structure. It's defined as a combination of persistence and prescribed observation error. Persistence observation error is formulated to reflect an observation's dependence on season, and geographical position. Prescribed observation error reflects the performance of the observing systems as components of the VAS over a long period of operational use (ECMWF, 2003).

FGD and FSD give departure values between the analysis observation variable values and spatially interpolated model fields. FGD is the analysis observation variable departure from the initial background (6-hour forecast) field. FSD is the analysis observation variable departure from the final analysis (observation included in the analysis).

3.3 Report Feedback Parameters

Entire reports are assigned feedback record parameters after the individual report variables have been examined by the VAS. These parameters describe whether and why a complete report was accepted or rejected by the VAS. They include Variational Analysis Report Events (VARE), Report Blacklist Events (RBLE), and Variational Analysis Report Status (VARS).

VARE and RBLE describe why a report was rejected or blacklisted. VARS gives the status of the report, describing whether it was accepted, rejected, or blacklisted.

3.4 Radiosonde Feedback Record Reports

Radiosonde reports are available at 00, 06, 12, and 18 UTC and the input and analysis variables are listed in Table 1. Variable values are generally available at mandatory and significant levels, and occasionally at much higher vertical resolution.

Input Variables	Analysis Variables
Pressure (Pa)	Height (m)
Geopotential (m^2/s^2)	Temperature Dry Bulb (K)
Temperature Dry Bulb (K)	Relative Humidity (%)
Dew Point (K)	U-wind speed (m/s)
Wind Direction (Deg)	V-wind speed (m/s)
Wind Speed (m/s)	

Table 1. Input and Analysis Variable Types Found in Radiosonde Feedback Record Reports.

3.5 Surface Station Feedback Record Reports

Surface Station reports are available in 3-hourly intervals from 00 to 21 UTC. The input and analysis variables are listed in Table 2.

Input Variables	Analysis Variables
Pressure (Pa)	Pressure (Pa)
Mean Sea Level Pressure (Pa)	Relative Humidity (%)
Relative Humidity (%)	Station Height (m)
2 m Temperature Dry Bulb (K)	10 m U-wind speed (m/s)
2 m Dew Point (K)	10 m V-wind speed (m/s)
10 m Wind Direction (Deg)	
10 m Wind Speed (m/s)	

Table 2. Input and Analysis Variable Types Found in Surface Station Feedback Record Reports.

4. DATA FORMAT and SOFTWARE

All feedback record data have been archived in an ASCII format. Easy to use software supported by the DSS specialist provides the ability to read, subset, and reformat the data into a spreadsheet compatible, or customized format. Perl and Fortran-77 versions of the software are currently available.

5. SUMMARY

The ERA-40 project has produced a valuable archive of observational data feedback record products covering a 45-year period, September 1957-August 2002. The archive includes global radiosonde and surface station data derived from multiple source datasets. Assimilation model metadata accompany the observational data, providing potential benefits for observational studies by making supplemental QC indicators available. Observational values versus model determined fields yield comparative metrics that provide additional information for studies based on ERA-40 model products.

Access to the feedback record archives is offered in several ways:

- Native ASCII files are online and available for direct download by web and FTP transfer. Temporal and spatial subset extraction is also possible by delayed mode processing.
- Data may be provided on writeable media, upon request.
- All feedback record data are available to NCAR users from the MSS.

The primary focus is to provide a high quality archive with an emphasis on data delivery. The NCAR ERA-40 feedback record archive has been designed to promote efficient access for a large variety of users and requests. It is actively supported by data specialists who provide consultation on the archive products, locally developed software, and individual requests that require non-routine data processing and possible data delivery on media. Many data services and access methods for the archive are now available while still more will be developed in the future.

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