A demonstration of data encoding for statistical post-processing of NWP output

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ABSTRACT

NOAA's vision for modeling is to engage with the public, private, and academic sectors in a Modeling Community, and we are pursuing this goal aggressively. Only with appropriate contributions from the entire U.S. modeling community will we be able to build the best national modeling system possible. This vision extends beyond Numerical Weather Prediction (NWP) to Statistical Post-processing (StatPP) of NWP output. At the same time, the NWS is in the early stages of developing a Weather Information Statistical Post-processing System (WISPS). WISPS is a community-based software system, designed to support StatPP using modern software languages and self-describing data formats.

WISPS has proposed an application profile of the netCDF (Network Common Data Form) data storage standard and its associated Climate and Forecast conventions (CF; netCDF-CF). This application profile contains a number of best practices that can expand netCDF-CF when applied to StatPP, enhance data interoperability, and promote collaboration with the community.

This poster will offer concrete examples of these data encoding techniques as they apply to common scenarios drawn from StatPP in operational meteorology.

WISPS Goals

- Develop community software framework and data formatting standards for StatPP
- Emphasize modern tools and techniques

Building Blocks

NetCDF data format

Well-supported, flexible data encoding for array-oriented data. (Future switch to HDF possible.)

http://www.unidata.ucar.edu/software/netcdf/docs/

Climate and Forecast (CF) Conventions

Defines metadata, spatial, and temporal properties of data. Conventions for attributes (standard_name, long_name, units), auxiliary variables (cell methods, time_bounds), and controlled vocabularies.

http://cfconventions.org/cf-conventions/v1.6.0/cf-conventions.html

ISO Standards

Data models and controlled vocabularies designed to apply across many disciplines. Widely accepted outside of traditional weather and water communities.

http://www.opengeospatial.org/standards/om

Linked Data

Method of publishing structured data that enables interlinking of data, human and machine access. Builds on standard web technologies (HTTP, RDF, URI). Enables connections and queries among data from different sources

https://codes.nws.noaa.gov

Data Encoding Demonstration

Below, we present two examples of metadata encoding adapted specifically for statistical post-processing. The first example shows how metadata would be encoded for a mesonet surface observation. The second describes a sample gridded field from the National Blend of Models.

The relevant portions of the netCDF codes are included in this center column. Supporting information that is found in the NWS Codes Registry is shown in the right column.

Sample Field from an Archive of Mesonet Surface Observations

```
short MESONET_TotalPrecip_24_2_(number_of_stations=3000, default_time_coordinate_size=744);
 :ancillary_variables = "OM_resultTime OM_validTime OM_phenomenonTimePeriod24hr
   MesoObProcStep1 MesoObProcStep2 MesoObProcStep3";
 :standard_name = "precipitation_amount";
 :long_name = "24-hour precipitation amount";
 :cell_methods = "default_time_coordinate_size :sum";
 :OM_observedProperty = "https://codes.nws.noaa.gov/StatPP/Data/Met/Wx/TotalPrecip";
 :OM_procedure = "( MesoObProcStep1,MesoObProcStep2,MesoObProcStep3 )";

short MesoObProcStep1;
 :LE_ProcessStep = "https://codes.nws.noaa.gov/StatPP/Methods/Ingest/DecodeTabularText";
 :LE_Source = "https://codes.nws.noaa.gov/StatPP/Data/Source/MADISMesonet";
 :long_name = "Ingest tabular text-encoded mesonet data from MADIS";

short MesoObProcStep2;
 :LE_ProcessStep = "https://codes.nws.noaa.gov/StatPP/Methods/QC/MesoQC";
 :long_name = "Apply MDL mesonet Quality Control technique";

short MesoObProcStep3;
 :LE_ProcessStep = "https://codes.nws.noaa.gov/StatPP/Methods/QC/GeospatialQC";
 :long_name = "Identify and resolve geospatial inconsistencies";
```

Attribute names based on ISO controlled vocabularies

Entries in the Codes Registry document these attributes.

This attribute references a linked data entry in the NWS Codes Registry

Sample Field from the National Blend of Models

```
float nbm_temperature(time_03h=77, nsta=3018);
 :ancillary_variables = "phenomenon_time_03h resultTime validTime forecast_reference_time";
 :standard_name = "dew_point_temperature";
 :long_name = "2m Dewpoint Temperature";
 :OM_observedProperty = "https://codes.nws.noaa.gov/StatPP/Data/Met/Temp/DewPt";
 :OM_procedure = "( NBM_technique )";

short NBM_technique;
 :LE_Source = "https://codes.nws.noaa.gov/StatPP/Data/Source/NBM0301Inputs";
 :LE_ProcessStep = "https://codes.nws.noaa.gov/StatPP/Methods/NBM";
 :LE_Algorithm.citation = "https://codes.nws.noaa.gov/StatPP/Methods/NBM/NBMVersions/NBM0301";
 :long_name = "National Blend of Models version 3.1";
```

This attribute references a linked data entry in the NWS Codes Registry

Additional entries in the Codes Registry document these attributes.

Associated Codes Registry Entries

https://codes.nws.noaa.gov / StatPP / Methods / QC / _GeospatialQC — stable

Entry: Geospatial Quality Control

Core metadata | Reg metadata | Download | History

URI: https://codes.nws.noaa.gov/StatPP/Methods/QC/GeospatialQC

A set of geospatial checks generally used for mesonet observations that move relatively frequently

Definition

description	A set of geospatial checks generally used for mesonet observations that move relatively frequently
label	Geospatial Quality Control
notation	GeospatialQC
notation	GeospatialQC
type	Concept

https://codes.nws.noaa.gov / StatPP / Data / Met / Temp / _DewPt — stable

Entry: Dewpoint temperature

Core metadata | Reg metadata | Download | History

URI: https://codes.nws.noaa.gov/StatPP/Data/Met/Temp/DewPt

Dewpoint temperature

Definition

description	Dewpoint temperature
label	Dewpoint temperature
references	0 0 6
type	Concept

Acknowledgement

We acknowledge the contributions of Mark Antolik in the development of the controlled vocabulary for statistical post-processing that we present here.

Contact Information

WISPS documentation can be found at https://sats.nws.noaa.gov/~wisps/

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