WIGOS Transition —

U.S. Challenges and Impacts as the International Community Transitions from Legacy WMO Identifiers to a WIGOS Identifiers for all Surface-based Observing Platforms

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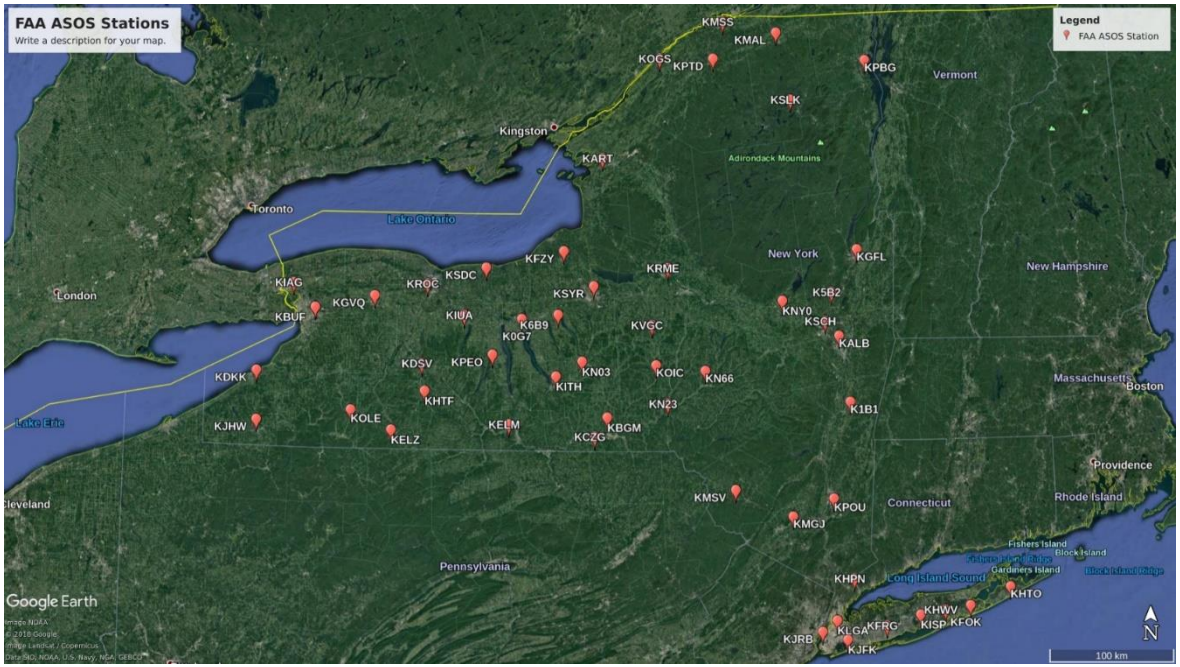
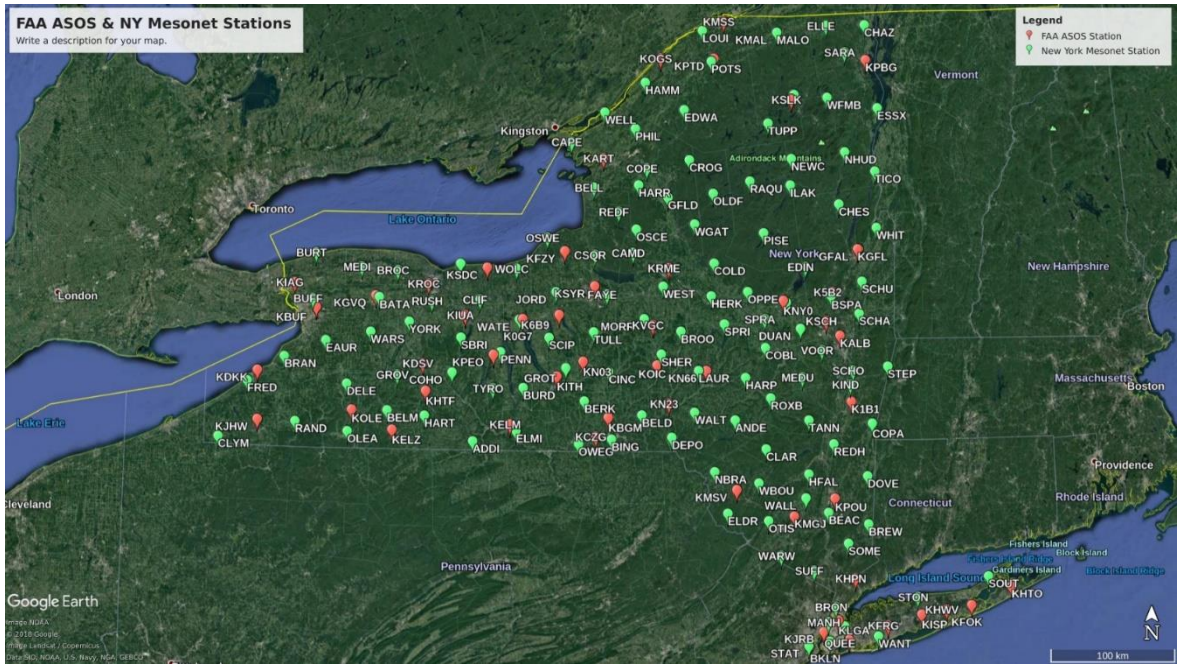
Motivation for Shift



- **Legacy TAC meta-data catalogues**
  - Severely limited the amount of observational data that could be exchanged
  - Number of internationally exchangeable observations indirectly limited by the number of unique WMO station IDs

- **Graphic depicting FAA ASOS sites (red) for the state of New York. (https://www.faa.gov/air_traffic/weather/asos/?state=NY)**

Motivation for Shift



- **Further advancement in NWP analysis and forecasting skill requires:**
  - Ability to integrate into new, higher density mesonet observing networks vice discrete observing networks
  - Ability to monitor and exchange quality observational data between National Meteorological and Hydrological Services (NMHSs), academia, commercial/private enterprise, and Research & Development

What happened to Vol A?

- **WMO Pub.9, Volume A, "Observing Stations and WMO Catalog of Radiosondes":**
  - One of several legacy meta-data catalogues used for exchange of Traditional Alphanumeric Code formatted data
  - Limited number of unique 5-digit WMO station IDs constrained the amount of observational data that could be exchanged internationally
- **In order to extend the number of and allow for the expected future growth in observing stations/networks, international community must:**
  - Terminate the use of 5-digit WMO station IDs
  - Transition to a completely new methodology of assigning unique identifiers to observing platforms for international observational data exchange
- **To accomplish this, the WMO and its co-sponsored observing systems are transitioning to WIGOS (WMO Integrated Global Observing System).**

What is WIGOS?

- **WIGOS provides:**
  - A common framework for all sources of observations (research, operational, public and private)
  - A one-stop shop for all observing systems metadata (WIGOS Information Resource to include the OSCAR databases)
  - Identification of observing system gaps and/or observing system over-saturation due to overlapping observing systems operated by disparate entities within the same geographic location (WIGOS Rolling Review of Requirements (RRR))
  - Ensure real-time international exchange of quality observations via the WIGOS Data Quality Monitoring System

- **WIGOS spans all WMO and co-sponsored observing systems (GOS, WHOS, GAW, GCW…)**
  - Sensors/platforms in space, air, surface and sub-surface
  - Entered “Pre-operational Phase” in May 2016

WIGOS Metadata

- **WIGOS Metadata Standard (WMDS)**
  - Specifies the metadata elements (both optional and required fields) for observations that are to be recorded and exchanged
- **Observing Systems Capability Analysis and Review (OSCAR) database**
  - Official repository of WIGOS component observing systems instrument and platform metadata that are required for international exchange according to the WIGOS Metadata Standard (WMDS)
  - Web based tool
  - OSCAR/Surface replaced significantly extended WMO Publication No. 9, Volume A in May 2016 (Pre-Operational Phase)
  - WIGOS Station Identifiers, whose structure consists of four sections of alpha-numeric values, replaced the traditional (legacy) 5-digit station identifiers (from Pub 9, Vol A) within OSCAR/Surface
  - WIGOS Station Identifiers link the station to its WIGOS metadata

WIGOS Station Identifiers

- **WIGOS Station IDs utilized in Table Driven Code Form (BUFR/CREX) equivalent observations**
  - TAC format cannot accommodate the (much) longer WIGOS Station Identifier
  - WIGOS Station IDs have no meaning
  - Related to (but not directly part of) the larger “TAC to BUFR” transition
- **Legacy WMO Publication No. 9, Volume A (TAC) Example:**
  - 72662: Rapid City, North Dakota, United States
  - 72250: Brownsville, Texas, United States (SYNOP & RAOB)
- **WIGOS Station Identifier Examples:**
  - 0-20000-0-72662: Rapid City, North Dakota, United States (SYNOP)
  - 0-20001-0-72662: Rapid City, North Dakota, United States (RAOB)
  - 0-20000-0-72250: Brownsville, Texas, United States (SYNOP & RAOB)

WIGOS Station ID Components

- **WIGOS Station ID have four parts:**

WIGOS Identifier Series (number)	Issuer of Identifier (number)	Issue Number (number)	Local Identifier (characters)
0 01 125	0 01 126	0 01 127	0 01 128
4 bits = 2 digits	16 bits = 5 digits	16 bits = 5 digits	128 bits = 16 chars (a-z), (A-Z), (0-9), (-), (_), (.)
Only series “0” has been defined; identifies observing stations	WMO Program or Country/National Identifier	Typically zero for WMO Programs & WMO Co-Sponsored Programs; can range from 0-65535 for national schemas	For WMO Programs & Co-Sponsored Programs, typically the “legacy” WMO Identifier; can be (up to) any 16 char string for national schemas
0	20001	0	72662

Challenges with WIGOS Station IDs

- **Software unable to process Table Driven Code Forms (BUFR/CREX) will not be able to:**
  - Decode/Display BUFR observations regardless if report contains legacy WMO Identifier (Example: Spain & France Radiosonde Data)
- **Decoding BUFR observations with WIGOS Station IDs is relatively trivial, however…**
  - Data providers will need to update applications to handle the longer WIGOS Station Identifiers
  - Without update, applications will not be able to take advantage of observations from new stations/networks that will only be assigned WIGOS Station Identifiers (Example: New York mesonet)
- **WIGOS Station Identifiers are much longer than legacy WMO Identifiers, so one of the major challenges will be for NMHS (NWP) centers to account for this within their internal processing**
  - FNMOC's current innovation vector format uses 16-character platform identifiers with the identifier itself limited to 5 characters for radiosonde and surface land data and to 7 characters for buoys
  - ECMWF will not be ready to process WIGOS Station IDs until summer 2019
  - Accommodating WIGOS Station Identifiers poses significant difficulties!

U.S. NAVAL RESEARCH LABORATORY

Loss of Data Example

- **TAC-to-BUFR transition and shift to WIGOS Station Identifiers will require:**
  - Applications that are capable of reading/decoding Table Driven Code Form (BUFR/CREX) formatted data
  - Applications must be able to display at least the 16 character Local Identifier (but may require the ability to display the full WIGOS Station ID to maintain uniqueness)

- **Graphic pulled from the University of Wyoming Department of Atmospheric Sciences on 07 Dec 2018 (http://weather.uwyo.edu/upperair/sounding.html)**
  - **NOTE: Radiosonde data missing from Spain and France. Both countries have completed their transition from TAC to BUFR and are no longer distributing TAC TEMP.**

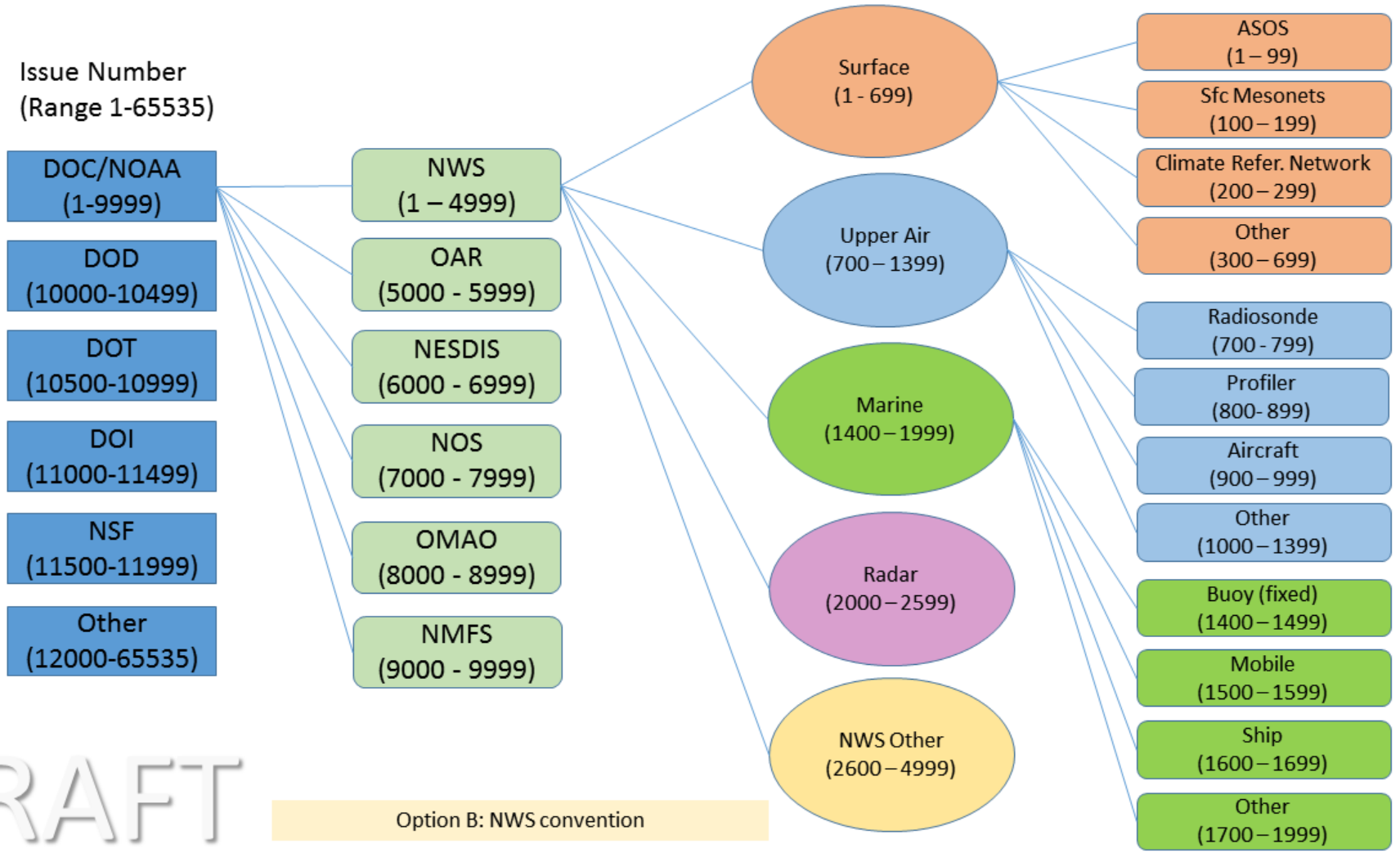
Challenges with WIGOS Station IDs (con't)

- **WIGOS Station Identifier implementation plan pushed to the national level to develop country specific schemas**
  - No international standard
  - Can have multiple WIGOS Station Identifiers representing the exact same station (i.e. one assigned by WMO Program and another issued at the national level)
  - Some countries plan to use the "Issue Number" to represent when a station moves; other countries (U.S.) are considering using the "Issue Number" to indicate which Department/Agency is responsible for maintaining the sensor/platform

- **Lax rules for nations to follow when generating the Local Identifier could lead to confusion on whether or not a WIGOS Station ID represents a truly unique platform/station or does the Local Identifier have a typo?**
  - Are these unique or the same station?
    - 0-840-0-abc123
    - 0-840-0-Abc123
    - 0-840-0-ABc123
    - 0-840-0-ABC123
    - 0-840-0-aBC123
    - 0-840-0-abC123

U.S. WIGOS Schema Concept

U.S. national WIGOS schema *may* use "Issue Number" to delineate sensors/platform managed by various Departments/national Agencies



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Option B: NWS convention

The way forward…

- **In late-spring 2018, WMO formed the Task Team on WIGOS Station Identifiers (TT-WSI) to address some of these concerns**
  - Membership includes members from U.S., Canada, U.K., Australia, Japan, Korea, Brazil and Norway

- **Members met at the 1st Session on TT-WSI held in Oslo, Norway (17-20 Sep 2018)**

The way forward… (con't)

- **Key recommendations from 1st Session on TT-WSI:**
  - Need to develop a more constrained WSI structure
    - Local ID must use either all uppercase or lowercase characters
    - Require 16 characters to be used in Local ID (padding maybe required)
    - Establish procedures on how to pad Local ID (i.e. what character will be used and from which direction)
    - Reserve "Issue Number" blocks for different types of organizations (i.e. National Level Departments/Agencies, Academia, etc)
  - Develop a process where trusted 3rd party organizations can assign WSI for stations located in other nations (i.e. a not-to-interfere-basis with the national WSI schema)
  - Develop the procedures for the operational transmission of WSI in BUFR messages (i.e. 3-6 months advanced notice to the international community would be required prior to transmitted observations that included WSI)
  - BUFR messages that contain WSIs for legacy WMO Program platforms must continue to include the WMO legacy Identifier in the BUFR message for the foreseeable future (i.e. WMO Block & Station number, Buoy number, etc)
  - Reduce the number of mandatory WIGOS metadata fields when registering a new station/WSI in OSCAR/Surface (currently 30+ required fields)
  - Need a repository for documentation describing national schemas for WSI

Summary

Transition from legacy WMO Identifiers to WIGOS Station Identifiers has already begun

- End state will allow for greater access by end users to environmental sensors/networks managed by NMHSs, academia, commercial/private enterprise, and the R&D communities
- Significant effort will be required to update applications/code in order to process reports in TDCF as well as being able to incorporate the much longer WIGOS Station Identifiers
- Large degree of freedom for countries to independently develop their national WSI implementation schema may prove problematic for both data providers and data users
- Migration from legacy WMO Identifiers to new WSI format has started but it is expected to take years for completion


Questions?

Reserve Slides

WIGOS References

- **WMO Publications**
  - WMO-No. 49 (Volume I – General Meteorological Standards and Recommended Practices)
  - WMO-No. 1160 (Manual on the WMO Integrated Global Observing System)
  - WMO-No. 1165* (Guide to the WMO Integrated Global Observing System)
  - WMO-No. 1192 (WIGOS Metadata Standard)

- **WIGOS Websites**
  - https://www.wmo.int/pages/prog/www/wigos/index_en.html
  - https://oscar.wmo.int/surface/index.html

* Recommended Initial Starting Point for broad overview of WIGOS

WIGOS Metadata Background

- **WIGOS metadata**
  - Is used to support planning and management of WIGOS observing systems
  - Describes the station/platform where the observation was made
  - Describes the system(s) or network(s) the station/platform contributes to
  - Describes the instruments and methods of observations used
  - Describes the observing schedules

- **OSCAR/Surface**
  - The WMO official authoritative repository of metadata on surface-based meteorological, climatological, hydrological and other related environmental observations

WMDS Categories

1. Observed variable
2. Purpose of Observation
3. Station/Platform
4. Environment
5. Instruments and methods of observation
6. Sampling
7. Data processing and reporting
8. Data quality
9. Ownership and data policy
10. Contact

Pre-Operational Phase Priorities

- **WIGOS Pre-Operational Phase Priorities (2016-2019):**
  - National WIGOS Implementation
  - WIGOS regulatory and guidance material
  - WIGOS Information Resource
  - WIGOS Data Quality Monitoring System
  - Regional WIGOS centers

Definition of "WIGOS Ready"

- **Goal: All member will be WIGOS Ready by 2019**
- **At a minimum, all Members will have implemented at the national level:**
  - OSCAR
  - WIGOS Station IDs
  - WIGOS metadata
  - WIGOS Data Quality Monitoring

Reserved Issuer of Identifier Values:
WMO Programs

Issuer of Identifier value	Category of Station Identifier	New WIGOS Station Identifier example
20000	World Weather Watch (WWW) land station with sub-index (SI) = 0	Station “01415” becomes 0-20000-0-01415
20001	WWW land station with sub-index (SI) = 1	Station “57816” becomes 0-20001-0-57816
20002	WWW Marine Platform (moored or drifting buoy, platform, etc)	($A_1 b_w n_b n_b n_b$) Buoy “59091” becomes 0-20002-0-59091
20003	Ship ID based on Int’l Telecommunication Union Callsign	Ship “C7R” becomes 0-20003-0-C7R
20004	Ship ID issued nationally	Ship “XY123AB” becomes 0-20004-0-XY123AB
20005	AMDAR aircraft identifier	Aircraft “EU0246” becomes 0-20005-0-EU0246
20006	ICAO airfield identifiers	Monterey airport “KMRY” becomes 0-20006-0-KMRY
20007	Int’l Maritime Organization (IMO) ship number (hull number)	Ship “9631369” becomes 0-20007-0-9631369
20008	Global Atmosphere Watch (GAW) identifier	“Jungfraujoch JFJ” becomes 0-20008-0-JFJ
20009	WMO Satellite Program	METEOSAT 10 (with identifier “057”) becomes 0-20009-0-057
20010	WMO Weather Radar	Station with record number “121” becomes 0-20010-0-121
20011-21999	Reserved for future use	

Reserved Issuer of Identifier Values:
WMO Partner Programs

Issuer of Identifier value	Category of Station Identifier	New WIGOS Station Identifier example
22000	Identifiers for marine systems administered through JCOMMOPS	To Be Determined (TBD) by JCOMMOPS 0-22000-(TBD by JCOMMOPS)-(TBD by JCOMMOPS) [Issue Number] [Local Identifier]
22001-39999	Reserved for future use	