Development of harmonized data models and encodings for WMO, INSPIRE and aviation meteorology

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WMO
OMM

WMO Basic Systems

World Meteorological Organization

Specialized agency of UN (1951)

"UN system's authoritative voice on the state and behaviour of the Earth's atmosphere, its interaction with the oceans, the climate it produces and the resulting distribution of water resources"

188 Member States and Territories

'Resolution 40' data-products

'Resolution 28' data-products

WMO facilitates the free and **unrestricted exchange of data and information**, products and services in **real- or near-real time** relating to **safety and security of society**, **economic welfare** and the **protection of the environment**

Operational Meteorology

Global Telecommunication System (GTS/MTN)

Operational focus:

‘closed’ community
time & safety critical
developed over 50+ years
global extranet – predates internet
suitable for low-bandwidth networks

Aviation Community

ICAO delegation of responsibility to WMO:

‘Annex 3’ OPMET data-representation systems (Chicago Convention)

Traditional Alphanumeric Codes (TAC) & Table-Driven Code Forms

efficient encodings
data-product centric
external reference data (tables)

Aeronautical Information Management

ICAO Assembly – 36th Session (Montréal 2007)

Recognition of need to transition to the broader concept of aeronautical information management (AIM) to ensure availability of real-time accredited and quality assured information to any Air Traffic Management user in a globally interoperable and fully digital environment

EUROCONTROL SESAR NextGen FEDERAL AVIATION ADMINISTRATION

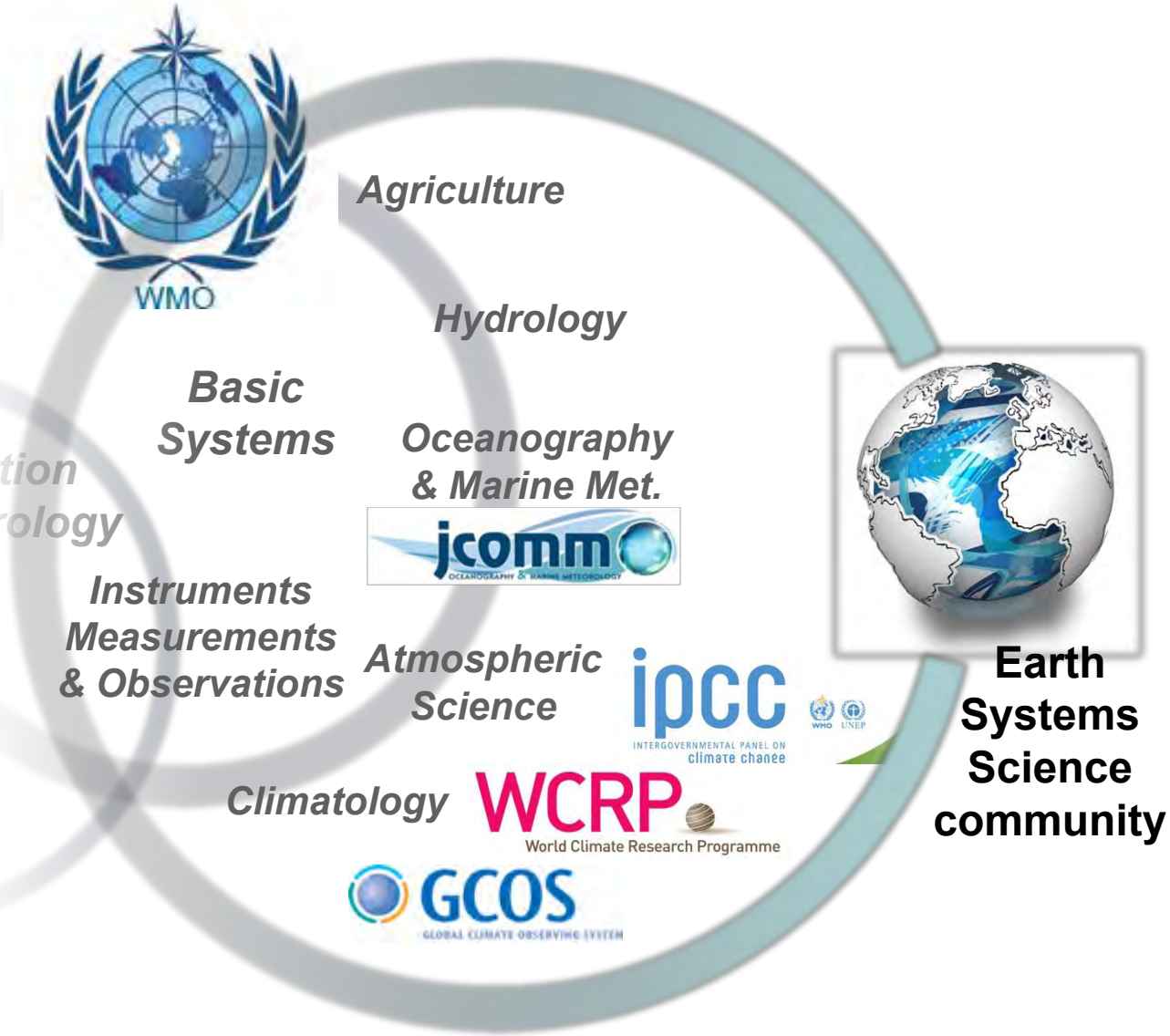
Weather Exchange Model (WXXM) has been developed with FAA-EUROCONTROL cooperation with the aim to displace existing Annex 3 data-products. It forms part of the family of Aeronautical Information Exchange Models (AIXM) based on the **ISO Geographic Information / Geomatics** suite of standards originating from **ISO TC/211**

WMO & science communities

Focus on operational information exchange insufficient …

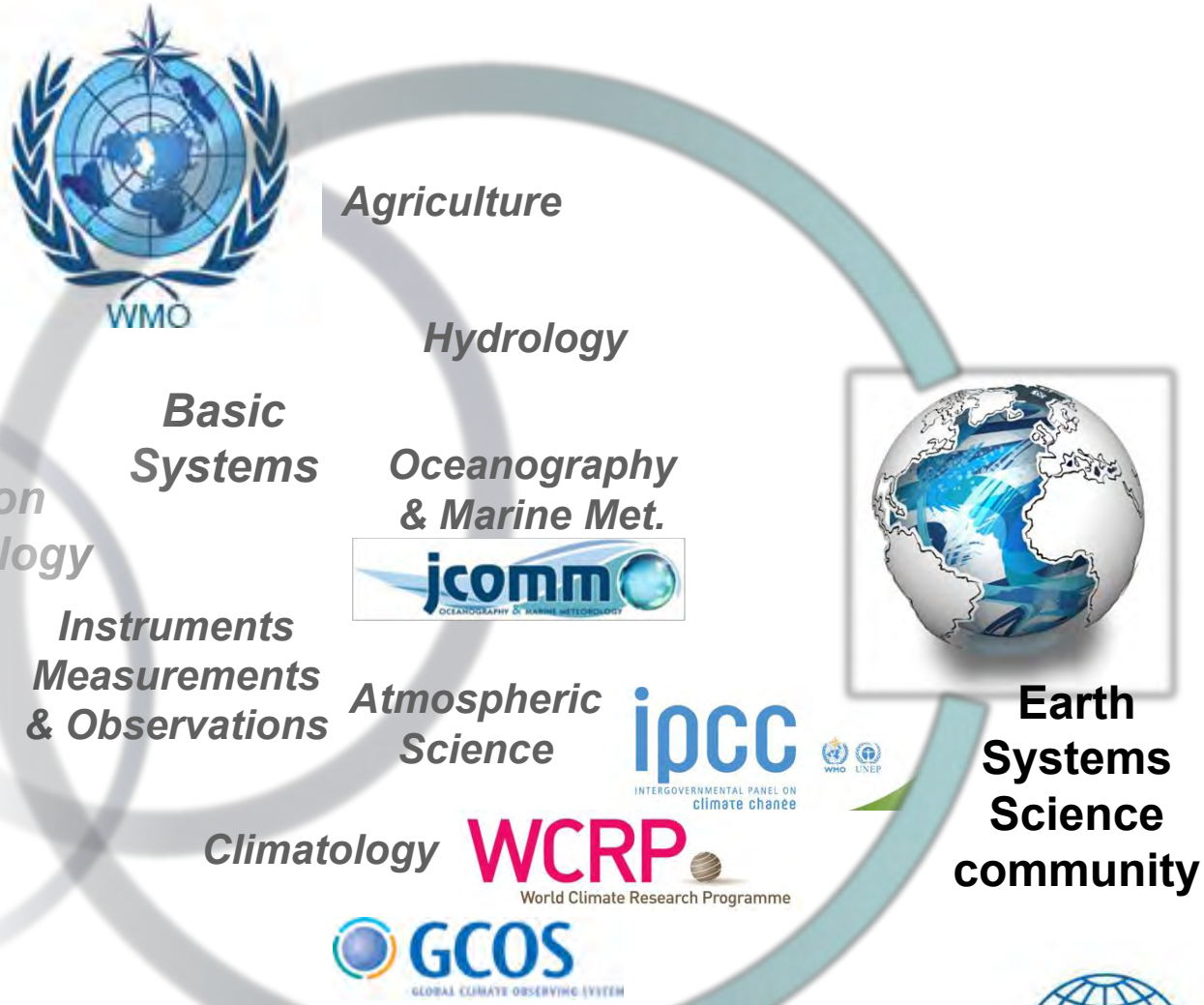
WMO has additional Commissions which engage in the broad community of Earth Systems Science

… often through partner programmes



WMO Information System (WIS)

WIS provides an integrated approach **suitable for all WMO Programmes** to meet the requirements for **routine collection** and **automated dissemination** of observed data and products, as well as **data discovery**, **access** and **retrieval** services for all weather, climate, water and related data



WIS builds on the **ISO Geographic Information / Geomatics** suite of standards. **WMO established a Class A Liaison with ISO TC/211**

Earth System Science standards

Standards for data representation and exchange within the Earth Systems Science community often have no explicit governance authority – community adoption is driven by the utility of the standards and richness of associated tooling: e.g.

unidata netCDF The HDF Group NASA **NASA-Ames format for data exchange**

The governance of these formats is outside the control of WMO, which has lead to divergence and lack of interoperability between formats maintained by WMO (with a focus on operational exchange) and those developed by the community (with a focus on utility for research)

The **Climate Science Modelling Language (CSML)** from UK Natural Environment Research Council **seeks to reconcile these standards with the ISO Geographic Information / Geomatics frameworks**

European Commission
INSPIRE

EUROPEAN COMMISSION > INSPIRE >

European Regional Legislation

The INSPIRE directive came into force on 15 May 2007

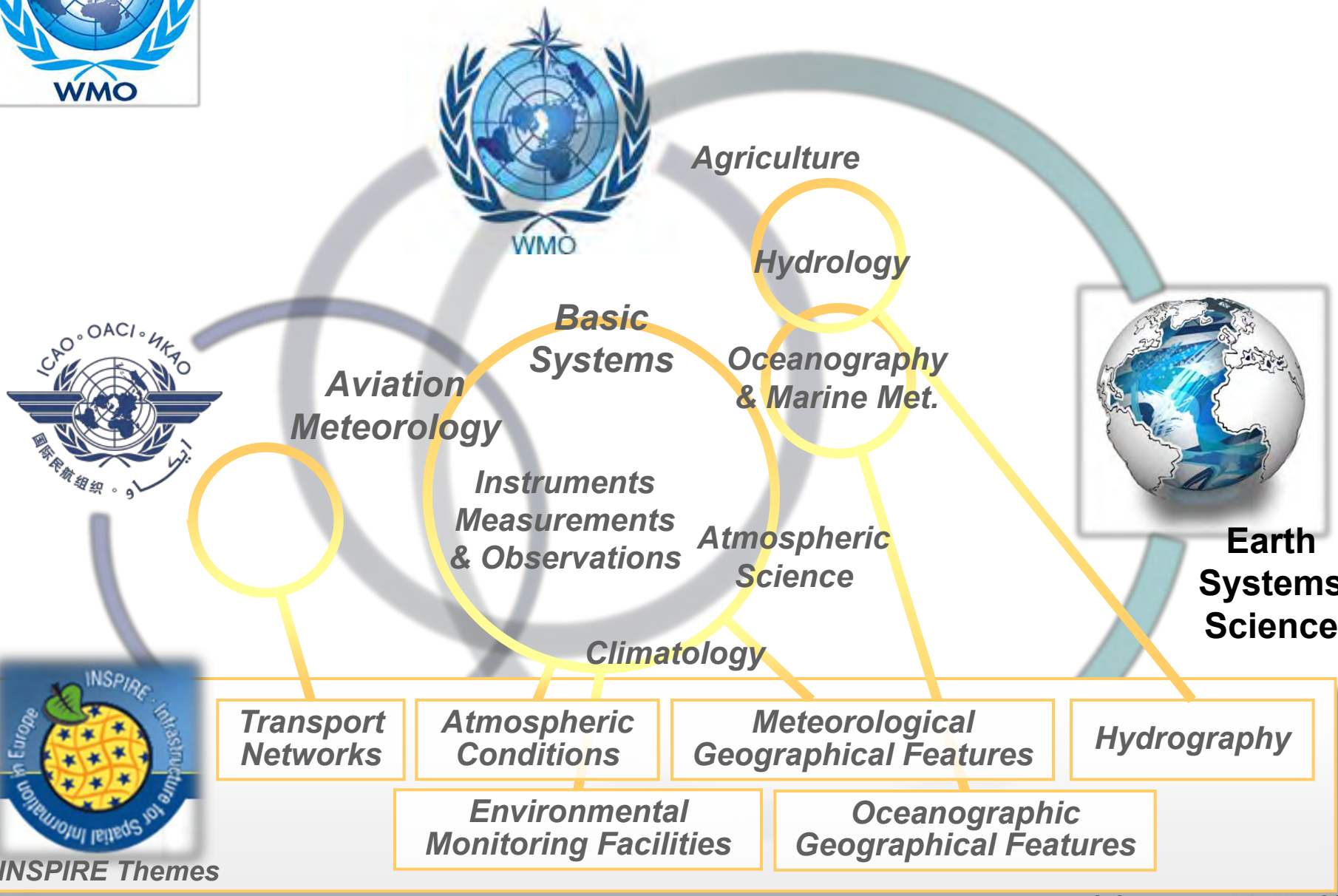
The INSPIRE directive aims to create a European Union (EU) spatial data infrastructure. This will enable the sharing of environmental spatial information among public sector organisations and better facilitate public access to spatial information across Europe in support of policy making and activities which may impact the environment.

The INSPIRE directive addresses 34 spatial data themes needed for environmental applications
[http://inspire.jrc.ec.europa.eu/index.cfm/pageid/2/list/7]

The INSPIRE directive implementing rules mandate the use of **ISO Geographic Information / Geomatics** standards from **ISO TC/211**

WMO Region VI (Europe) Members must conform to both INSPIRE & WMO implementation rules – therefore WMO seek to harmonize implementing rules with INSPIRE

WMO and INSPIRE overlaps



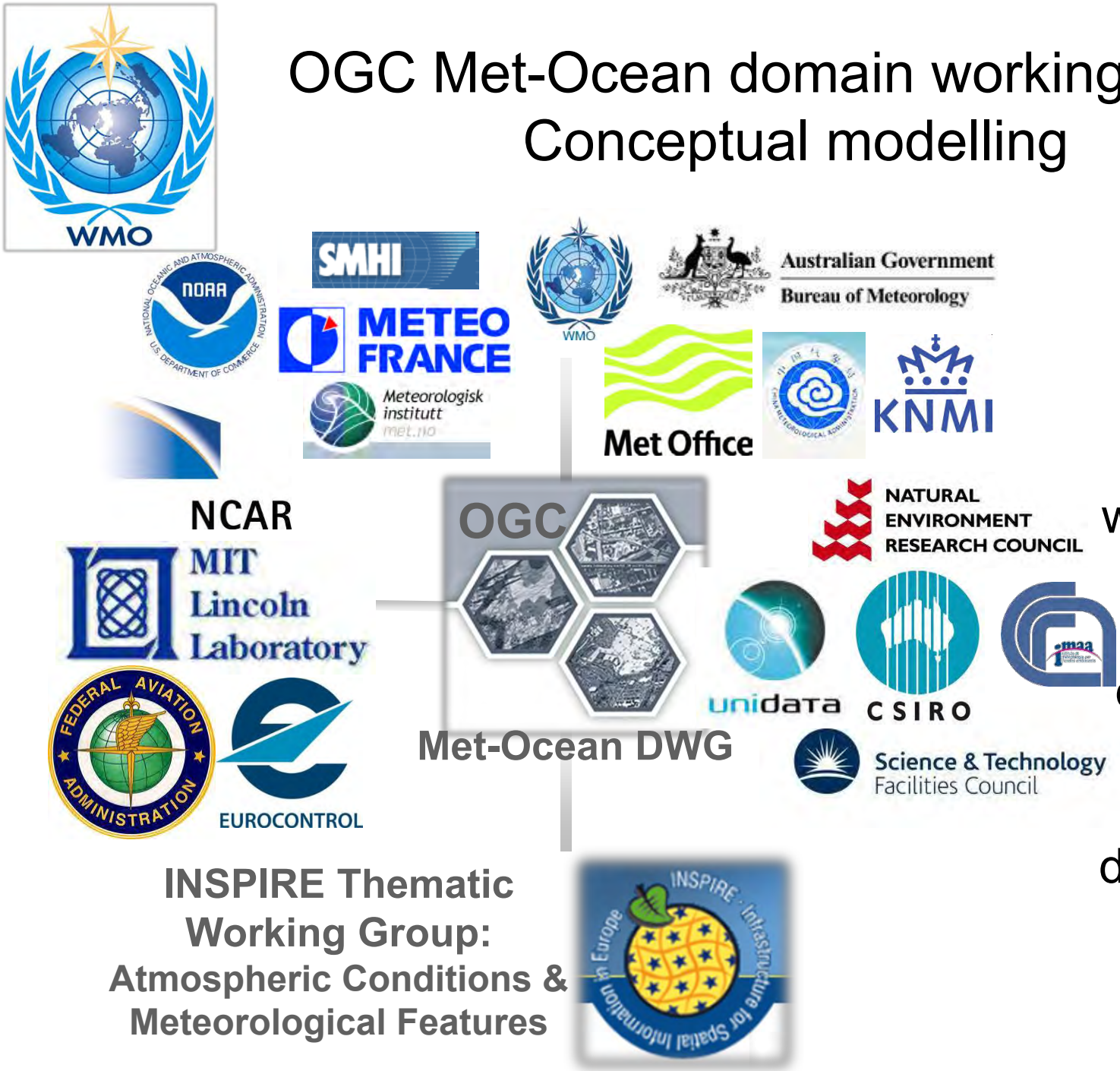
Standards incubation

WMO-OGC Memorandum of Understanding in place (2009)

Representatives of all groups are engaged in the OGC standards process

Open Geospatial Consortium (OGC) is a non-profit voluntary consensus standards organisation with a membership comprising commerce, government and academia. OGC leads the development of geospatial and location based standards – often acting as an *incubator* for ISO geographic information standards

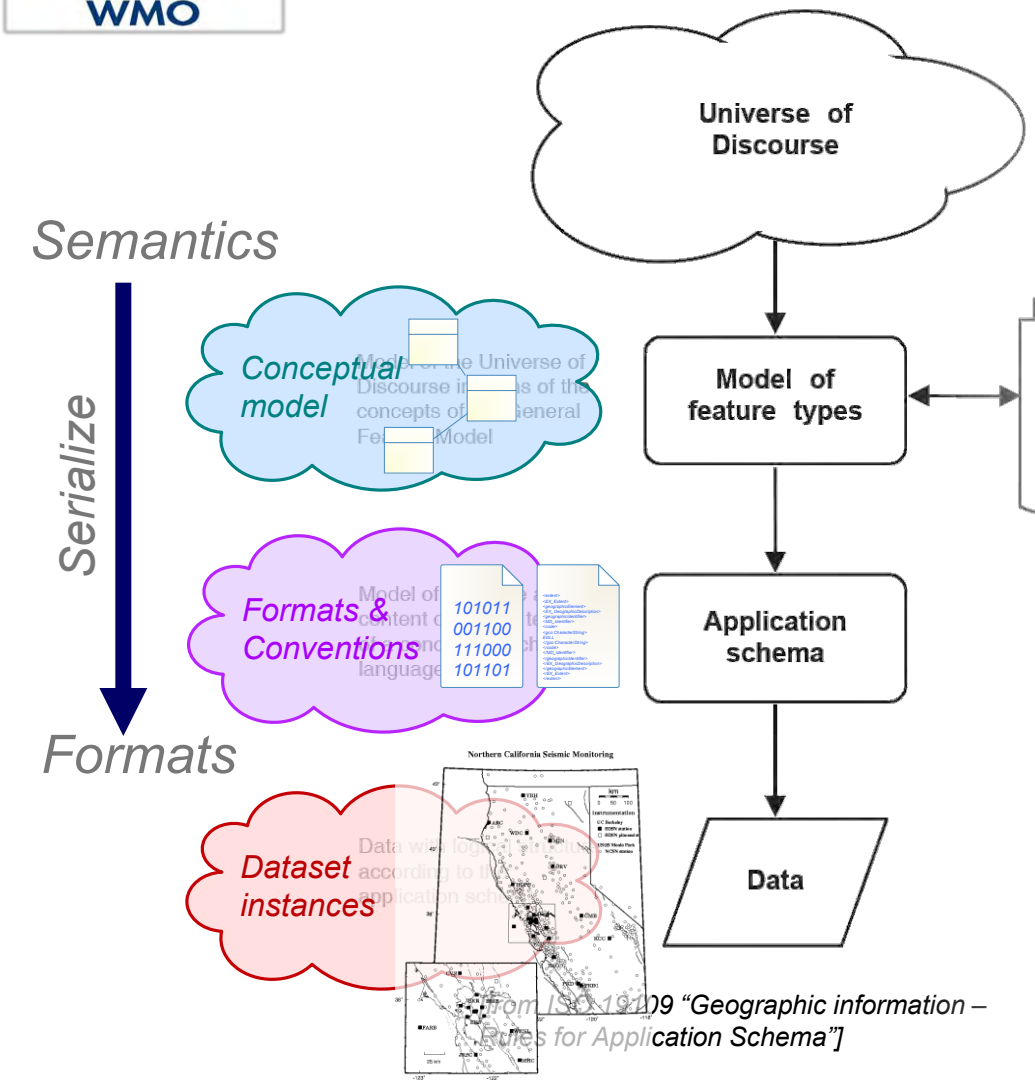
OGC Met-Ocean domain working group: Conceptual modelling



OGC Met-Ocean domain working group provides the forum for development of a harmonized data model for meteorology

INSPIRE Thematic Working Group: Atmospheric Conditions & Meteorological Features

Conceptual modelling for shared understanding *(ISO 19109)*



Our goal is to establish a core conceptual model that meets the needs of our stakeholder community and maintains compatibility with existing data encodings such as GRIB, BUFR and netCDF – providing a mechanism to map content from one format to another.

A common conceptual model will enable tooling and software to sourced / provisioned from the breadth of the community that subscribes to the core conceptual model

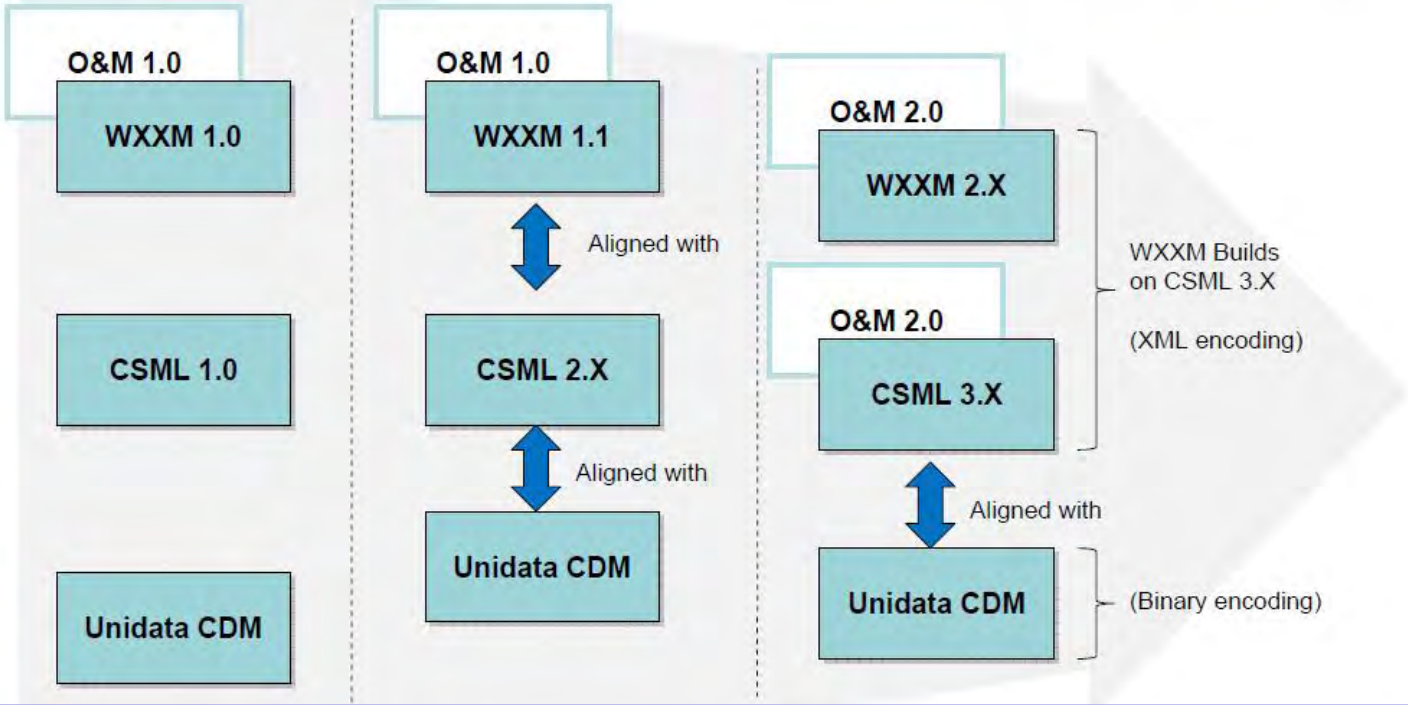
Candidates for convergence?

WXXM 2.0

Aaron Braeckel

WXXM 2.0

Weather Model Convergence?



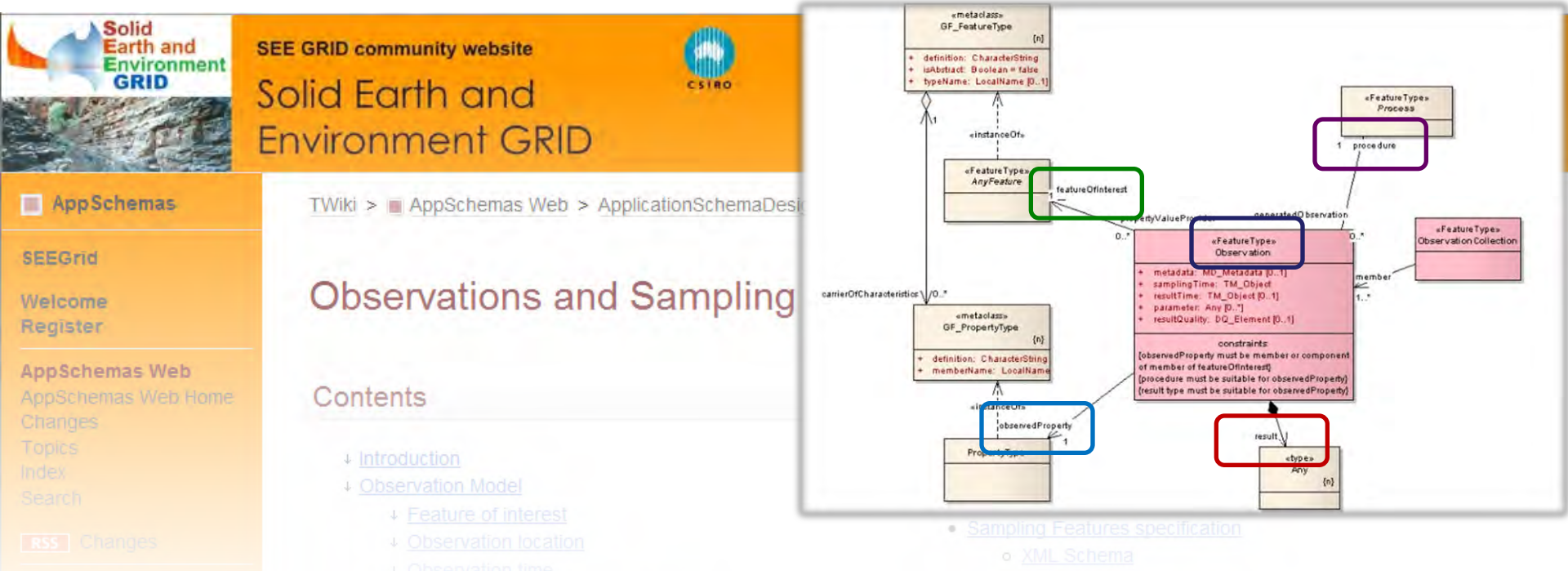
Briefing to W
04 May 201
National Cen
Boulder, CO

OGC Observations and Measurements (O&M)

now ISO/DIS 19156 Geographic Information – Observations and measurements

Observations and measurements

An **Observation** is an ***action*** whose **Result** is an estimate of the value of some **Property** of the **Feature-of-interest**, obtained using a specified **Procedure**



OGC Observations and Measurements (O&M)

now ISO/DIS 19156 Geographic Information – Observations and measurements

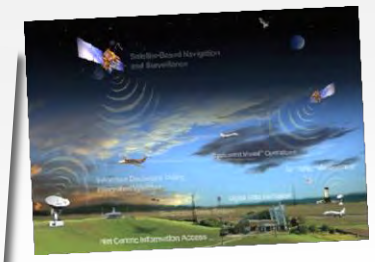
Methodology: use cases

Adopted variant of INSPIRE methodology for developing conceptual models

Develop narrative based on realistic & focused user scenarios

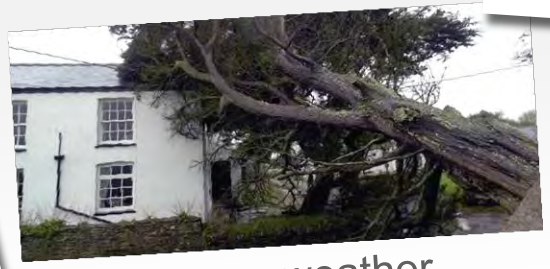
Use cases

current aviation



future aviation

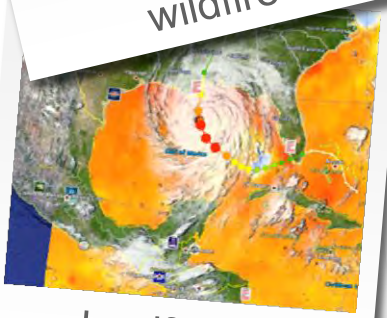
wildfire



severe weather warning service

sustained polar science campaign

climate assessment



landfalling hurricane

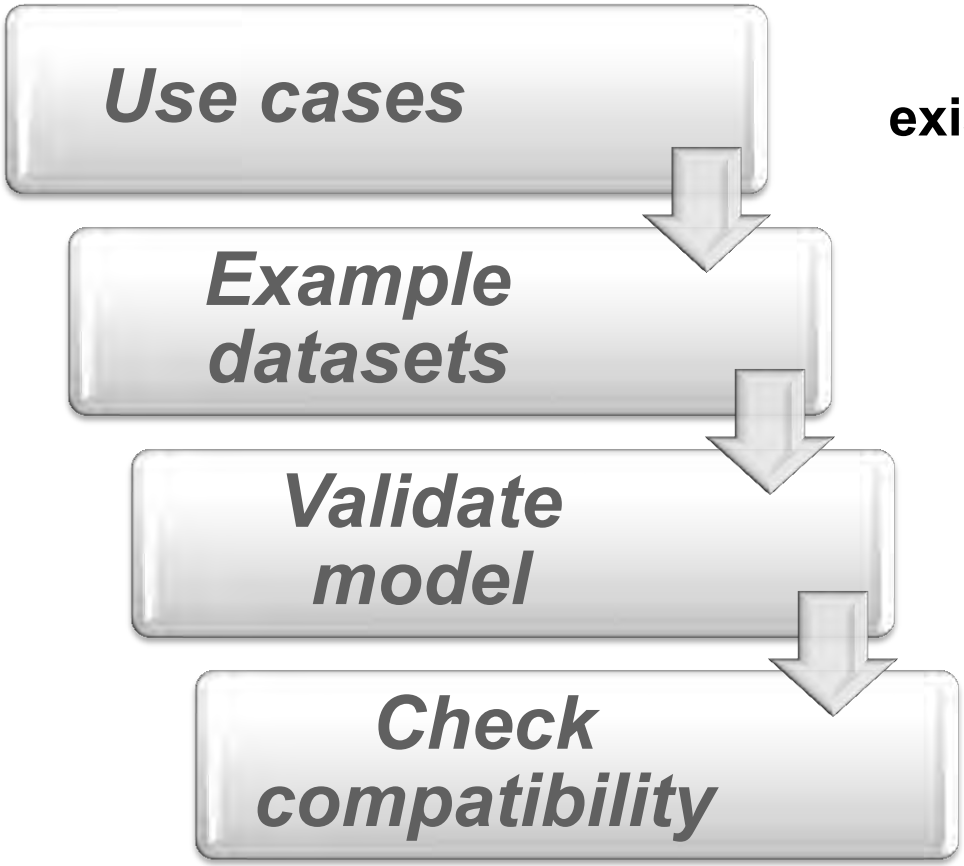
plume forecasting for emergency response

winter highways maintenance

riverine flood forecasting

Methodology: Example datasets

Adopted variant of INSPIRE methodology for developing conceptual models



Extract example datasets from existing (or postulated) workflows described within use cases

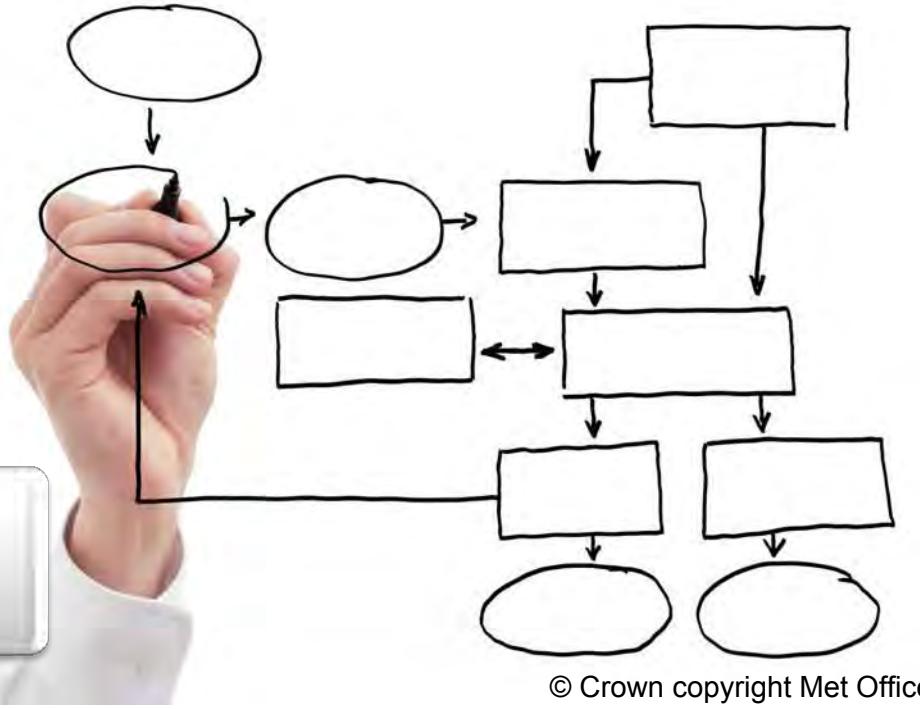
Methodology: Validate model

Adopted variant of INSPIRE methodology for developing conceptual models

Attempt to map content of datasets onto O&M model – identifying restrictions, constraints, controlled vocabularies

Is a *profile* of O&M valid for our user community?

- ***Use cases***
- ***Example datasets***
- ***Validate model***
- ***Check compatibility***

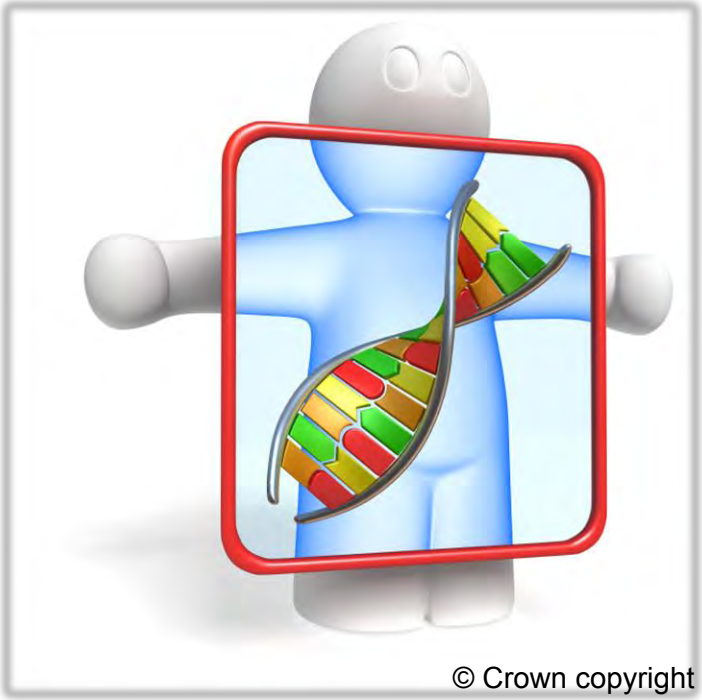


Methodology: Check compatibility

Adopted variant of INSPIRE methodology for developing conceptual models

Identify compatibility of existing encodings (BUFR, GRIB, CF-netCDF etc.). Develop conventions (or amendments) for their use with the common conceptual model … and hence compatibility of the common conceptual model with existing tooling and practices within the community

- *Use cases*
- *Example datasets*
- *Validate model*
- *Check compatibility*



Timelines

2010

2011

2012

2013

2014

WMO CBS Nov 2010: propose candidate data model & outline workplan for formalization of model & governance procedures

WMO Executive Council May 2011: endorse proposed changes as policy, update terms of reference for Technical Commissions / Programmes & allocate budgetary resources

WXCM / WXXM 2.0 Q4 2010: publish candidate for industry implementation and further standardization

WXCM / WXXM 3.0 2012: publish standard for industry implementation

ICAO Annex 3 2013: amend to permit exchange of XML-encoded OPMET products

ICAO Divisional Meeting 2014: endorse transition from product-centric to data-centric OPMET information exchange

INSPIRE TWG Nov 2010: Annex 3 Themes v1 data-specification published for internal review

INSPIRE TWG Aug 2011: Annex 3 Themes v2 data-specification published for wider consultation and testing

INSPIRE TWG Jan 2012: Annex 3 Themes v2 data-specification published for development of implementing rules

INSPIRE May 2012: v1 of implementing rules for Annex 3 Themes published (2-further revisions expected)

Summary

- **OGC Met-Ocean domain working group is providing the forum for WMO, INSPIRE, Aviation and Earth Systems Science communities to collaborate on the incubation of harmonized meteorological data standards**
- **ISO/DIS 19156 Geographic Information – Observations and Measurements has been adopted as the candidate target data model**
- **Participants in the Met-Ocean DWG seek to create a meteorological profile of O&M and develop rules for its usage enabling it to be mapped onto de-jure data formats**
- **Progress is slower than expected!**
- **Community engagement is good – but there is always room for more participation**

Thankyou

WMO
OMM