Standardised data representation - power of reproducible work-flow

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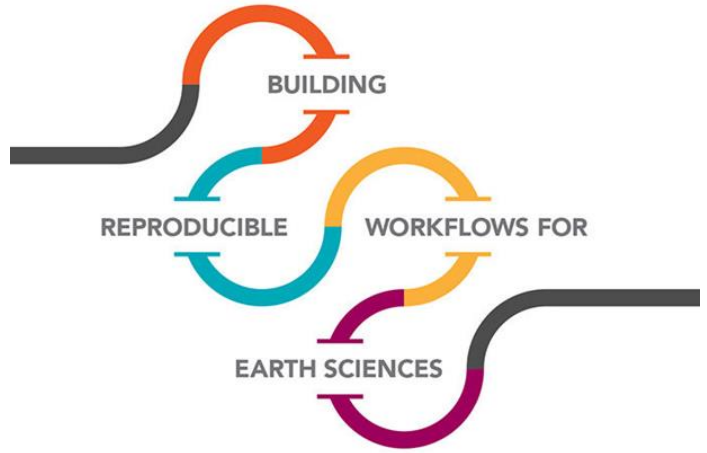
Forecast Department – Observation team



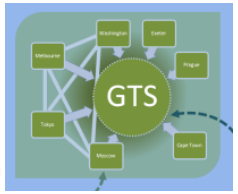
ECMWF

Introduction

- Hight level – ECMWF Workflow
- Earth Observations
- Observation data governance
- Conclusion

ECMWF Workflow - from observation to weather forecast

EUMETSAT



Acquisition
Pre-processing

IFS
Analysis and
Forecast

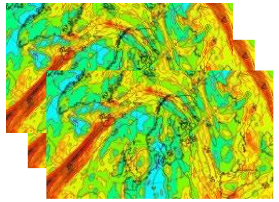
Product Generation
& Dissemination

Member
States
And
Customers

BUFR
ODB

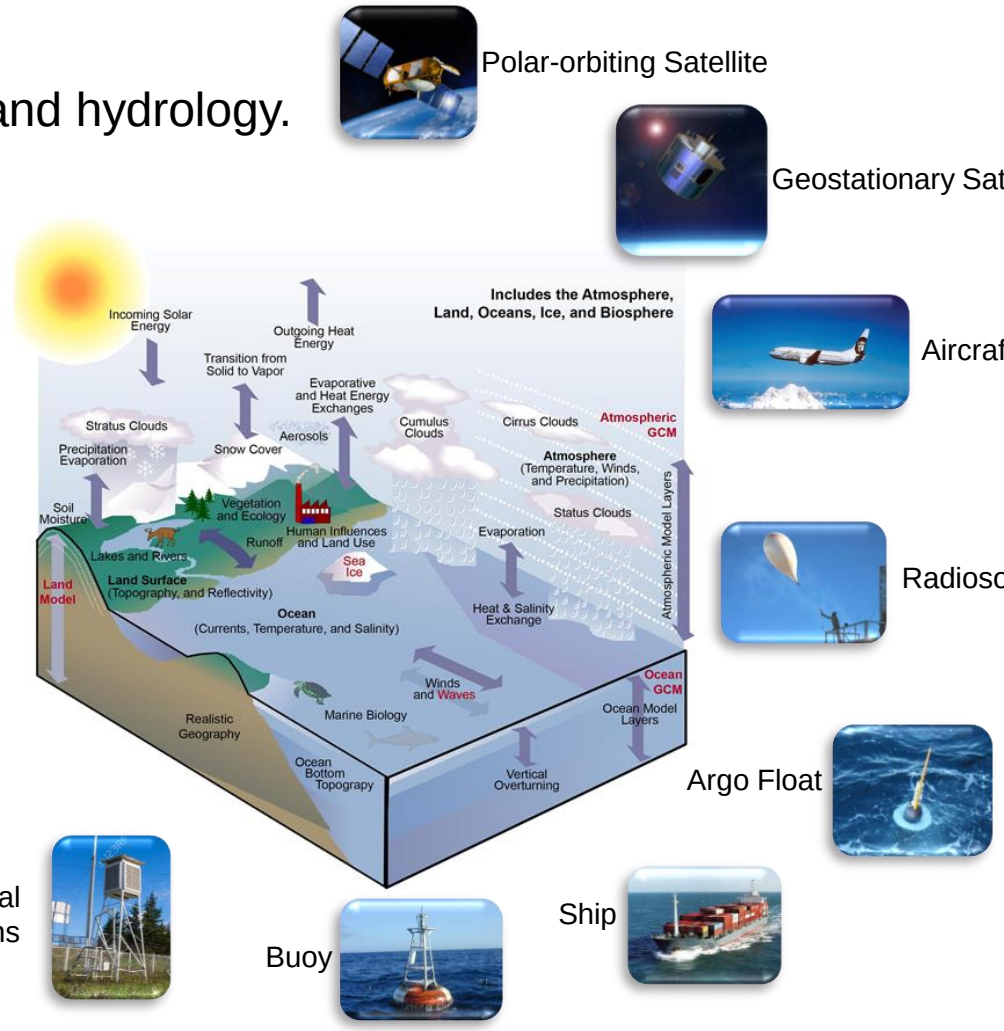
Fields

MARS
Archive

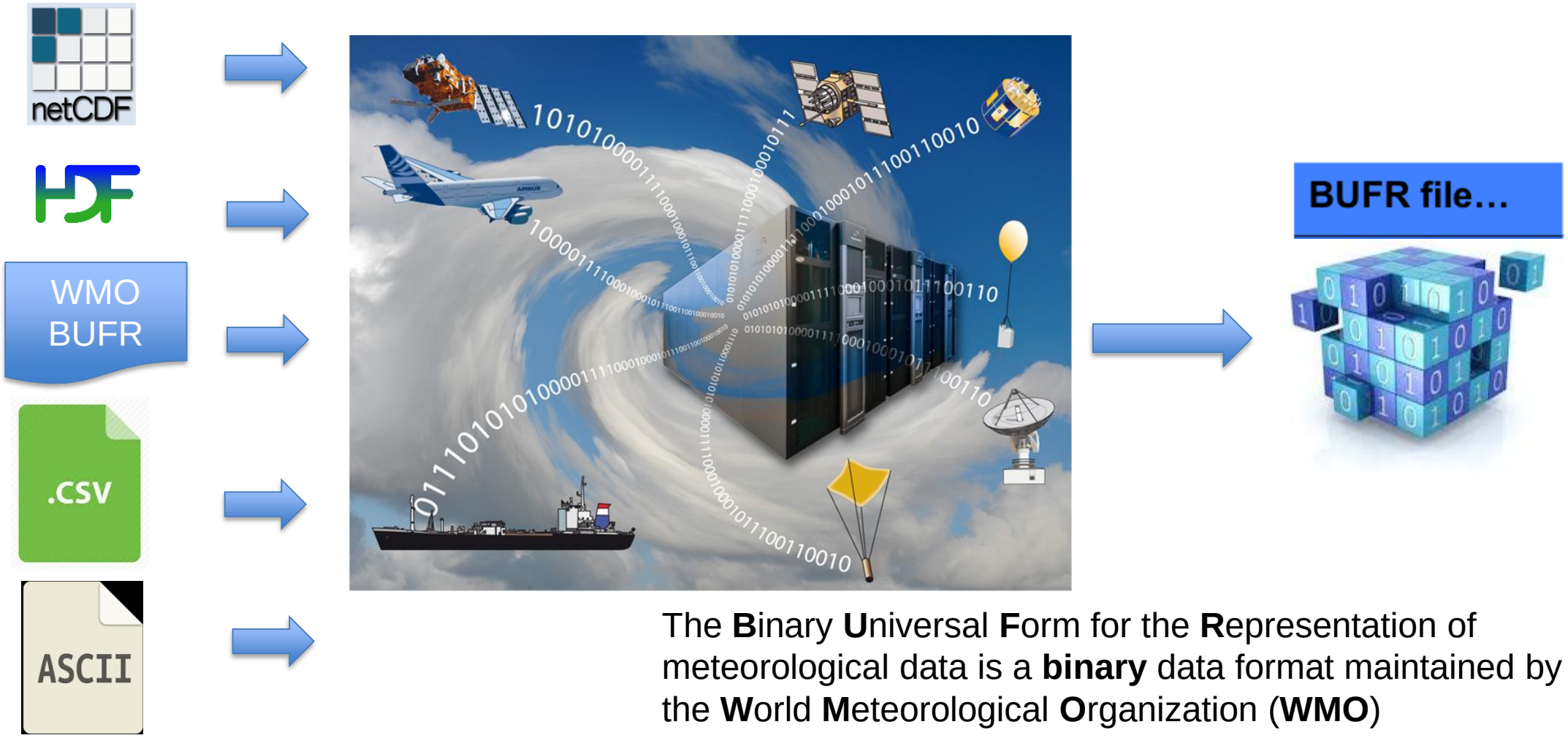


Earth observations - key to understanding weather, climate and hydrology

- Observations are key to our understanding weather, climate and hydrology.
- Combining the models with the observations we can identify
  - uncertainty in the observations
  - uncertainty in what we predict
  - discover systematic errors (bias)
- Improve instruments and refine the models.
- Adding new and better-quality observations successively enhance our forecast.

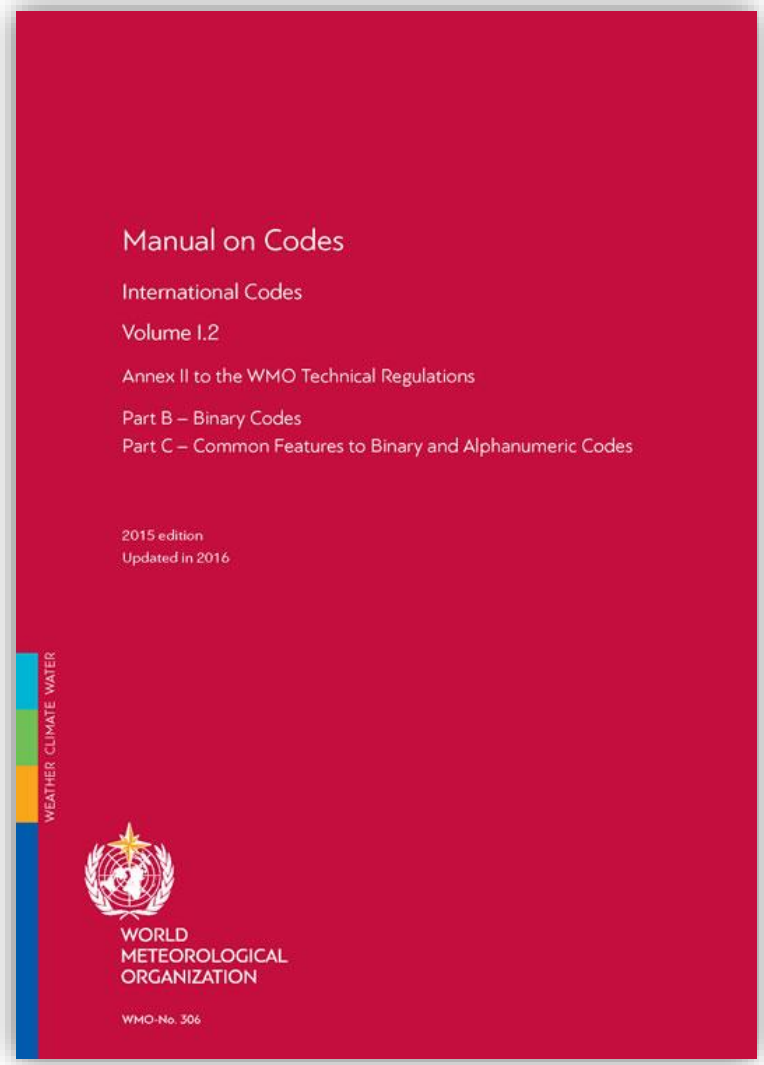


Earth observations pre-processing



The **B**inary **U**niversal **F**orm for the **R**epresentation of meteorological data is a **binary** data format maintained by the **W**orld **M**eteorological **O**rganization (**WMO**)

BUFR - WMO binary code



- **B**inary **U**niversal **F**orm for **R**epresentation of meteorological data govern by WMO.
- Continuous bit stream made of sequence of octets.
- Used to encode in situ and satellite observations.
- Self descriptive code and machine independent.
- Compression available for improved transmission speed.
- Table driven data format.
  Authoritative definitions with encoding information unit of measure and precision, derived from ‘scale’, ‘reference value’ and ‘data width (bits)’.
- A new version of the tables which are part of the manual is released externally twice a year.

Collaboration and Data governance

Internal and external stakeholders

ECMWF
EUROPEAN CENTRE FOR MEDIUM RANGE WEATHER FORECASTS

Inter-Programme Expert Team on Codes Maintenance

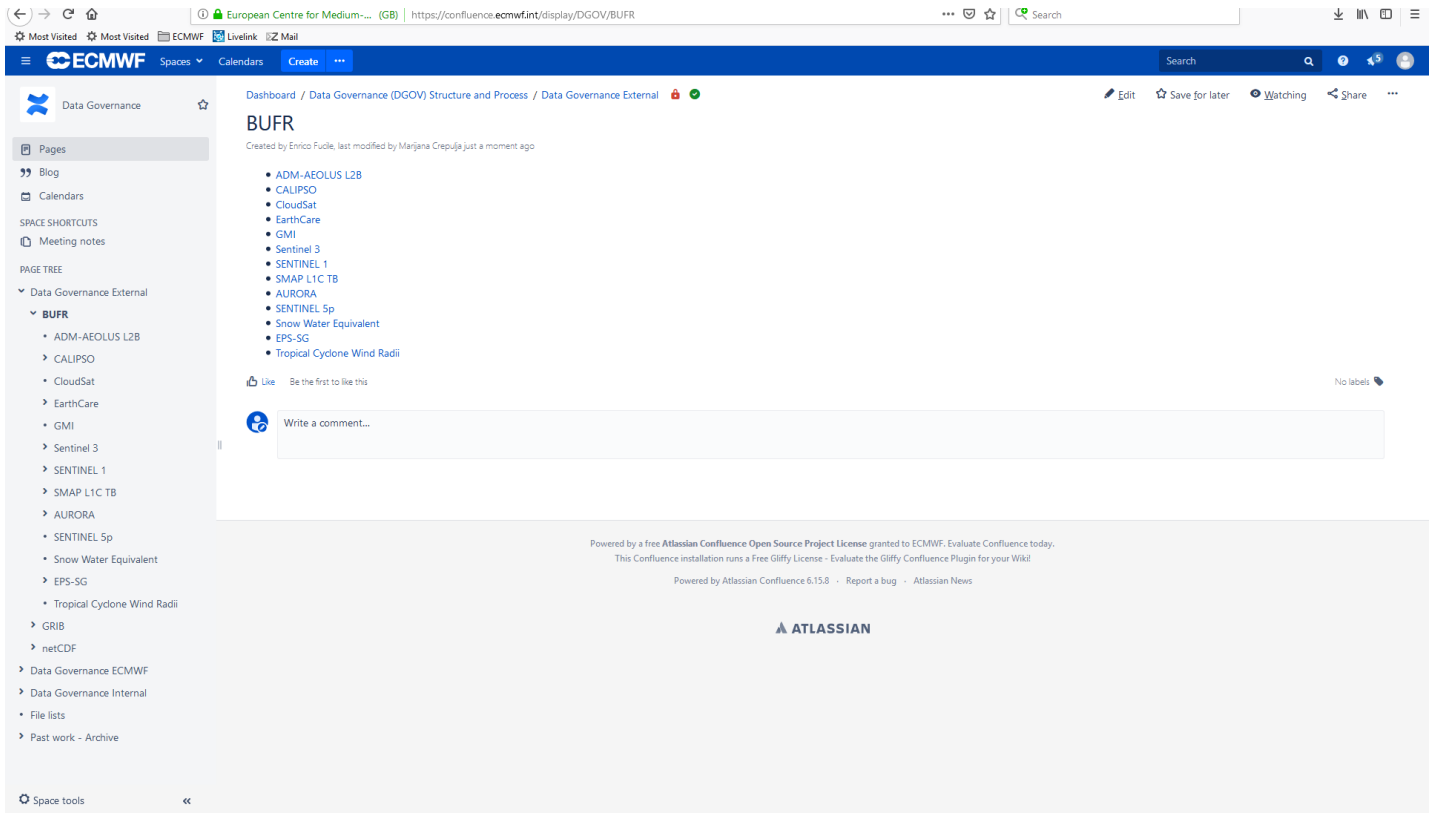
WMO

- New definitions of data representation
- Regulations on data exchange
- New editions
- Validations of proposed data models

- ECMWF works closely with space agencies and other data providers with respect to observations data governance to meet ECMWF and Member and Co-operating States requirements.
- In particular, concerning the content and format of new observations.

ECMWF Data governance

- Support current international standards and develop those which will be used in the future.
- Dedicated space on Confluence for collaboration with Research Department and external stakeholders (data producers and data users).

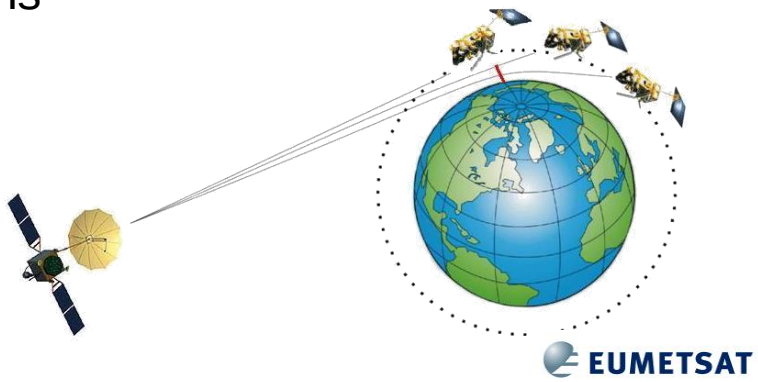


Observations - standardised representation

- Exchanging data into dedicated develop data model to enhance seam-less use of data in NWP operation, verification and archiving. Efficient use/re-use data in pre-operational new model cycle, reanalysis.

- One software application can handle data from various data providers, satellite/instruments represented in standardised format.

- Originating centres providing Radio occultation observations
  - EUMETSAT for GRAS data
  - DMI for GRAS data
  - UCAR for COSMIC and KOMPSAT-5 data
  - GFZ for TerraSAR-X and TANDEM-X data
  - CMA for FY-3C/D data
  - ISRO for Megha-Tropiques data



- Conventional data SYNOP

https://www.wmo.int/pages/prog/www/WMOCodes/WMO306_vI2/LatestVERSION/WMO306_vI2_BUFRCREX_BC1_en.pdf

Data volume increase - challenge

30 x more data disseminated per day

Data acquisition → Data pre-processing → Data Assimilation → Forecast run → Product Generation → Dissemination

10 x more Observations per day

2000x more data per model time step

100x more data archive per day

BUFR
ODB
GRIB

Conclusion

- Standardised observations to ensuring reproducibility workflow.
- Exchanging and processing standardised data
  - Better quality, seamless introduction in operation
  - Use/re-use data in pre-operational new model cycle, reanalysis
- Facing high volume diverse conventional and space-based observations in future
  - Develop different software application for handling data from different providers in different data formats (time consuming, readiness of data archiving, re-using data)?
  - Is it better to invest in data standardisation?

THANK YOU