

# Managing large volumes of information

## *Julie Pérès (Météo-France)*

Item 5.1



WMO OMM

World Meteorological Organization  
Organisation météorologique mondiale

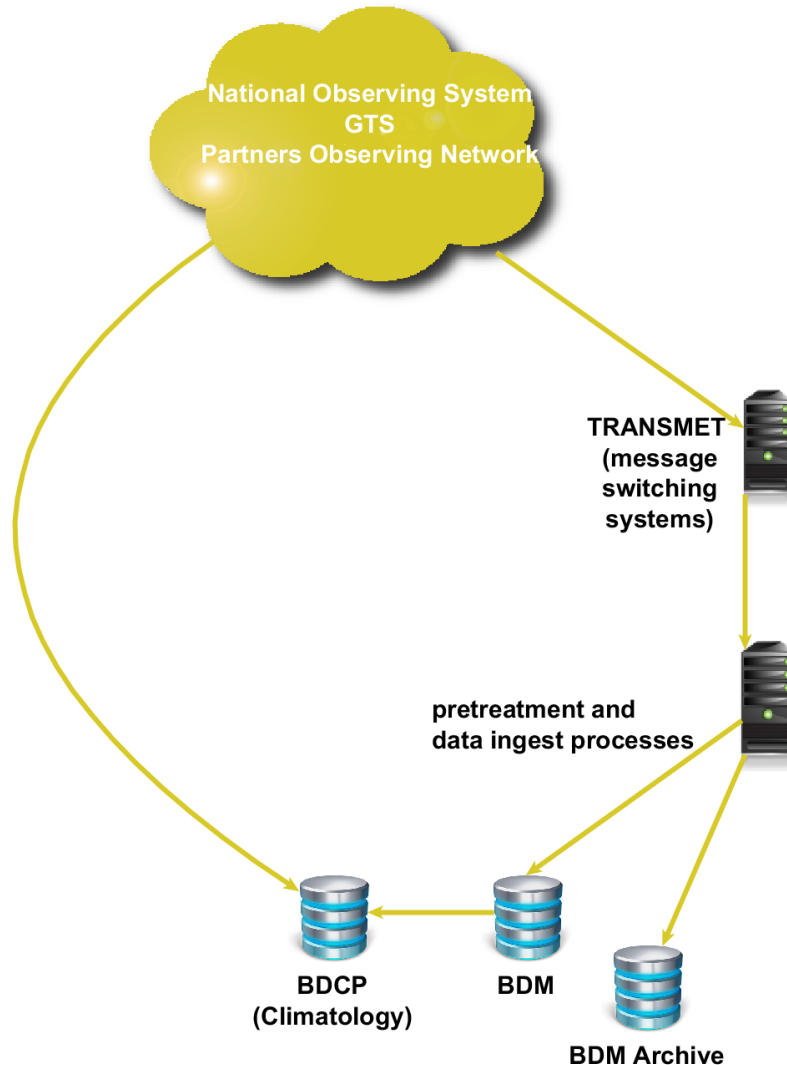
# Plan

- Data acquisition and pre-processing
- Databases
- Archives and Storage
- Data delivery

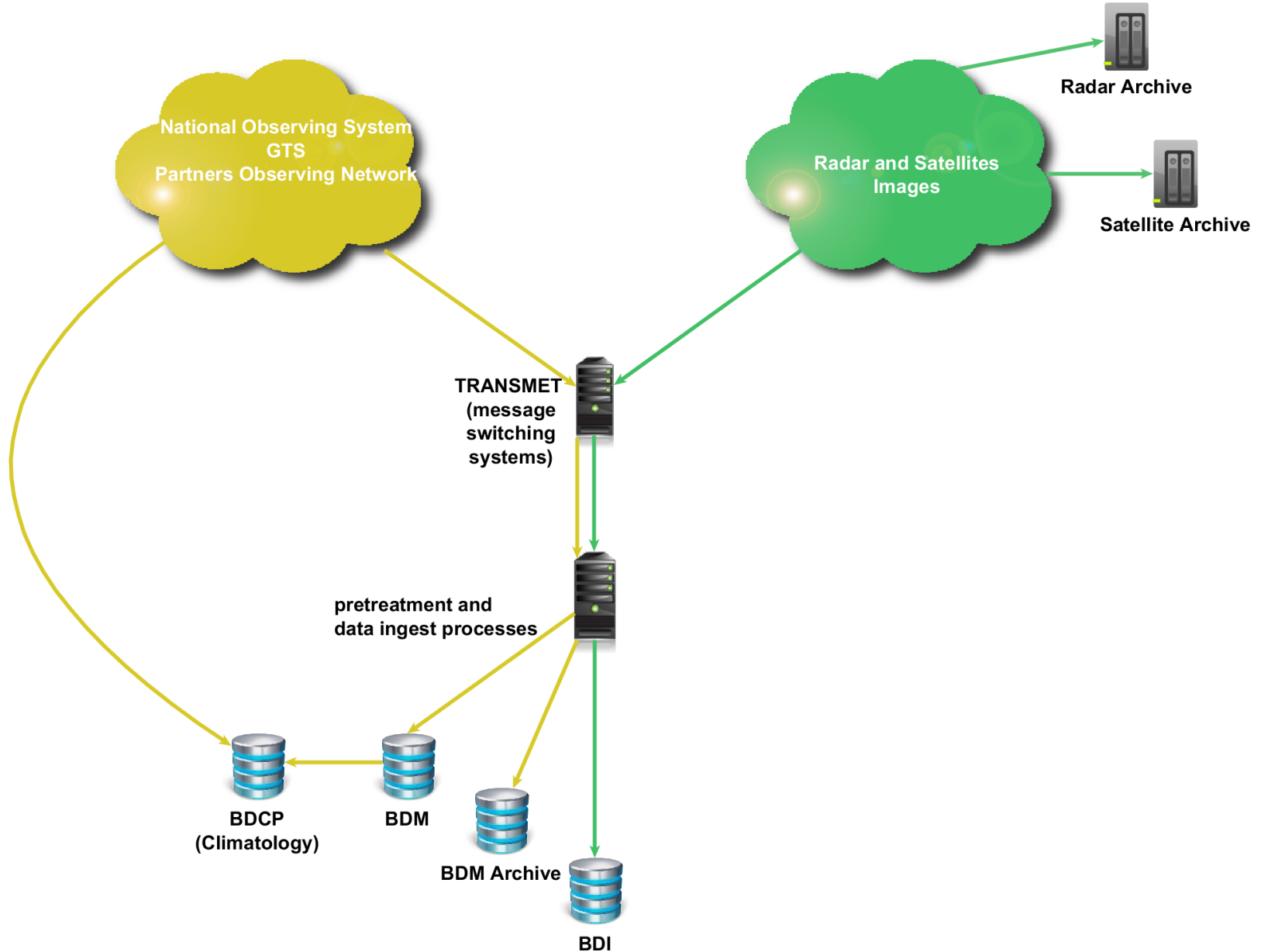
# Operational databases at Météo-France

- Concentration of real-time data relevant to the central production
- Data processing
- Delivery (Forecast / Climatology / Client)
- What ?
  - MF, overseas and partners observation network
  - Radar, satellite data and images
  - Forecasting model

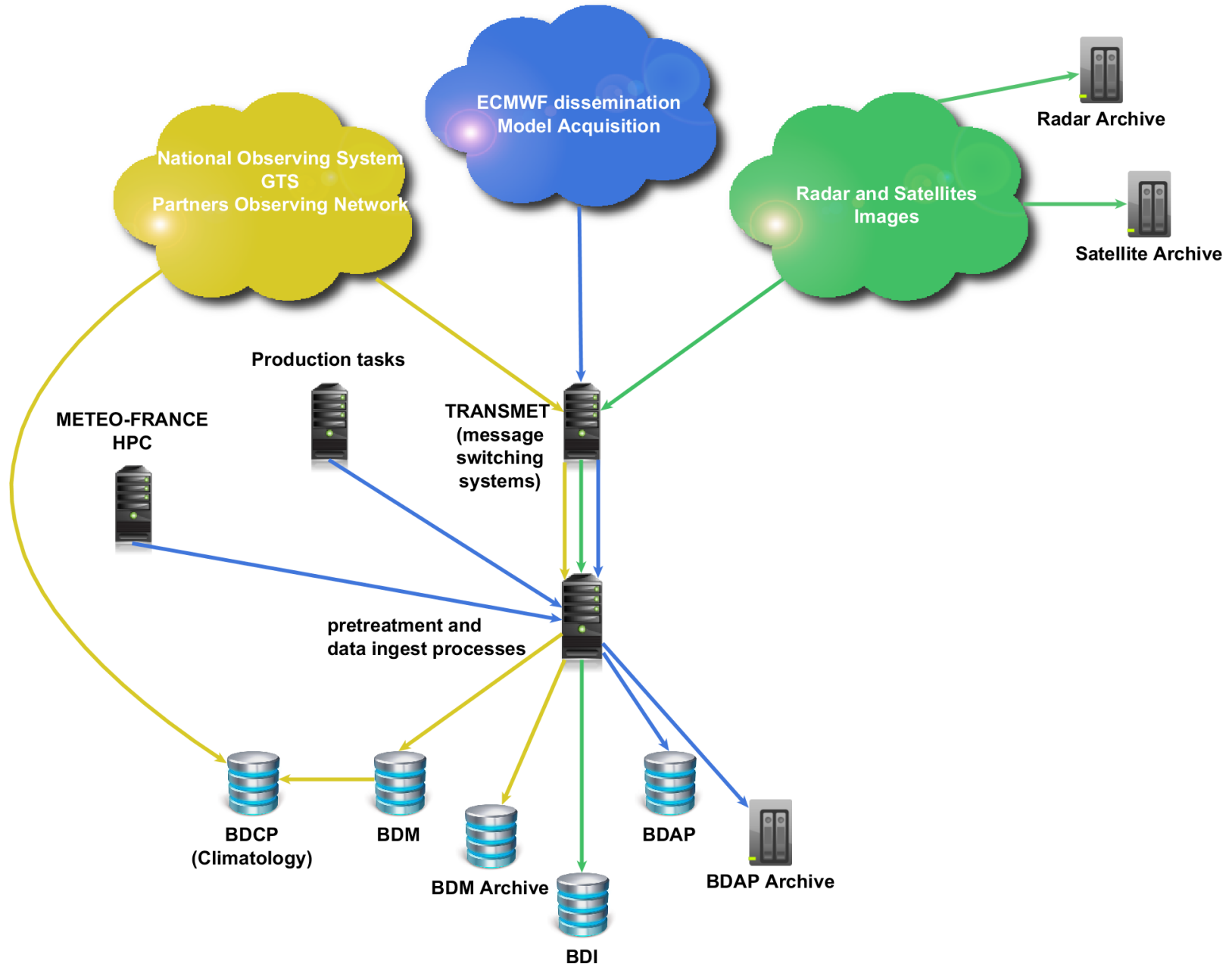
# Data acquisition and pre-processing



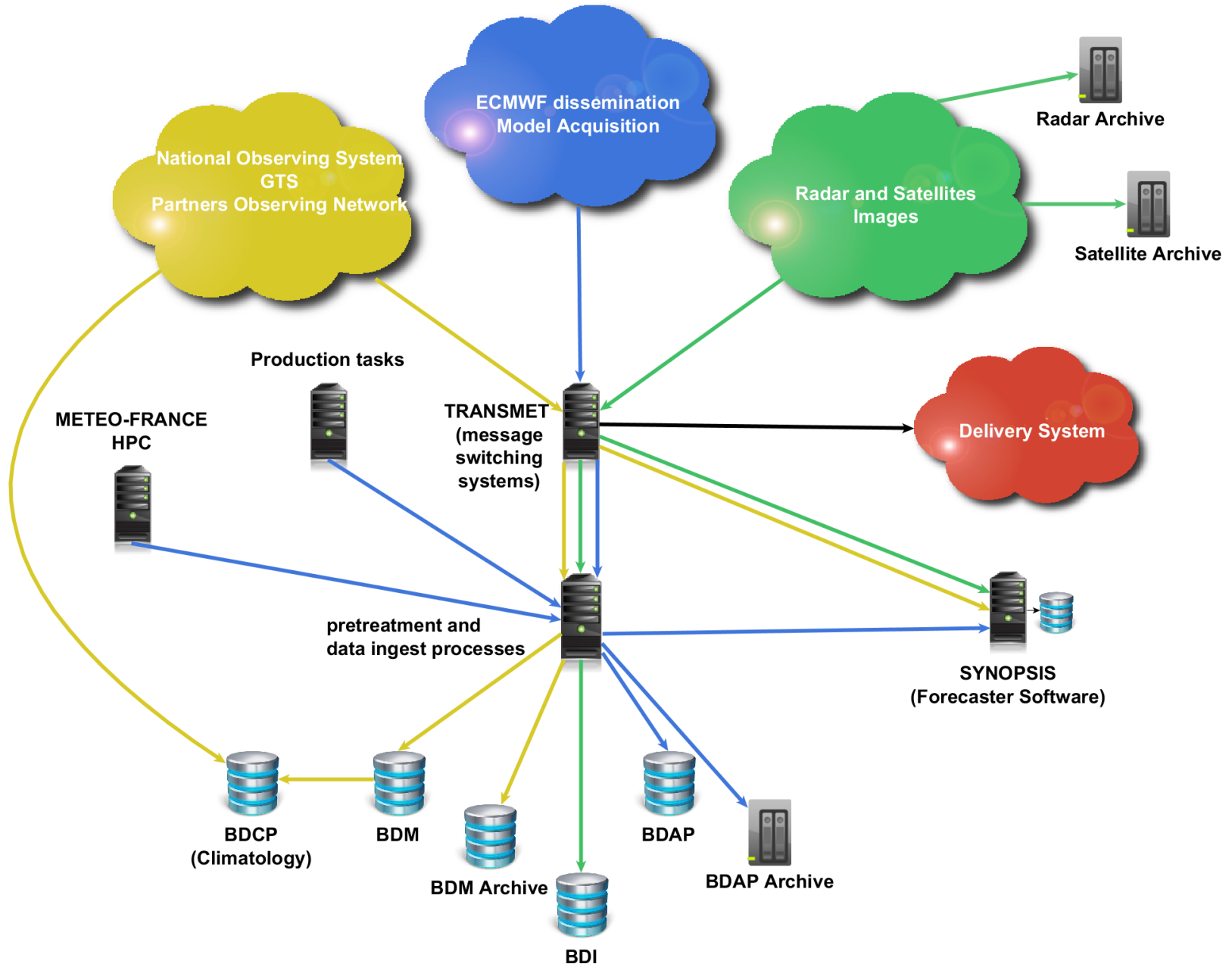
# Data acquisition and pre-processing



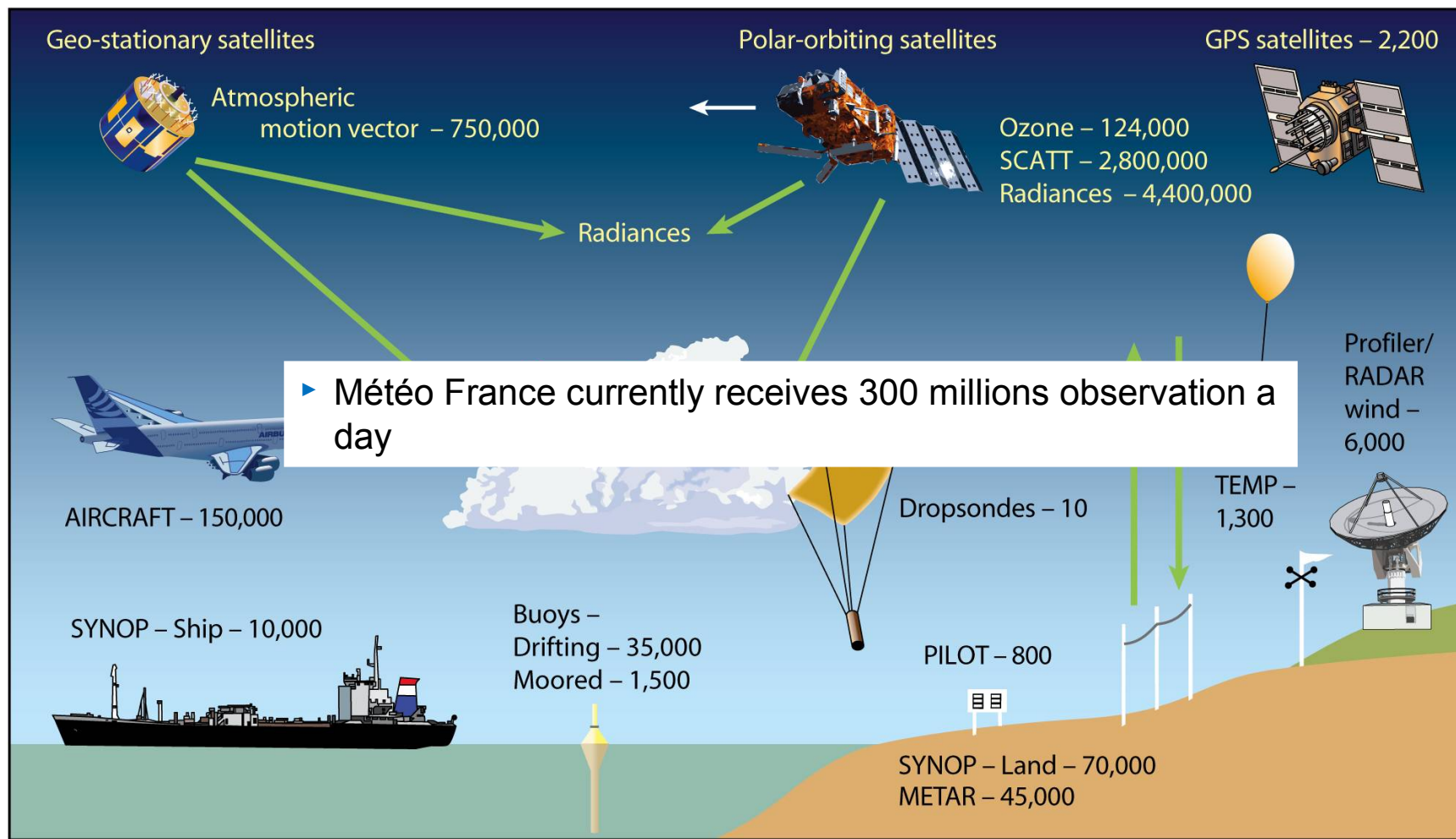
# Data acquisition and pre-processing



# Data acquisition and pre-processing



# Observation data





# Observation data

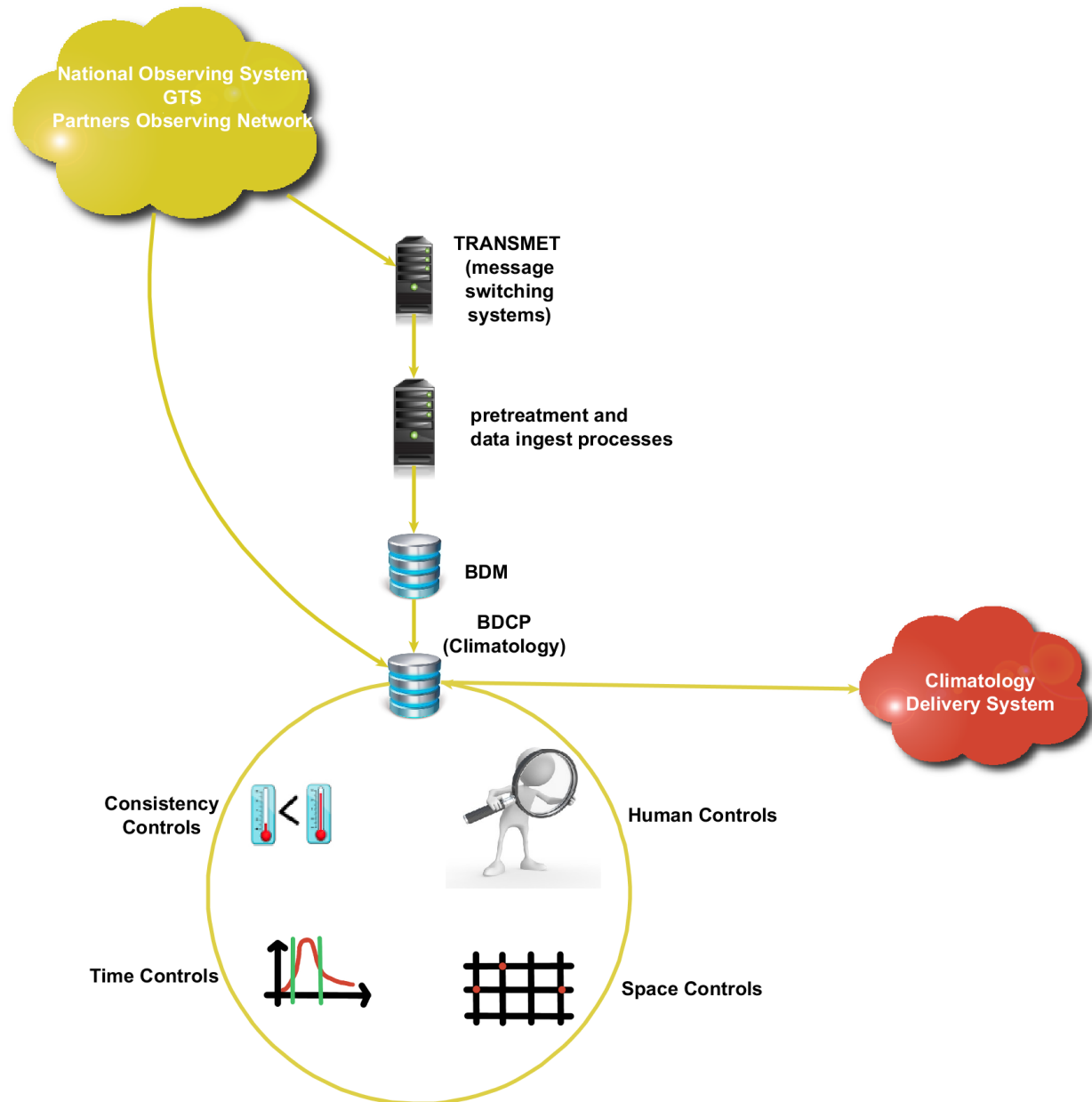
- More than 60 data types :
  - Aircraft data (ACAR, AMDAR), Buoy data, Ship data, Cyclone data, Satellite data, Radar data, Ground data (RADOME, SYNOP, ...), Altitude data (TEMP, PILOT, ...)
- Messages format :
  - BUFR, ASCII, JSON, NETCDF
- Pretreatment
  - Transcoding messages
  - Controls
  - Adding meta-data or calculated parameters
  - Formatting for database
- Database : BDM (PostgreSQL)
- Volumetry : 200 GB
- Retention : 5d

# BDM Archive

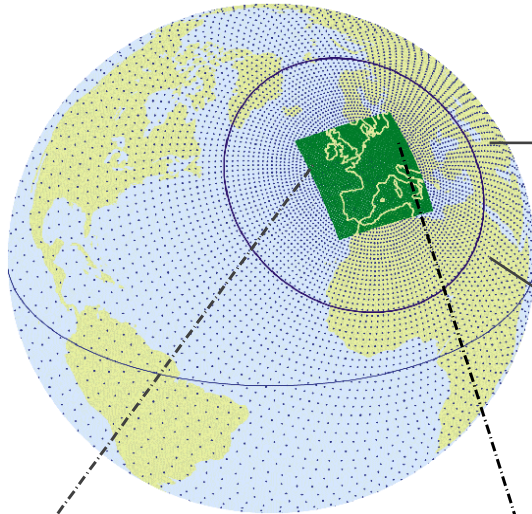
- BDM-Archive : another database (also PostgreSQL)
- Not accessible by operational tasks
- Retention is variable (from 3 months to eternity)
- Volumetry : 19 TB

# Climatology

- Data :
  - minutes, hours, daily, monthly, normal, hydrological, stations metadata
  -
- Volumetry : 700 GB



# Operational forecasting system



► Resolution 7,5 to 36 km  
Global model ARPEGE,  
Forecast up to 5 days

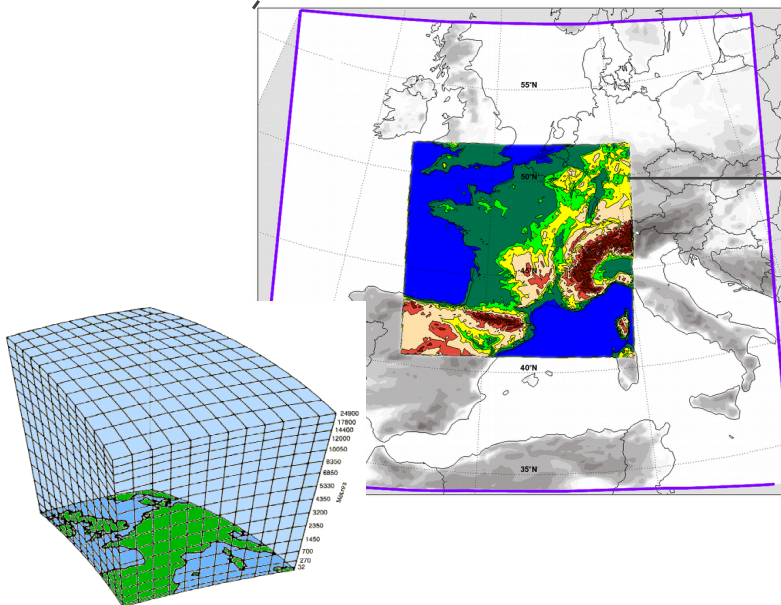


► Resolution 7,5 km  
Regional model ALADIN Europe,  
Forecast up to 5 days



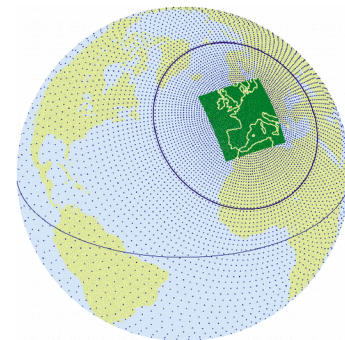
► Resolution 1,3 km  
Mainland France model AROME,  
Forecast up to 36 hours

► Doubling resolution = x16 compute  
at constant scientific complexity



# Operational forecasting system

- **Additional LAM outside Europe (overseas French territories)**
- **Ensemble forecast (EPS):**
  - Carrying out multiple runs of the model by introducing each time a slight modification of its initial state
  - Global PEARP twice daily 35 members, 16 km over France, to 4 days ahead PE-AROME :
  - France PE-AROME, twice daily, 12 membres, 2.5 km



- **Ocean waves: 4 time per day**
  - Global: 4 days ahead at 50 km with atmospheric forcing from IFS
  - Global: 4 days ahead at 50 km with atmospheric forcing from ARPEGE
  - European seas: 3 days ahead at 10 km
- **Seasonal forecast: once a month**
  - 41-members, 312 km, to 7 months ahead
- **Air pollution transport forecast: MOCAGE**
  - 10 km over France to 4 days ahead



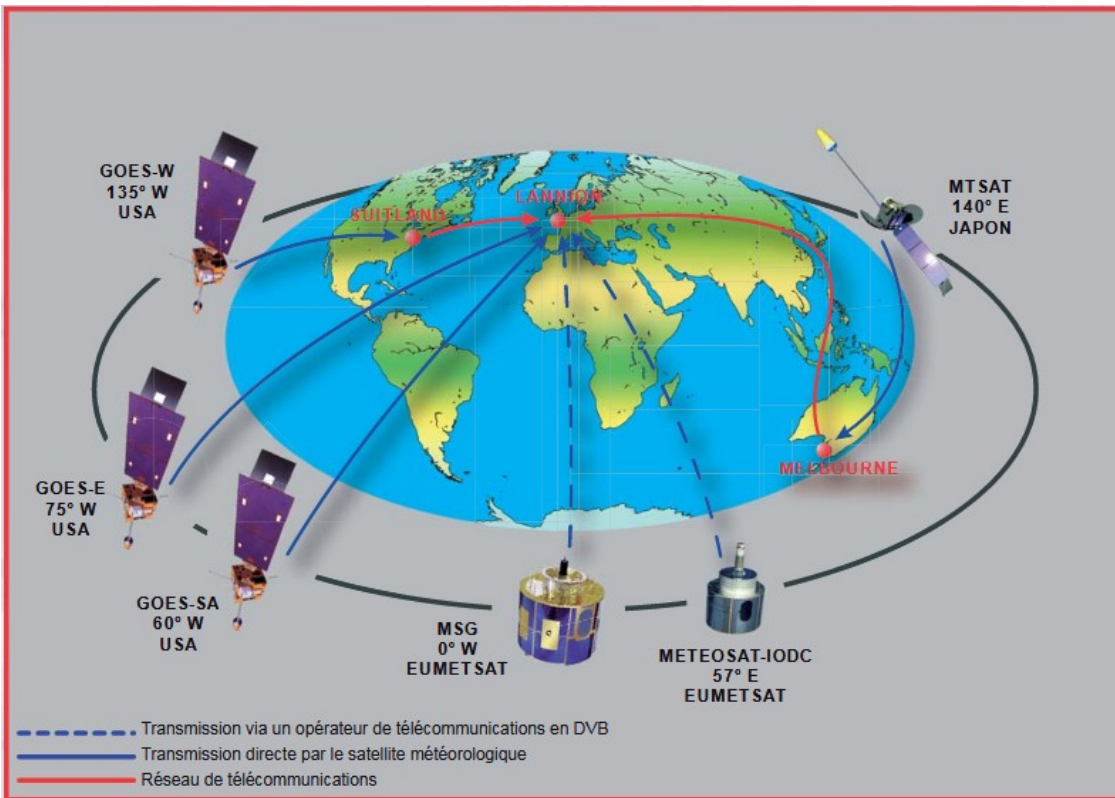
# Models data

- Messages format :
  - GRIB edition 1 and GRIB edition 2 in database
- Pretreatment
  - Change of descriptor
  - Calculated parameters
  - Transformation of grids
  - Transcoding from GRIB1 to GRIB2
  - Compression
  - Dissemination to our forecasting client (Synopsis)
- Database : BDAP (PostgreSQL)
- Volumetry : 5 TB ( 900 GB/jour)
- Retention : variable

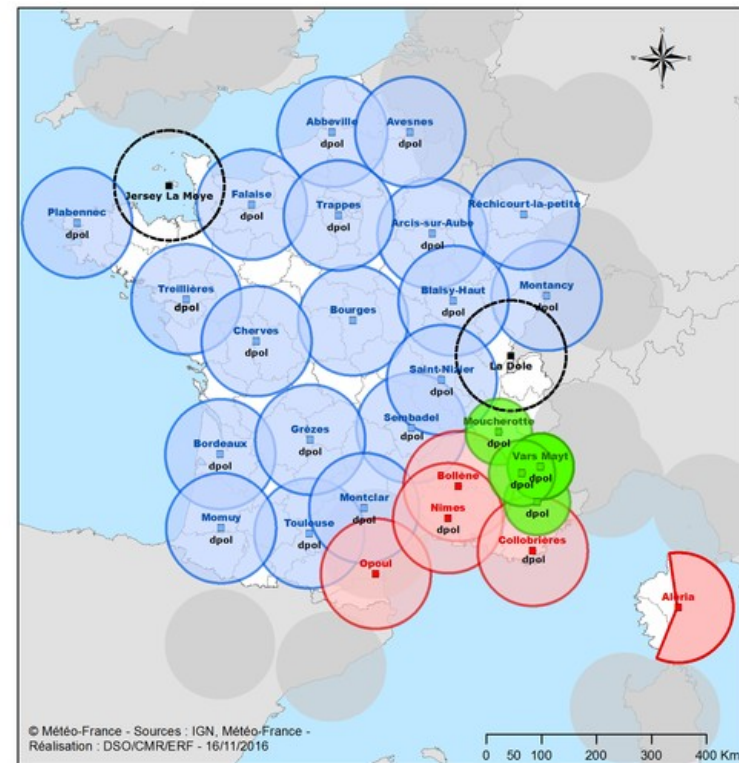
# BDAP-Archive

- Not in database → Grib Files stored in our storage system, under particular trees
- Not accessible by operational tasks
- About 500 TB
- Not optimized for data retrieve

# Images data



**RADAR network in 2016**



© Météo-France - Sources : IGN, Météo-France -  
Réalisation : DSO/CMR/ERF - 16/11/2016

## Légende

- C band - radar limitrophe
  - X band
  - S band
  - C band
- Dpol : dual polarization

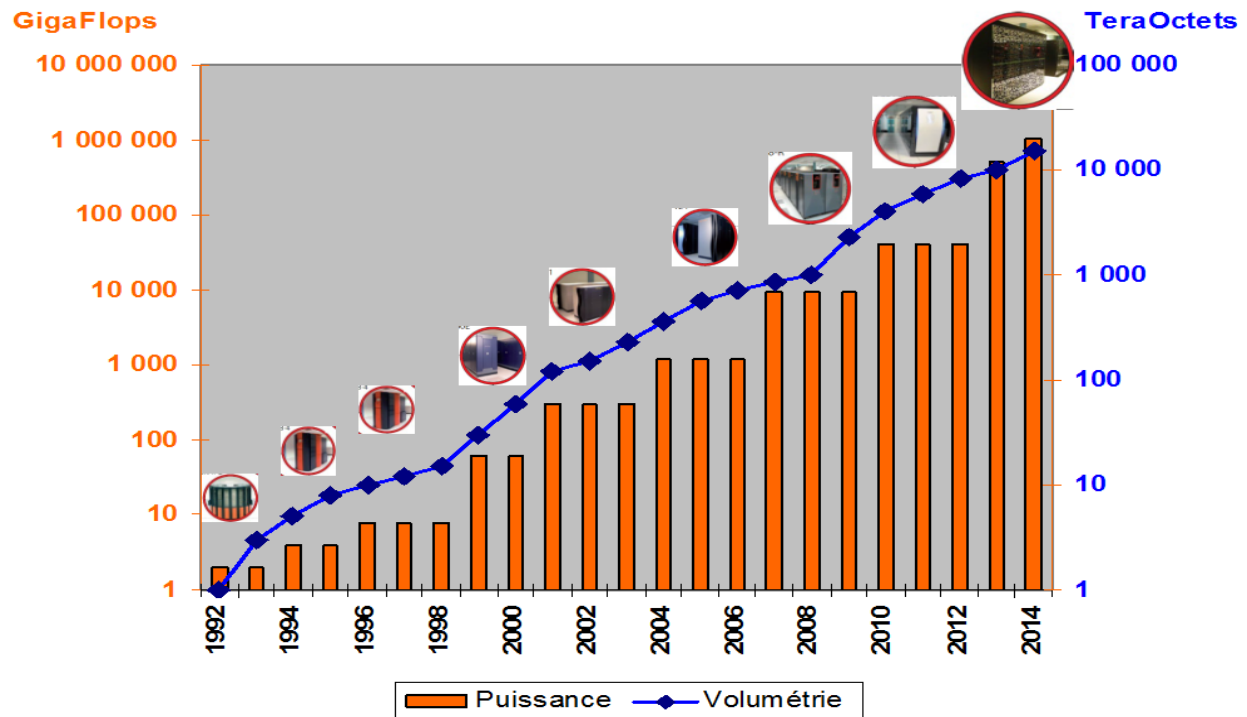


# Images data

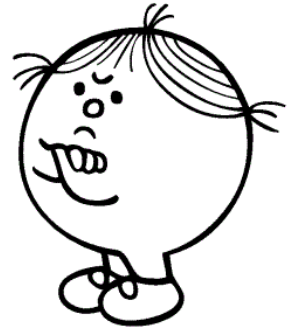
- Messages format :
  - GRIB, BUFR, TIFF , GEOTIFF
- Database : BDI (PostgreSQL)
- Volumetry : 55 GB (15 GB/d)
- Retention : 3d

# Growth of the archive

- MF archive grows exponentially (60% increase per year)
- The daily amount of data added to the archive grows exponentially at the same time
- A large part of research data is kept forever
  - For many studies, a data becomes useful once enough data has been accumulated
  - Deleting old data in an exponentially growing archive is meaningless



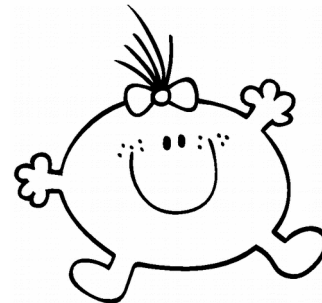
# Currently



- Many small files BUT tape storage more efficient with large files
- Only FTP interfaces
- Free organization of data for each user → non-trivial sharing
- Few access services

# In the future ...

- MF decided to install MARS (Meteorological Archive and Retrieve System) by 2020
  - Ease of access via directive files (the user does not care about the location)
  - Scalability
  - Optimization of the global flow of requests
  - Optimization of the tape reading
  - Rationalization of the storage space with control of the number of files



# Data delivery evolution

- MF is continuously evolving its data delivery methods and services to cater for the new user requirements
- Interoperability is key
  - Follow standards and governance to enable interoperability
  - OGC, INSPIRE, ISO 19xxx series, NetCDF-CF, WMO Information System, GEOSS
- Provide high-level services on the data
  - Data portals for data discovery
  - Web services, REST APIs for data retrieval and manipulation
- Close-to-the-data processes
  - The era of pushing the data to the user is coming to an end
  - ..... The volumes involved are too large

# Thank you Merci



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