NOAA AVHRR DATA CURATION AND REPROCESSING TIMELINE

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Background and Motivation

2013 marks the 35th anniversary of NOAA's Advanced Very High Resolution Radiometer (AVHRR) first launched on TIROS-N in 1978. The four to six band multi-spectral AVHRR data at 1.1 km spatial resolution constitute a valuable data source for deriving time series of surface parameters, such as snow cover, land surface temperature, or vegetation indices for monitoring global change. AVHRR data are residing in various archives worldwide. As an example ESA has archived NOAA data in several of their facilities; DLR has been receiving and processing NOAA AVHRR data into value-added products since 1981.
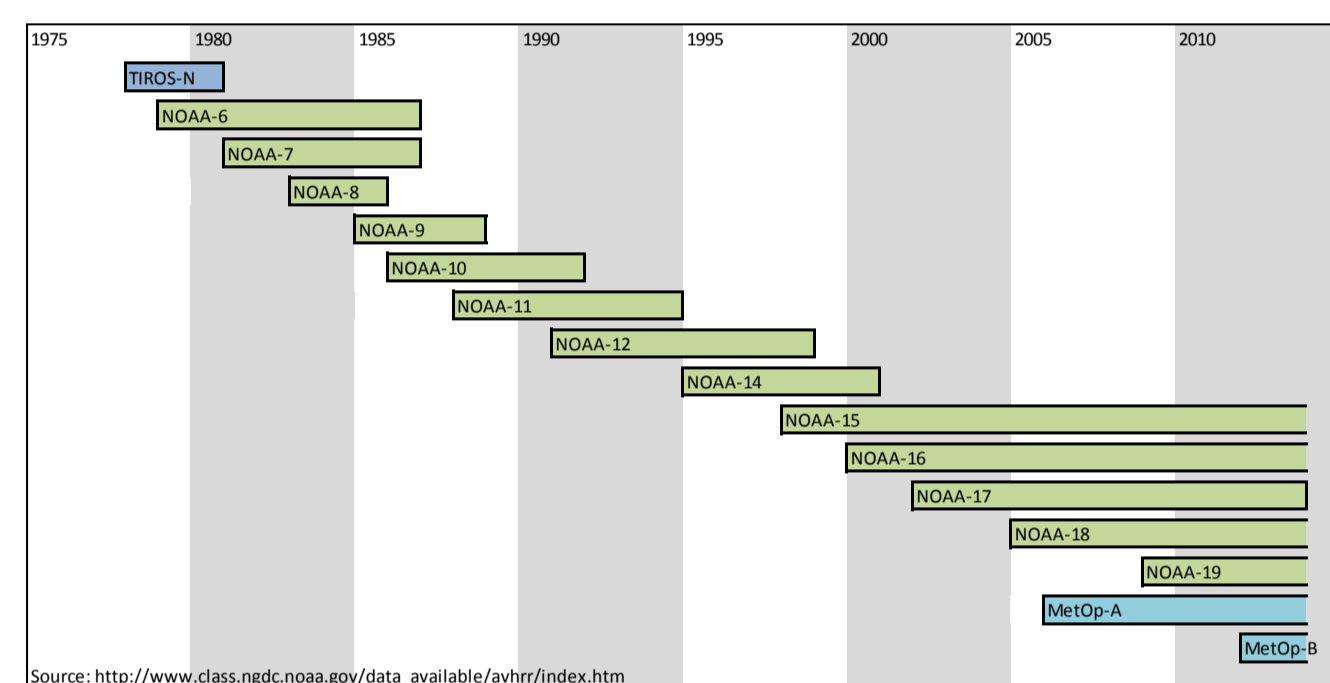

Figure 1. AVHRR, the multi-spectral sensor onboard the NOAA and MetOp satellites, offers data continuity since 1978.
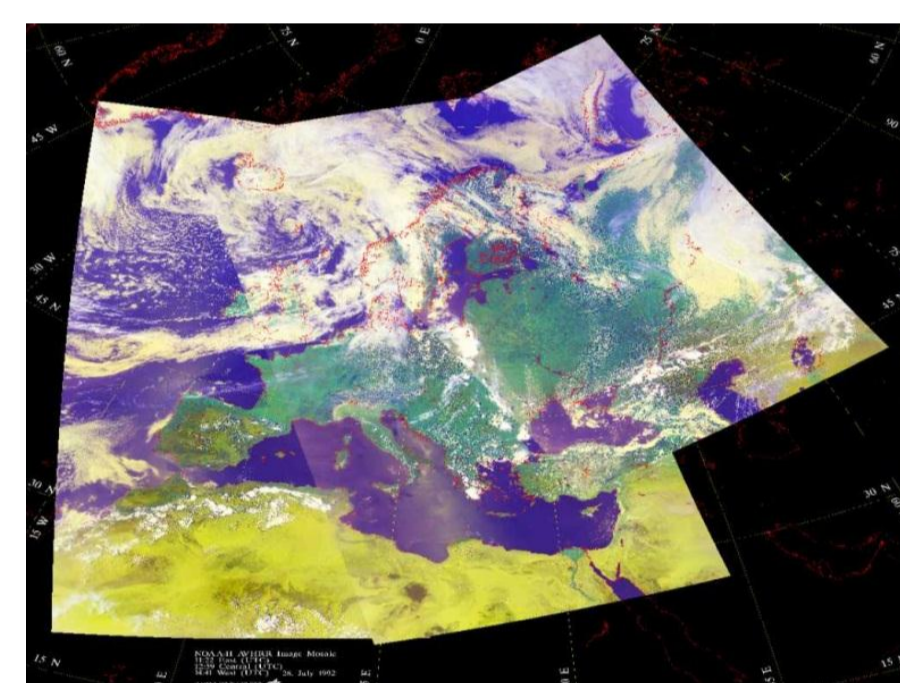

Figure 2. Spatial coverage of AVHRR data being received and processed at DLR.

NOAA AVHRR Curation and Reprocessing Projects

In order to properly preserve this valuable dataset, ESA has initiated the NOAA AVHRR Data Curation and Reprocessing initiative as a pilot project within ESA's long-term data preservation (LTDP) program. In 2013 DLR has kicked off TIMELINE - Earth Observation Time Series for Monitoring Global Change, a project focusing on generating a range of over 25 thematic products from the complete coverage of 30 years worth of NOAA AVHRR 1.1 km LAC (local area coverage) data over Europe.

The projects are complementary in scope and are being conducted cooperatively between DLR and the ESA LTDP program. They touch upon a variety of topics and disciplines on the scientific side as well as in large volume data processing and data management.
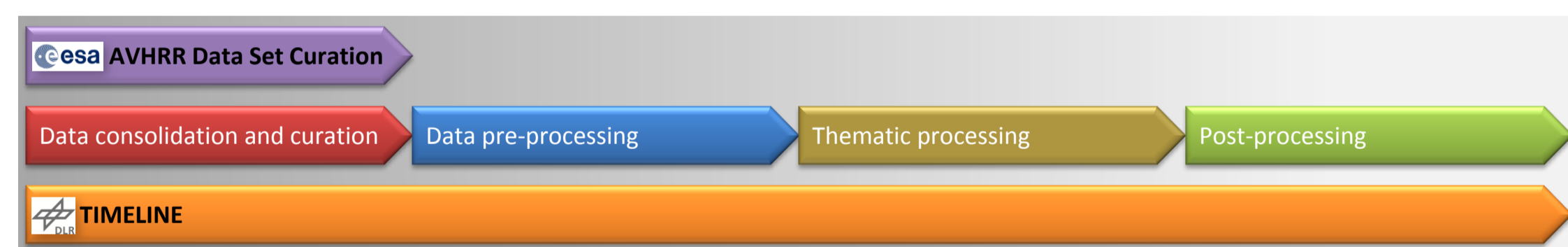

Figure 3. The DLR TIMELINE and the ESA AVHRR Data Curation and Reprocessing projects are complementary in scope. They overlap in the data set consolidation and curation work packages.

From the NOAA AVHRR Data Curation and Reprocessing and TIMELINE projects novel ideas for managing large Earth observation time series data sets are expected across the entire end-to-end chain - from data consolidation and curation via reprocessing and data management to innovative ways of data discovery and exploitation.
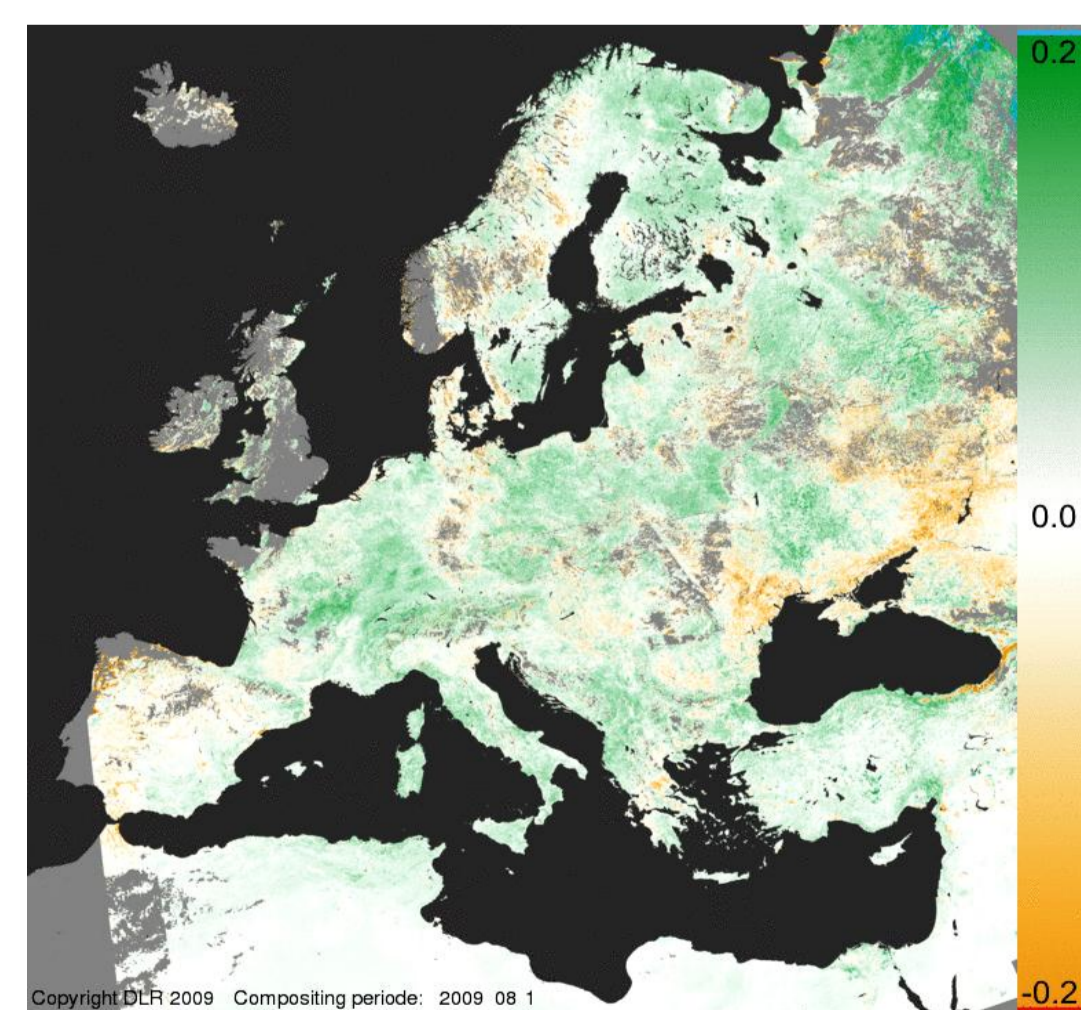

Figure 4. Application example: vegetation index (NDVI) anomaly for the period August 1 to10, 2009 compared to the long-term mean NDVI from 1998 to 2008. The product was derived from a time series of NOAA AVHRR LAC (local area coverage) data at 1.1 km spatial resolution.

Figure 5. AVHRR data set consolidation and curation is done in line with the European LTDP Common Guidelines and the Preserved Data Set Content documents developed within the ESA-led inter-agency LTDP working group. Both documents are available at http://earth.esa.int/gscb/ltdp/
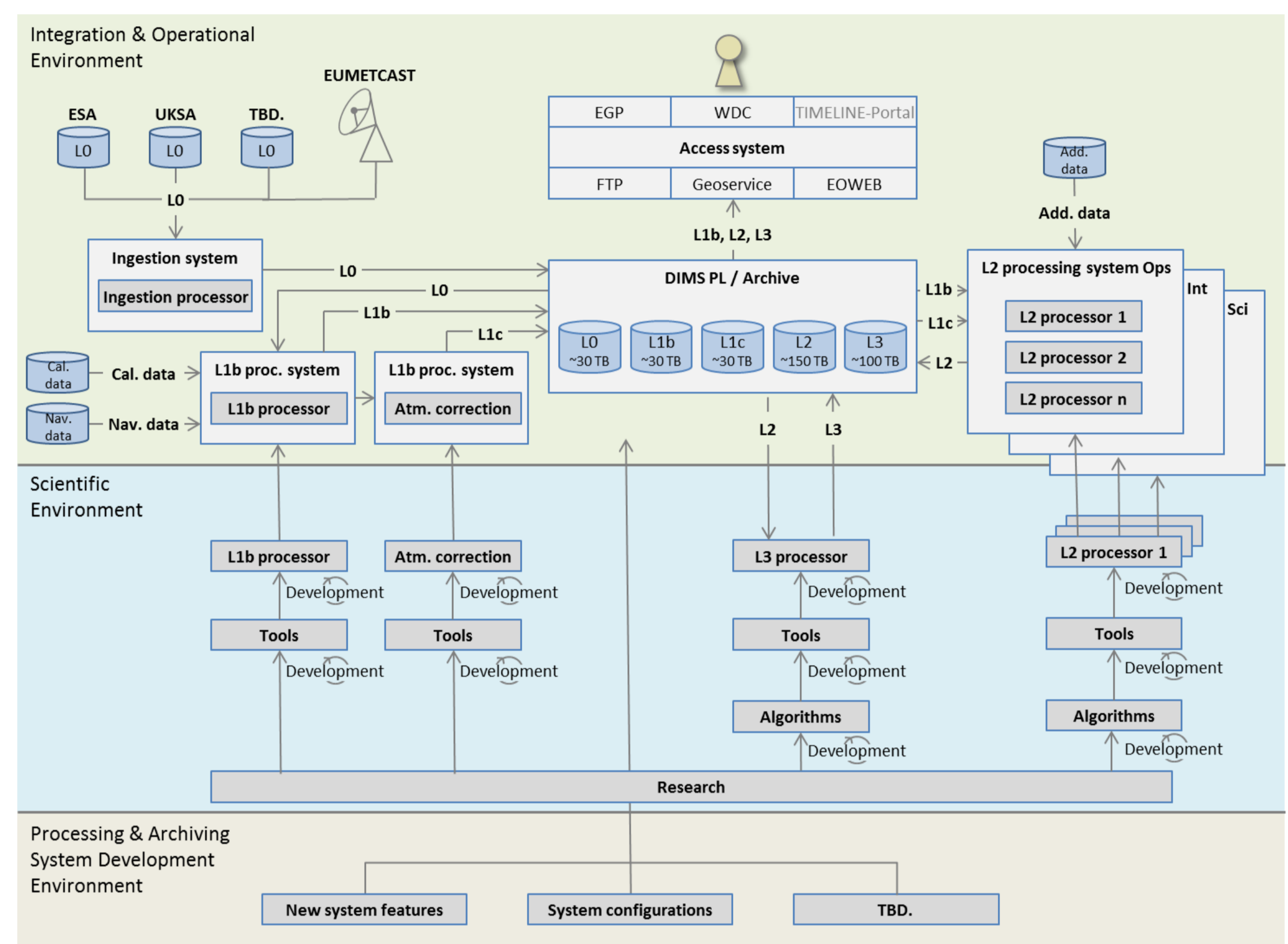

Figure 6. Draft system and data flow diagram of the DLR TIMELINE project. Processing and archiving system features and configurations are being developed in the system development environment (bottom) while algorithms and tools will be developed in the scientific environment (middle). Both are integrated in the operational environment (top) for AVHRR data reprocessing. The architecture being set up is to be generic enough to be transferable and re-useable with other Earth observation time series projects.

Challenges and Innovation Aspects

Data consolidation and curation
- Identifying and closing temporal and spatial data gaps in distributed AVHRR archives
- Data inventory and consolidation from various archives of ESA, DLR, UKSA, and CCRS into one consistent, spatially and temporally complete - possibly distributed - archive of AVHRR LAC data over Europe and Canada
- Curation of data, documentation, and software related to NOAA AVHRR in line with the European LTDP Common Guidelines and the Preserved Data Set Content documents
- Coordination between ESA and DLR AVHRR data curation initiatives, requirements, and expectations

Data processing and infrastructure
- Identify, obtain, and introduce into the processing chain external data for calibration and navigation of the entire time series
- Build from scientific algorithms flexible processing systems, integrated into the PDGS, for efficiently re-processing 30 terabytes of data into about 150 terabytes of validated thematic products
- Develop and set up a generic re-useable infrastructure for large volume time series data reprocessing in the PDGS

Time series data access
- Data management and archive data models ensuring efficient and user-friendly retrieval of localized time series data stacks of L1b data and thematic products
- Interactive on-the-fly visualizations of time series products to facilitate understanding of complex and interacting temporal phenomena

Selected References

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