ICSU/WMO World Data Center for Remote Sensing of the Atmosphere (WDC-RSAT)

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Since 2003 the Applied Remote Sensing Cluster[1] of the German Aerospace Center (DLR) has hosted and operated the World Data Center for Remote Sensing of the Atmosphere (WDC-RSAT) under the nongovernmental auspices of the International Council for Science (ICSU).

Logo of the ICSU/WMO World Data Center for Remote Sensing of the Atmosphere

An external advisory committee with representatives from space agencies (ESA), weather services (WMO, DWD) and scientific research has been established in 2006 to help WDC-RSAT better reaching its goals and fulfilling its tasks.

Data Holdings: Raw Data and Value-Added Products

WDC-RSAT offers scientists and the general public free access to a continuously growing collection of atmosphere-related data sets and services. These data holdings are available on-line and range from raw data collected by remote sensors (Tab. 1) to information products derived from the raw data ("value adding") (Tab. 2, Fig. 1). The current WDC-RSAT data holding contains data and information products on trace gases (Fig. 2), clouds, land and sea surface parameters, and solar radiation.

Service to the Scientific Community

In cooperation with the World Meteorological Organization (WMO), WDC-RSAT is currently being implemented as part of the WMO-GAW Strategic Plan 2008-2015[2] especially in the context of IGACO[3] within the WMO program Global Atmosphere Watch (GAW). This center would concern itself with linking different GAW-relevant data sets both with each other and with models. In this context WDC-RSAT will also handle non-satellite based data which are relevant within the context of validation. Strategies and techniques to properly validate data sets, including for example data assimilation methods, are developed and tested. Aspects of the atmosphere's variability at different temporal and spatial scales ("miss-integration error") are addressed.

Logo of the NDMC

Logo of the UFS

WDC-RSAT is envisaged to play a major role within the recently established international and global Network for the Detection of Mesopause Change, NDMC[4], with the mission to promote international cooperation among research groups active in the mesopause region (~80-100 km height) to enhance the suitability of airglow observations for the detection of long-term trends. WDC-RSAT will serve as a communication and data management platform for this worldwide network of ground-based measurements.

Additionally, WDC-RSAT serves the Bavarian Environmental Research Station "Schneefernerhaus" (UFS)[5] on the Zugspitze mountain (2650 m a.s.l.), which is also a WMO-GAW Global Station, with all aspects related to data management.

Sensor		Temporal Coverage
AATSR	(Advanced) Along-Track Scanning Radiometer	1991 - present
AIRS	Atmospheric Infrared Sounder	2002 - present
AMSR	Advanced Microwave Scanning Radiometer	2002 - present
AMSU	Advanced Microwave Sounding Unit A / B	1978 - present
ATMOS	Atmospheric Trace Molecules Observed by Spectroscopy	1985, 1992, -93, -94
ATOVS	Advanced Tiros Operational Vertical Sounder	1986 - present
AVHRR (/3)	Advanced Very High Resolution Radiometer (/3)	1978 - present
CRISTA	Cryogenic Infrared Spectrometers and Telescopes for the Atmosphere	1994, 1997
GOME (-2)	Global Ozone Monitoring Experiment (-2)	1995 - present
GOMOS	Global Ozone Monitoring by Occultation of Stars	2002 - present
HALOE	Halogen Occultation Experiment	1991- 2005
HIRDLS	High Resolution Dynamics Limb Sounder	2004 - present
IASI	Infrared Atmospheric Sounding Interferometer	2006 - present
MAS	Millimeter-wave Atmospheric Sounder	1993, 1994
MERIS	Medium Resolution Imaging Spectrometer	2002 - present
MHS	Microwave Humidity Sounder	2006 - present
MIPAS	Michelson Interferometer for Passive Atmospheric Sounding	2002 - present
MISR	Multi-angle Imaging SpectroRadiometer	1999 - present
MLS	Microwave Limb Sounder	1991 - present
MODIS	Moderate-Resolution Imaging Spectrometer	2001 - present
MOPITT	Measurements of Pollution in The Troposphere	1999 - present
OMI	Ozone Monitoring Instrument	2004 - present
POAM I/II	Polar Ozone and Aerosol Measurement I/II	1993 - present
SAGE I-III	Stratospheric Aerosol and Gas Experiment I-III	1979 - present
SCIAMACHY	Scanning Imaging Absorption Spectrometer for Atmospheric Chartography	2002 - present
SEVIRI	Spinning Enhanced Visible and Infrared Imager	2002 - present
(S)SBUV	(Shuttle) Solar Backscatter Ultraviolet Spectrometer	1978 - present
TES	Tropospheric Emission Spectrometer	2004 - present
TMI	Tropical Rainfall Measuring Mission (TRMM) Microwave Imager	1997 - present
TOMS	Total Ozone Mapping Spectrometer	1978 - present
VIRS	Visible and Infrared Scanner	1997 - present

Table 1: Level 1-2 data and information products in the WDC-RSAT

Level 1 Data: Radiometrically corrected and geolocated sensor data
Level 2 Data: Derived geophysical parameters from Level 1 data

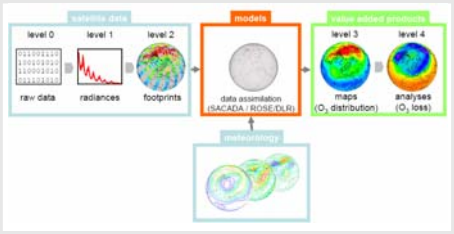

Figure 1: Elements of the value adding chain
Illustrated for the operational ozone processor operated at DLR on behalf of ESA and EUMETSAT, using ERS-2/GOME, MetOp-A/GOME-2, ENVISAT/SCIAMACHY, ENVISAT/MIPAS.

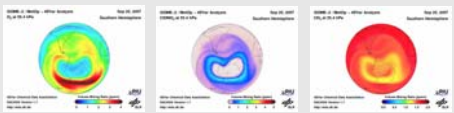

Figure 2: 4D variational analysis using CTMs (SACADA) – Typical Examples

Data	Geographic Coverage	Temporal Coverage	Data Availability
Level 3			
O_3 Vertical Column Density	global	1978-present	archived
O_3 Vertical Profile	global	2003-present	archived
NO_2 Vertical Column Density	global	2005-present	archived
SO_2 Vertical Column Density	global	2008-present	archived
Temperature & Dewpoint Temperature Profile	Europe/North Africa	1999-2005	upon request
Total Water Vapor Content	Europe/North Africa	1999-present	upon request
Aerosol Optical Depth	Europe/Africa	2005-present	archived
Aerosol Type	Europe/Africa	2005-present	archived
Cloud Coverage	Europe/North Africa; global	2003-present (earlier); 2007-present	archived (upon request); archived
Cloud Top Height	Europe/North Africa; global	2003-present (earlier); 2007-present	archived (upon request); archived
Cloud Optical Thickness	Europe/North Africa	2003-present (earlier)	archived (upon request)
Cloud Top Albedo	global	2007-present	archived
Cloud Classification	Europe/North Africa	2003-present (earlier)	archived (upon request)
Cloud Ice/Liquid Water Path	Europe/North Africa	2003-present (earlier)	archived (upon request)
Snow Cover	Europe/North Africa	2006-present	upon request
Vegetation Index (NDVI)	Europe+	1995-present	archived
Land Surface Temperature	Europe+	1998-present	archived
Sea Surface Temperature	Europe+	1993-present	archived
Level 4			
Total Ozone Record	global	2003-present	archived
Total Ozone Change	global	2007-present	archived
CIOx Activation	global	2007-present	archived
Aerosol Type Climatology	Europe/Africa	1997-1998	archived
Leaf Area Index	Europe+	1998	upon request
Net Primary Productivity	Europe	1998	upon request
Land Cover Classification	Germany	2004	archived
Dynamic Activity Index	hemispheric	2003-2005	archived
Planetary Wave Amplitude and Phase	hemispheric	2003-2005	archived

Table 2: Level 3-4 data and information products in the WDC-RSAT

Level 3 Data: Geophysical parameters that have been spatially and/or temporally resampled from Level 2 data.
Level 4+ Data: Outputs of results from models using lower level data as inputs and thus not directly derived from the data.

Networking: Improving Communication and Collaboration

As part of the ICSU-WDC family, WDC-RSAT is by definition integrated and linked to other WDCs worldwide. Besides this link, fostering a WDC subnetwork which focuses on key aspects of "System Earth" is regarded as significantly adding value to the individual WDC data holdings. One such key aspects touching WDC-RSAT is the question of changes in climate and weather extremes, which is of fundamental significance for the economic well-being of all nations and of major concern when attempting to understand natural and anthropogenic climate variability. Because the climate system is influenced by the state of and changes in the atmosphere, on land, and in the oceans, data describing these subsystems, as well as the mechanisms affecting climate, are required. Many of the required data sets are archived in three current ICSU World Data Centers, namely WDC-Climate (hosted by the German Climate Computer Center), WDC-MARE (co-hosted by AWI and the University of Bremen), WDC-RSAT (hosted by DLR), and the pending WDC-TERRA (to be hosted by GFZ). In 2004 these four WDCs founded the WDC cluster "Earth System Research".

WDC-RSAT cooperates with partners in establishing and making use of modern information technologies. As an example, WDC-RSAT, together with the abovementioned WDCs, is part of the German C3-Grid (Collaborative Climate Community Data and Processing Grid) project. In addition to these activities, the WDCs are actively working together on issues related to data publication. WDC-RSAT is currently being implemented as a data publication agent for data related to remote sensing of the atmosphere. Both projects are concerned with the data stored in the WDCs and ensuring that they are available and can be cited thanks to proper handling of metadata files.

[1] German Remote Sensing Data Center, DFD, and Remote Sensing Technology Institute, IMF
[2] http://www.wmo.int/pages/prog/arep/gaw/documents/gaw172-26sept07.pdf
[3] Integrated Global Atmospheric Chemistry Observations (IGACO)
[4] http://wdc.dlr.de → ndmc
[5] http://www.schneefernerhaus.de