Kongsberg Spacetec AS

KONGSBERG

MEOS™ Polar

Ground Station

The *MEOS™ Polar Ground Station* is a multi-mission, flexible and modular turnkey system for acquisition, archiving, processing, analysis and distribution of meteorological data.

The *MEOS™ Polar Ground Station* supports the following satellites, sensors and transmission formats:

Satellites	Sensors	Transmissions
NOAA	AVHRR, TOVS, ATOVS	HRPT, Eumetcast
TERRA and AQUA	MODIS, AIRS AMSU-A, HSB	Direct Broadcast
METOP	AVHRR, ATOVS	AHRPT, Eumetcast
FY-3	VIRR, MERSI	CHRPT, MPT
NPP	ViiRS	HRD
JPSS1	ViiRS	HRD

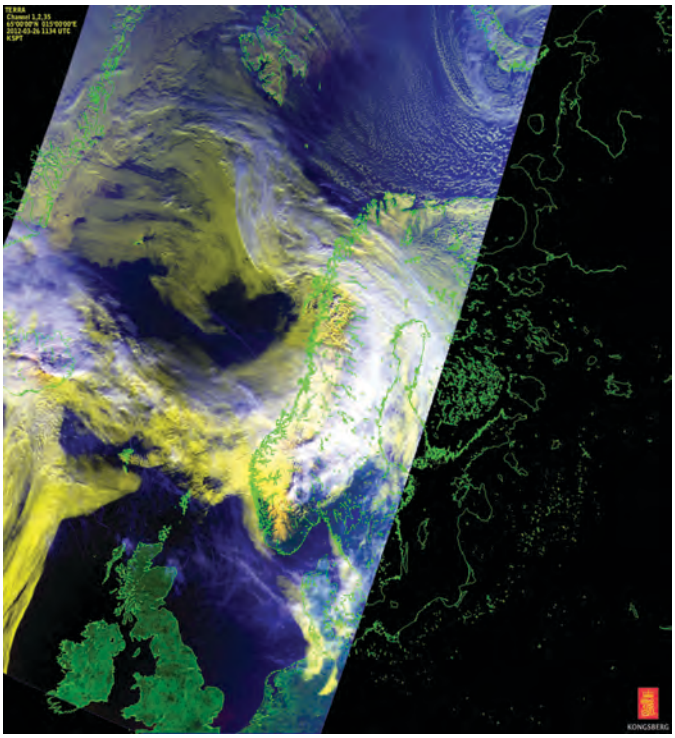
Supports other missions upon request.

The *MEOS™ Polar Ground Station* can be delivered with support for any combination of these missions depending on the customer's requirements.

The *MEOS™ Polar* support direct broadcast reception in L- and X-band. In addition C- og Ku-band reception through Eumetcast is supported for NOAA and METOP.

Key features & benefits

- Complete ground station
- Open architecture allows easy upgrading
- Unix/Linux based environment
- Flexible, modular and scalable design
- Multi-mission support
- Ingest of raw data to disk and pre-processing
- Local and remote operation control
- Configurable Graphical User Interface for monitoring and control of the ground station
- Advanced logging and display of site telemetry and status in real time
- Quick Look Viewer
- Processing of basic products depending on mission
- Open data access at all processing levels
- Generating of browse
- Archiving of raw data and higher order products
- Export file formats: JPEG, PPM, PNG and Geotiff
- Distribution of raw data and products (FTP and NFS)
- Visualisation tools
- Web reports
- Extensive training, maintenance and support program



Calibrated and geocoded TERRA MODIS, Channels 1,2,35. North sea, Norwegian sea, Barents sea. Snow showers are developing in Barents sea east of Bear Island, hitting Northern coast of Norway and Russia. Typical cloud waves east of Jan Mayen can also be seen.

MEOS POLAR MET

The Basic Package ingests data from the Front End System and provides all the necessary tools for basic processing and operation of the ground station. Data are pre-processed and stored into a Unix file system in mission specific formats or as Level 0, Level 1 and map-projected products in HDF 5 format. All data is archived in a product database.

Map-projected products can be viewed with the visualisation software package MEOS™ *VImSat*. It is a fast, operational viewing tool containing functions; such as accessing archived products, zooming, printing, image enhancements, format converting and overlaying graphics.

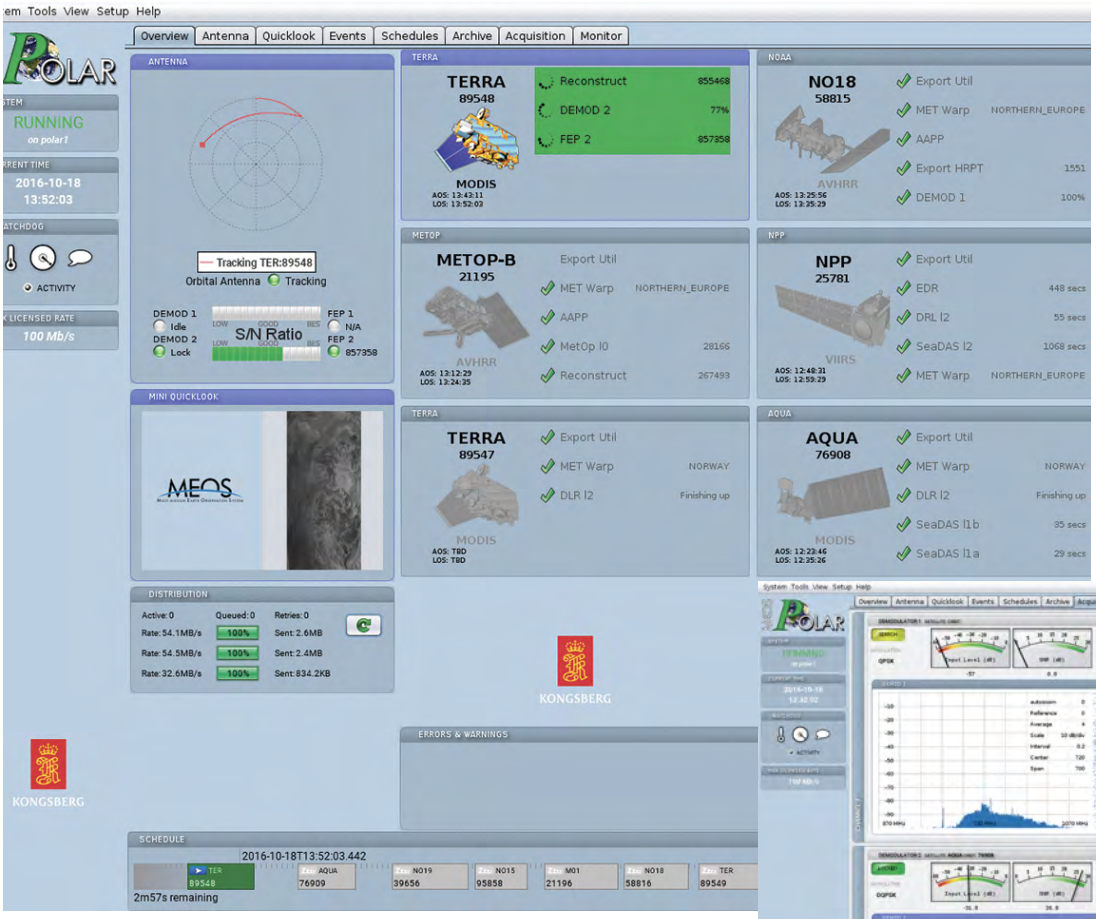
Raw data files and higher level products may be distributed over LAN/WAN to other users. All operations are automatic and easily configurable, including management of disk space and retrieval of processing parameter files.

The system has advanced capabilities for monitoring of the system. All status information is written to disk as log reports. This gives a unique capability to do diagnostics locally as well as remotely, and to generate reception quality reports. The Basic Package contains a Quick Look Viewer showing incoming data in real time, with possibility to show selected channels, perform image enhancement, view a previous dissemination and to display multiple missions.

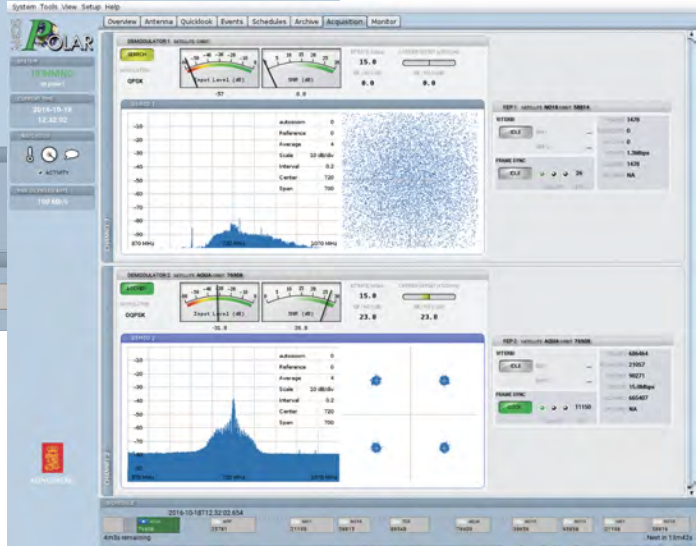
Advanced Package

The Advanced Package is an add-on to the Basic Package and contains automatic processing of Value Added Products. The range of Value Added Products include nowcasting products, such as Cloud Type and Cloud Top Temperature, and climatological products like Sea Surface Temperature and Normalised Difference Vegetation Index.

Display Examples



The status and progress of scheduled receptions is shown in the GUI.



Spectrum and scatter plot from two channels during FY-3 reception.

Front End System

The system provides the functionality to track the satellite, receive the radio frequency and deliver data to the ingest system. The Front End System includes:

- Antenna
- Feed/downconverter
- X-band RHCP / LHCP switchable polarity
- L-band RHCP / LHCP switchable polarity
- Digital receiver/bitsynchroniser
- Satellite tracking controller

Kongsberg Spacetec provides different antenna sizes depending on the customer's requirements:

Frequencies	C/Ku*	**L**	**L**	**X**	**Dual L,X**				
Antenna sizes (m)		**1.8**	**2.4**	**2.4**	**2.4**	**3.0**	**3.8**	**4,3**	**5.0**
Satellites									
NOAA	+	+	+		+	+	+	+	+
METOP	+	+	+		+	+	+	+	+
TERRA				+	+	+	+	+	+
AQUA				+	+	+	+	+	+
FY-3			+	+	+	+	+	+	+
NPP				+	+	+	+	+	+
JPSS1				+	+	+	+	+	+
METOP SG				+	+	+	+	+	+

** Reception of retransmitted data over EUMETCAST via telecom satellite.*

Basic Package

- Ingest of raw data to disk and pre-processing
- Production oriented /Station Control System/
- Local and remote operation control
- Configurable Graphical User Interface for monitoring and control of the ground station
- Advanced logging and display of site telemetry and status in real time:
  - Schedule display
  - Activity display
  - Event log display
  - Station overview display
- *Quick Look Viewer*
- Generating of browse image files
- Archiving of raw data and higher order products
- Processing of the following products:
  - NOAA and METOP AVHRR:
    Level 1b and calibrated map-projected products
    Kongsberg Spacetec integrates the ATOVS and AVHRR Pre-processing Package - AAPP.
  - NPP/JPSS1 ViiRS:
    Level 1 calibrated (CSPP) and geocoded
  - FY-3 MERSI and VIRR:
    Level 1b and calibrated map-projected images.
    The CMA FY-3 software pacakge is integrated in MEOS™ and used for Level 1b processing.
  - TERRA and AQUA MODIS:
    Level 0, Level 1a and Level 1b, and bowtie corrected calibrated map-projected products
    The SeaDAS package is integrated in MEOS™ and used for Level 1a and Level 1b MODIS processing
- All map-projected products have defined projection parameters, and are stored as HDF 5 files
- Open data access at all processing levels
- Export of HDF 5 products to JPEG, PPM and PNG, GeoTiff
- Distribution of raw data and products (FTP, SFTP and NFS)
- Web reports
- Visualisation tools:
  - MEOS™ VImSat HDF 5 products
  - HDFLook or HDFview can be used for MODIS Level 1a, Level 1b and Level 2
  - DIANA Meteorological Workstation from Norwegian Meteorological Institute (met.no) for visualization of satellite imagery combined with NWP and observation data in netCDF and BUFR.

Host Computer and Receiver

The host computer is a server with Linux operating system. It is equipped with state-of-the-art hardware, a recent model CPU, sufficient RAM for fast processing, and disk space dimensioned for the customer's data storage demands.

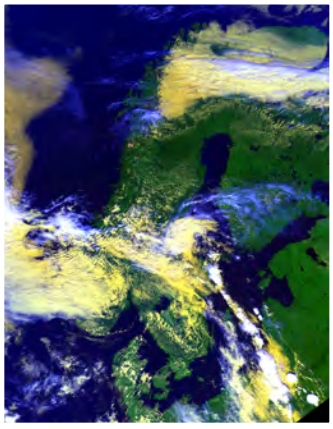
Additional computers can be connected in LAN/WAN if a distributed system with multiple workstations is desired.

One or two receivers are integrated in the server. *MEOS™ Polar* can also be delivered for operation with customer furnished external receiver(s).

Processing Speed for TERRA and AQUA Direct Broadcast

From the end of reception (loss of signal) to finished Level 1 is typically 5 minutes.

MEOS™ Antenna avaliable from 2.4 m to 5.0 m L/S/X-Band



AVHRR - Channels 1,2 and 4

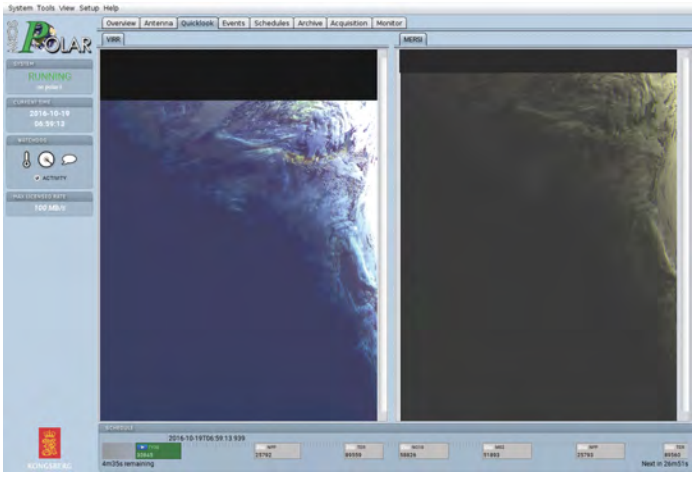
Options

The following packages are fully integrated in the MEOS™ for operational production:

- **AVHRR Advanced Package - Value Added Products**:
  - Sea Surface Temperature (SST)
  - Cloud Top Temperature (CTT)
  - Cloud Top Height (CTH)
  - Cloud Top Pressure (CTP)
  - Cloud Amount (CA)
  - Cloud Type (CTYPE)
  - Hot Spot Detection (HSD)
  - Precipitation Index (PI)
  - Normalised Difference Vegetation Index (NDVI)
  - Yellow Sand

- **MODIS Advanced Package - Value Added Products**:
  - Ocean Colour Products (MOD18)
  - Sea Surface Temperatures (MOD 28)
  - Aerosol Products on day time data (MOD 04)
  - Water Vapor and Atmospheric profiles (MOD 07)
  - Cloud Products (MOD 06)
  - Land Surface Temperature (MOD 11)
  - Normalized Difference Vegetation Index (NDVI) & EVI (MOD 13)
  - Fire detection (MOD 14)
  - Cloud Mask (MOD 35)
  - Corrected Reflectance (CREFL)
  - Water Vapor Near Infrared

- **NPP Advanced Package- Value added Products:**
  - Cloud Mask
  - Active Fires



MEOS™ FY-3a dual channel realtime quicklook

- Aerosol Optical Thickness
- Suspended Matter
- Sea Surface Temperature
- Surface Reflectance
- Normalized Difference Vegetation Index (NDVI)
- Enhanced Vegetation Index (EVI)
- Surface Type
- Land Surface Type
- Atmospheric Temperature [K]
- Atmospheric Humidity [g/kg]
- Atmospheric Ozone [ppmv]
- Atmospheric Relative Humidity [%]
- Atmospheric Dew Point Temperature [K]
- Surface Skin Temperature [K]
- Surface Emissivity at instrument spectral resolution [cm-1]
- Total Precipitable Water
- Total Ozone Amount (vertically integrated) [dobson units]
- Lifted Index [deg celsius]
- Convective available potential energy [J/kg]
- CO2 amount [ppmv]

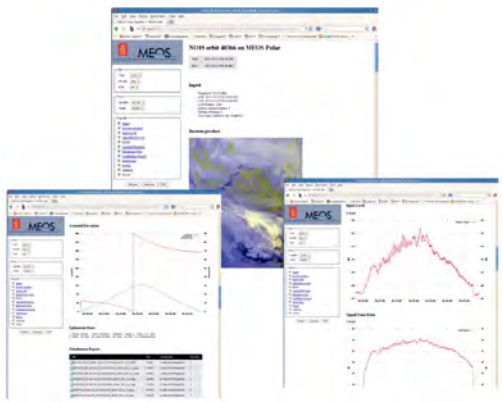
- **EARS Segmentation**
  EARS segmentation and remote scheduling (NOAA, METOP, NPP, FY-3, JPSS and METOP SG)

- **AIRS, AMSU-A and HSB, Processing**
  Kongsberg Spacetec integrates the International MODIS and AIRS Processing Package.

- **TIP Data Extraction and Archiving Package**
  The package demultiplexes NOAA and METOP HRPT raw data files and extracts TIROS Information Processor (TIP) data. TIP data is stored as a seperate data type in a standard rolling archive of the MEOS™ system. User defined processing TIP files, such as extraction and archiving of Argos information, is implemented upon demand.

- **Additional Value Added Products**
  Please consult Kongsberg Spacetec for more details.

- **Integration**
  Integration of customer specific ddata, in-situ and radar images into the MEOS™ Visualisation Tools.



MEOS™ Web Reports

Note:
MEOS is a registered trademark of Kongsberg Spacetec AS.
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