Top 300 Features

Have a look at the Top 30 Highlights.
And these are CineSat's top 300 features:

Real-Time Meteorological Image Analysis

Receiving a real-time satellite image data stream, CineSat automatically computes the following analysis products:

- Cloud Motion Analysis (all spectral channels):
  - Absolute cloud motion
  - Cloud system motion
  - Relative motion within cloud systems
- Cloud Development Analysis
  Separates cloud movement from cloud development (configurable observation interval)
- Convective Cell Analysis
  Detection and description of convective cloud cells
  (position, diameter, area, motion speed and direction, cell top temperature, cooling rate, cell border, expansion/shrinking rate)
- Upper Tropospheric Humidity computed from water vapor images
- Normalized Difference Vegetation Index

Nowcasting Products

Based on this automatic real-time image analysis, CineSat computes the following short-range forecast products:

- Cloud border prediction
- Convective cell trajectory prediction
- Rainfall and lightning trajectories
  if rainfall and lightning positions are provided
- Inverse trajectories; at what time will certain weather events approach an airport
- Interface to MSG Nowcasting SAF
- Prediction of future satellite images;
  single images for defined time steps and
  image series - watch a cloud movie covering
  several hours from the past into the future

Composite Images

- RGB Color Composites
  - Combine any three images to an RGB composite
  - Predefined composites based on MSG Interpretation Guide, a standardized, internationally approved reference work for satellite channel composites, to make physical cloud properties visible in a standardized presentation; for ice/water clouds, fog, cirrus, convection, ...
  - Interactive RGB tool: channel differences, weighting, linearization, and gamma correction of MSG channels
- Mosaic images built from several satellites in any supported map projection
- Full resolution World Cloud Maps from all geostationary satellites; interactive zoom and scroll, and overlay of
- world-wide observation data like temperature and wind
- Spectral composite images
- Merging of different spectral channels into a single gray/color image (e.g. adding IR and VIS clouds)
- Image arithmetics: weighted adding, subtracting, multiplication, (absolute) linear combination
- Minimum and maximum of two images
- Superimpose clouds on selected background for TV weather animation
- Automated real-time production of composites

Satellite Image Movies

- Perfectly smooth and sharp interpolation of satellite images for TV weather animation loops
- Accurate interpolation of missing images
- Convert your raw input data stream to appealing movies
- Automated real-time movie production
- Easy interactive movie generation for selected regions; snapshot facility, documentation of weather events for studies, research, education, and your web service
- User-defined graphic layouts (colors, overlays, underlays)
- Formats: support for AVI, MPEG, and animated GIF
- Export movie frames in GIF, JPEG, PNG,
- Automatically update your website with new animations

Automated Weather Graphics

For every incoming satellite image CineSat can automatically produce weather displays and animation movies, composed of cloud images, backgrounds, and overlays. You can choose almost any cartographic projection, image size, and color.

- User defined colors for images and overlays
- Pre-defined standard color look-up tables
- Import of ASCII look-up tables
- Perfect dithering of RGB images to 8-bit images
- Declouding of infra-red images:
  timely consistent and robust extraction of IR clouds
  and overlay on colored topographic backgrounds
- Overlays: borders, geographical net, cities, vector fields, positions, convective cells, ...(see overlays)
- Draw directly into an image, or produce vector overlays
- Drawing supports 8-bit palette and true color images
- Export of transparent GIFs (space masking)

FrontEditor - Interactive Drawing Tool

- Draw front lines, convergence lines, jets, and many more meteorological tracks
- Meteorological symbols
- Annotation text with selected font, size and color
- Position icons, images and logos
- Graphical lines and shapes (rectangles, polygons, circles, freehand curves, etc.)
- Drawings are stored with geographical coordinates
- Re-map your drawings to other projections / sectors
- Save as Scalable Vector Graphics (SVG) that can be viewed with any web browser

Contrast Enhancement

- Linear brightness shift and contrast stretching
- Local contour enhancement filters
- User-defined (non-linear) pixel transformation tables
- Global and local histogram equalization

Image Processing

- More than 40 pre-defined image filters for
  - Noise removal (speckle filter, ...)
  - Smoothing (median, gauss, binomial, ...)
  - Cloud contouring, sharpening, edge detection
  - 3D relief filtering
- User-configurable filter kernels
- Black line removal
- Neat and seamless removal of burnt-in overlays
- Rich set of Earth / space masking options
- Land / sea masking
- Region clearing and masking
- Image thresholding and binarization
- Geometrical operations: flip, tilt, rotate, resize, zoom
- Crop region of interest; projection adapts accordingly
- Image arithmetics: min, max, multiply, divide, linear combination of up to 10 images
- Most operations support palette, gray, and true color images
- Set / remove / edit / list user-defined image annotations
- Image annotations can be “tag”=”value” pairs or file attachments (text or binary)

Calibration and Radiometric Processing

- Image calibration and re-calibration
- Gain and offset
- Pixel-to-temperature conversion table
- Supports various physical dimensions like
  temperature, length, area, pressure, weight, time, ..
  in more than 40 international standard units
- Supports and converts between spectral and effective MSG radiance schemes
- Atmospheric correction, sun angle correction
- User-defined pixel transformation tables
- Invert image pixel values and color maps
- Image processing preserves calibration as far as possible
- Conversion of physical units

Sun Tools

- Accurate sun position for a given date and time
- Sun rise and twilight information for any given date and location
- Sun angle correction of visible images
- Use sun elevation to decide on processing of an image
- Mask out day-time, night-time, and twilight areas
- Combine day-time and night-time images

Space Handling

- Set space hint when importing an image
  (max satellite angle, pixel range, ...)
- Apply space hint to mask out space pixels
- Handling of masked space in meteorological product extraction

Geographical Processing & Maps

63 user-configurable projection types:

- 10 azimuthal (plane) projections:
  ORTHO, GNOMONIC, STEREO, NPOL, SPOL, GEOSAT,
  EDAP, LAZIMUTH, VPERSPECT, HAMMER
- 14 cylindrical projections:
  EQUIRECT, PCARREE, MERCATOR, MILLER, GALLISO,
  GALLORTHO, GALLSTEREO, GNOMOCYL, ISOCYL,
  LAMBCYL, BEHRMANN, TRYSTAN, PETERS, BALTHASART
- 3 transverse cylindrical projections:
  CASSINI, TISOCYL, TMERCATOR
- 25 pseudo-cylindrical projections:
  ECKERT3, ECKERT4, ECKERT5, GOODE, IGOODE,
  KAVRAISKY7, MERCSAN, MOLLWEIDE, PUTNINS1,
  PUTNINS2, PUTNINS3, PUTNINS3P, PUTNINS4P,
  PUTNINS5, PUTNINS5P, PUTNINS6, PUTNINS6P,
  ROBINSON, WAGNER2, WAGNER3, WAGNER4,
  WAGNER6, WAGNER7, WERENSKIOLD1, WINKEL1
- 10 conical projections:
  ALBERS, ISLE, LAMBERT, TISSOT, MURDOCH1,
  MURDOCH2, MURDOCH3, EULER, PCONIC, VITKOVSKY1
- Miscellaneous projections: VANDGRINTEN
- Rotated COSMO Weather Model projections

User configurable projection parameters:

- Projection origin and standard parallel(s)
- Rotation angle for rotated projections
- Earth radius or spheroid axes
- Satellite height (where appropriate)
- Map area (region and scale)
- More than 90 predefined projections
- Define your map centered at any location of interest
- Use of elliptic earth model in important projections
- 50 pre-defined standard earth spheroids
- Nearest neighbor /bilinear /bicubic spline resampling
- Special treatment of masked space and space border
- Parallax correction (rectification of cloud displacement due to satellite viewing angle)
- Interactive map editor and map preview

Time Tools

- Time and date arithmetics
- Handle Julian day, day of year
- Create / modify time stamps in file names:
  e.g. compute the image file name plus 2 hours
  considering change of day/month/year/leap years
- Time difference from time stamps in file names
- Check if file matches a user-defined time or production schedule
- Use UTC or computer (local) time
- Supports 00:00 and 24:00 mid-night conventions

Table Data Handling

- Import and Export of ASCII and binary table data
- Example table input: cities, locations, lightning, station definition and station observations, color map, pixel transformation, calibration table, etc.
- Production of
- Cloud motion tables
- Trajectory tables
- Convective cell property tables
- Upper tropospheric humidity tables
- Renaming, deleting, and merging of table columns
- Table plots: cities overlay, stations, wind charts, trajectory plots

APE Automatic Product Extraction

- Operational power tool for automated real-time image processing, analysis, and extraction of your customized weather products:
- Raw image pre-processing (correction, mapping)
- Real-time image analysis and forecast information
- Fully configurable production of weather displays
- Interfaces to your own data processing
- Support for remote backup data sources
- Automated dispatch of input data to other CineSat servers
- Can invoke your site-specific applications (e.g. SAF)
- Very flexible automatic import of your image data
- Configurable distribution of results to your network
- Data transfer with ftp, rcp, NFS, and site-specific tools
- Automated file access by configurable file name rules
- Ready-to-use pre-configured processing chains,
  approved and developed with weather services, e.g.
  MSG / FSD / MPEF / OSISAF / NOWCAST / MOVIE, …
- Processing chains are simple pairs of Unix scripts and configuration files that can easily be created, modified or extended by the user to produce customized weather products and to process new data sets

- Easy configuration of secondary chain products (e.g. product displays, format conversions, ...)
- Support of multi-processor and multi-core platforms
- Processing can be split to several computers
- CineSat proved to operate fast, accurate, and safe

Operator Features

- Simple and intuitive operator GUI
- Operate and monitor CineSat from GUI or from Unix command line
- Log file viewer
- Configuration of Automatic Product Extraction (APE):
  Data import, result distribution, product parameters, ...
- APE operation: start, stop, restart after reconfiguration, processing of archived test cases
- APE monitoring: status, log files, processes, disk space
- Event logger, status monitor
- Watchdog timer and automatic restart will immediately resume normal operation after a machine reboot
- Data house-holding: comfortable, automatic, configurable Reporting and profiling tools
- Use “Server Roles” as master configuration flags
- Easy version control with CinePacks
- CinePack: package with all necessary software, data, and configuration items (user and system configuration); supports easy version roll-out and fallback
- Easy software updating due to strict separation and hierarchy of system and user configuration
- Very robust and operationally proven performance
- CineSat processing even survives power failures and and will seamlessly resume after power-on / reboot

Data Householding

- Flexible data scrubbing can be defined for single userdefined directories or complete directory trees
- Householding applies to all files or specified patterns
- You can limit
  - the maximum file age
  - the number of files per directory or tree to match a given pattern
  - the total accumulated size of files in a directory / tree matching a given pattern
- If the limit is exceeded, CineSat deletes the oldest files until the limit is reached
- File age can be determined from
  - Creation time, last modification time, or
  - Time stamp in file name
- Define any number of clean-up rules per directory
- You may set the clean-up times or period individually for each clean-up rule

APE Browser

A JavaScript-based interface to monitor the Automatic Product Extraction by means of a standard web browser.

- View real-time result images
- Inspect log, status, and configuration files
- Browse electronic CineSat documentation

User Interface Options

- Menu-driven graphical user interface (Java)
- HTML-based APE monitor and result browser
- Command line interface from a Unix terminal to all described data processing functions
- Invoke your applications from CineSat
- Invoke CineSat functions from your applications
- Menu- or batch-driven test case processing

Commands and Macros

- Most functions can be accessed both from GUI and from Unix scripts
- More than 100 proven image and data processing commands
- Command macro facility for batch control of graphical user interface
- Automatically load and animate images from a Unix shell script

Enterprise-Ready Configuration

- Multi-level and cascaded configuration profiles
- Define child configurations that override selected parent settings
- Use enterprise / site / group / server default settings that can be modified and extended by your own profiles
- Users are not limited to a single profile - define any number of profile hierarchies and decide which application profile to use when starting your GUI or the Automatic Product Extraction
- Conditional data import, export, processing, and cleanup; e.g. depending on server role, user/host name pattern, existence of files, ...
- This allows to easily create test beds for your operational servers and new applications, and to move from research and development to operations without changes
- Easily switch between configurations and user roles
- Strict separation of system and user configuration
- Profile management GUI
- Rich configuration GUI

Graphical User Interface

- Multi-window image, text, and HTML browser
- High-performance display of standard graphic formats:
  PNG, JPG, RAS, PBM, PGM, PPM, BMP, GIF, and of
  standard Meteosat Second Generation distribution formats
- Browse additional image formats by configuring standard conversion filters
- Display 8/10/12/16-bit indexed and 24-bit RGB images
- Supports palette, gray, and true color images
- Easy and intuitive color tools and Color Expert
- Quickly set preferred color maps from your favorites
- Fast zoom and scroll with mouse, keys, and scroll-wheel
- Individual or simultaneous zoom and pan in all windows
- Loop and Movie toolbox (see animation)
- Standard window layouts: full window, cascaded, side-by-side, top-to-bottom, tiled, tabbed
- Vector overlays, image legend (see overlays)
- Dynamic data window to display table values near cursor position, like convective cell properties
- Screenshot facility for single or all display windows, with or without enclosing frames
- Image and window printing
- Macro facility for batch control of graphical user interface
- Map editor and preview
- Choice of visual menu “look-and-feels” (Motif, Windows, CineSat)
- Customize your CineSat GUI:
  - Add color maps, macros, scripts, images, info files, etc to menu favorites
  - Hide selected menues for special applications
  - Add your own menu items
  - Run Unix scripts and CineSat functions on selected or all images, and display the results of this operation
- GUI is based on latest Java software technologies

Overlays

- Load any number of vector overlays like
  - Geographical nets and grid markers
  - Coastlines (resolution 25 km to 200 m)
  - Political borders
  - Cities (database of 3000+ world cities)
  - User-defined named locations
  - Basic graphics (title, text, lines, boxes)
  - Convective cell positions
  - Motion vector fields and trajectories
  - Predicted cloud contour overlay
  - Semi-transparent raster image overlay
  - Overlay your company logo to weather products
- Export to standard graphic formats (PNG, JPEG, PBM, PGM, PPM, SUN RAS, BMP, GIF, TIFF, …)
- Geographical overlays with sub-pixel accuracy
- Geographical overlays will adapt to image projection

- Image legend (for raw and calibrated values)
- Change overlay properties and order
- Apply overlays to a single or to all loaded images
- Quickly access preferred overlays from your Favorites

Station Model

- 250 configuration parameters for standard WMO model
- 20 pre-defined graphical components
- Up to 25 user-definable components
- Text, vector symbols, and icons
- Scalable vector fonts
- Definition of missing symbols
- Individual component color assignment
- Station collision control
- Easy adaptation to different parameter names and units
- Reads standard comma-separated-value data files (e.g. data base dumps)
- Supports separate station list and station data files
- Produce customized station plots with user-defined layout and user-provided background (street maps, aerial photos, satellite images) from real-time measurements (e.g. every 5 minutes)

Image Analysis

- Region statistics and histogram, even for 10/16/24 bit images
- Line profile read-outs
- Configurable cursor area read-outs
- 3D-display of selected image regions
- 3D-display updates with cursor movement
- Read-out of color, raw and calibrated pixel values
- All read-outs as graphics and exportable ASCII text

Provided Data Sets

- Up-to-date world borders (political, sea, lakes)
- Shorelines from 25 to 200 m resolution
- Land / sea mask (1/12 degree resolution)
- Topographic world map (1/12 degree resolution)
- Shaded relief world map (1/12 degree resolution)
- World cities data base (3000 major cities)
- Countries (Labels and positions)
- Capitals data set
- Easily add your own locations

MSG Edition - EUMETCast Compatibility

- CineSat supports all standard EUMETCast receivers
- Just provide CineSat with the last 4 hours of the raw, decrypted EUMETCast data files
- Interface via
  - Network directories (Windows shares, NFS)
  - FTP, SFTP, SCP push or poll
  - Support to user-supplied network transfer agents
- Support for backup EUMETCast receiver
- Support of satellite modes and mission
- Default processing chains for
  - MSG primary / backup / rapid-scan satellite
  - Foreign satellites (GOES-E, GOES-W, MTSAT, MET-7)
  - MPEF from MSG primary/backup/rapid scan satellites
  - OSISAF data
- EUMETCast Import Formats (current and legacy):
  - HRIT: MSG
  - LRIT: MET-5/6/7, GOES-E, GOES-W, MTSAT
  - OpenMTP: MET-6
  - GRIB: MPEF, OSISAF
  - BUFR: MPEF
  - PFS: METOP AVHRR (POLAR Module)
  - HRPT: NOAA (POLAR Module)
  - TIFF: DWDSat data
  - Admin Messages in various formats
- The living and continuously developing EUMETCast data stream requires constant maintenance and update of interfaces and processing chains.

Please see www.cinesat.com for an up-to-date compatibility list.

Import and Export File Formats

Image Import:

- PNG, JPEG, PBM, PGM, PPM, SUN RAS, BMP, GIF, TIFF
- RAW - ASCII or binary pixel dump
- HRIT/LRIT: Meteosat, MSG, GOES, MTSAT
- Eumetsat UMARF distribution formats:
  MSG Native & BSQ level 1.0 and level 1.5
- OpenMTP (rapid scan and archive images)
- PIF and XPIF (for VCS PDUS stations)
- GRIB1 & GRIB2: MPEF, OSISAF, NWPSAF, DWDSat
- BUFR: MPEF products
- PFS: METOP
- HRPT Level 1.5: NOAA, ANA software (POLAR Module)
- HDF5 - various flavors, e.g.: NWCSAF/MSG, and NWCSAF/PPS images
- McIDAS netCDF satellite data
- NinJo - multi-resolution tiled TIFF

Image Export:

- PNG, JPEG, PBM, PGM, PPM, SUN RAS, BMP, GIF, TIFF
- HDF5, GeoTIFF
- NinJo multi-resolution tiled TIFF
- RAW format: ASCII or binary pixel dump
- PostScript, Encapsulated PostScript
- GRIB2 writer (option)

Table Data - Import and Export:

- CSV (comma separated values)
- ASCII text tables
- Binary arrays sorted by rows or columns

Other Import Formats:

- CSV station data
- GIS overlay formats: E00, Shape

Other Output Formats:

- SVG - Scalable Vector Graphics
- HPGL plotter files
- AVI and MPEG movies

- Nearly all standard graphic formats by use of standard Linux conversion tools
- Turn-key systems can be configured for your data source
- Customers can include / design / build their own data interfaces as well without CineSat manufacturer support:
- Generic interface delivered in source code
- Convert all ingest formats to any supported output format
- Conversion between all bit depths and color types
- Image conversion adapts calibration accordingly
- Metadata support added to standard graphic formats

POLAR Module

- Interface and processing of METOP native PFS format
- Interface and processing of level 1.5 HRPT data
- Interface to HRPT as produced by ANA software
- Overflight mosaics for any supported projection
- RGB channel composites
- Graphics in original spacecraft view
- Interface to PPS Nowcasting SAF
- Apply all CineSat functions to imported polar orbiter images

Application Fields

- National and commercial weather services
- Civil and military Air Traffic Control
- TV weather service / animations; automated, real-time website feed
- Operational weather forecasting & Research and development

CineSat & Satellite Application Facilities

- CineSat is intended to complement existing forecasting techniques (including NWP and SAF)
- CineSat can read most SAF products distributed via EUMETCast
- CineSat feeds your locally running SAF production with decompressed raw input data
- CineSat's Automatic Product Extraction Facility will ingest the locally produced SAF products, post-process and combine them with other data, display, distribute, and convert them to appealing products for your website
- CineSat and SAF nowcasting products only have minimum overlap

Research Test Bed

- Flexibly combine more than 100 data processing functions to generate new weather products
- Add your own data interfaces, programs, and algorithms
- Detailed interactive image & data analysis
- Start your new products from GUI and analyse results interactively
- Extend existing processing chains and easily create new ones
- Offline testing of products and processing chains (test case processing)
- Put tested processing chains to operation without changes

Supported Platforms

- For performance reasons and due to 3rd party tool requirements, CineSat V4 is still a 32-bit Linux application
- Runs on all recent 32/64-bit bi-architecture Linux distributions (RedHat, SuSE, Debian, etc)
- Validated reference platform: RedHat Enterprise Linux 5 (Linux kernel 2.6.18) and higher
- Legacy support for old operating system versions RHEL3/4 until further notice (Linux kernel 2.4.21-40++)
- Optimized for multi-core processors
- Optimized for virtual environments (Xen, VMWare)
- Optimized for network installation (band width and operational safety)
- Updating made easy:
  A single software version supports all your CineSat machines from old RedHat 3 to latest RedHat 5 systems and independently from processor number and types.

Services Included in System Delivery

- On-site installation
- Set-up of operational product extraction
- MSG Edition: Interface to your EUMETCast receiver
- 1-week training course (forecasters, operators, R&D)
- Qualified support by your CineSat team

CineSat includes

- 230.000 lines of C-code
- 105.000 lines of Java
- 155.000 lines of scripts and configurations
- 55.000 lines of help pages
- 700 pages of PDF documentation
- more than 25 years of research and development

Documentation

- Support Wiki with 600 pages of online documentation
- Hyperlinked Local Documentation
- Software User Manual
- Operation Manual
- Interface Control Documents
- Training material
- Server and operating system documentation (for CineSat Server deliveries)