Diana: A Free Meteorological Workstation

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Diana is a meteorological visualisation and production software developed at the Norwegian Meteorological Institute (**met.no**). It has been used operationally since the spring of 2000. Diana is also used extensively by researchers in meteorology, oceanography and climatology both at **met.no** and at the Universities of Norway. The development group consists of 5 programmers, and work in close cooperation with forecasters and researchers.

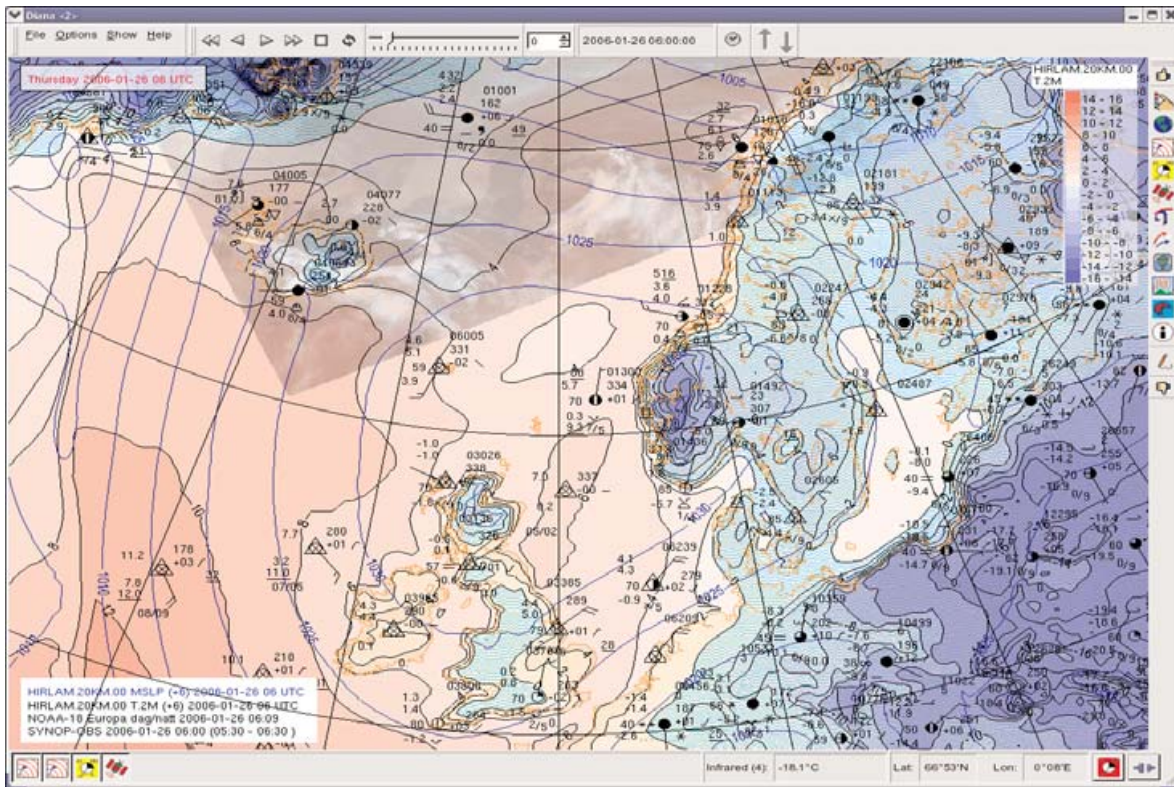Diana will be released as open source under the GPL license in March 2006.

Fig. 1   Visualisation: model fields, satellite images, and observations.

Visualisation

Diana's main feature is fast and high-quality visualisation of meteorological data. The visualisation is performed in a single map window. The supported data sources with visualisation types are:

Model fields

Scalar and vector fields viewed as isolines, filled isolines with or without patterns, vectors, wind vectors, continuous shading, max/min cutoff.

Satellite and radar images

rgb-plotting with freely combined satellite channels, palette images (possible to mask out colours), mosaic of different images, translucency.

Observations

synop, metar, temp, aireps, etc. Customable criterias: max/min cutoff , different colour depending on value, different colour on different parameters.

Trajectories in iso-surfaces

2D-trajectories calculated on the fly from any vector field, trajectory animation forward and backward in time.

Weather Charts

Manually edited weather charts produced with Diana.

These products are visualised in separate layers on a map, and can be combined freely with as many layers as wanted. The different layers can easily be turned on and off. Forward and backward animations with adjustable time steps, zooming, panning etc. are also available.

In addition to the map visualisation, there are separate viewers available for:

Soundings

Amble diagrams. Both observations (temp, pilot) and precalculated prognostic soundings.

Vertical cross sections

Full-featured data selection and plotting control of precalculated cross-section data. Zoom, animation, time series of one-dimensional vertical slices (Hovmoeller diagrams).

Time series

Curves, histograms, wind arrows, vectors etc combined into standard meteograms, smoke plume diagrams etc. Highly configurable through style sheets (in-house **met.no** format). Depends on precalculated data.

Editing

With tools for drawing and field modification, Diana can be used to produce weather charts. Layout and available editing tools for the different weather charts are defined in the setup-file.

Scalar field modification

A set of fast and sophisticated tools for interactive modification of scalar fields. These include moving features around in the field, detailed control over grid values by direct modification of isolines, by heightening/lowering areas, or by modifying the gradient. Separate tools for modifying non-continuous fields, support for grid points with undefined values. All tools offer control over influence area, outlined by an ellipse or circle. The resulting field saves to in-house field format.

Fronts, weather symbols and areas

Draw, move, stretch, snap together, etc. The resulting meteorological objects save to in-house ascii-format.

Combining weather charts

At **met.no** weather charts are produced at different regional centres. The different charts are combined into one chart, the main guidance, using flexible borders.

Other features

Highly customable

Many features are controlled with an extensive setup-file (ascii). Easy to add new colour palettes, new submenus for the data dialogs etc. Field products are defined in the setup-file using simple algorithms or predefined advanced algorithms (vorticity, geostrophic wind, humidity and temperature based calculations etc).

GUI

Easy to use with both detailed dialogs and quick menus. All features are available via the extensive dialogs, but it is also possible to store favourite views in quick menus for fast retrieval and sharing with co-workers. Most options/preferences and command history are saved to next session. There are keyboard shortcuts for all functions.

Language

The user interface is multilingual. The basic language is English, but it is easy to add a dictionary for any language.

Map layer

The map layer includes support for simple coastlines and precalculated land/sea masks
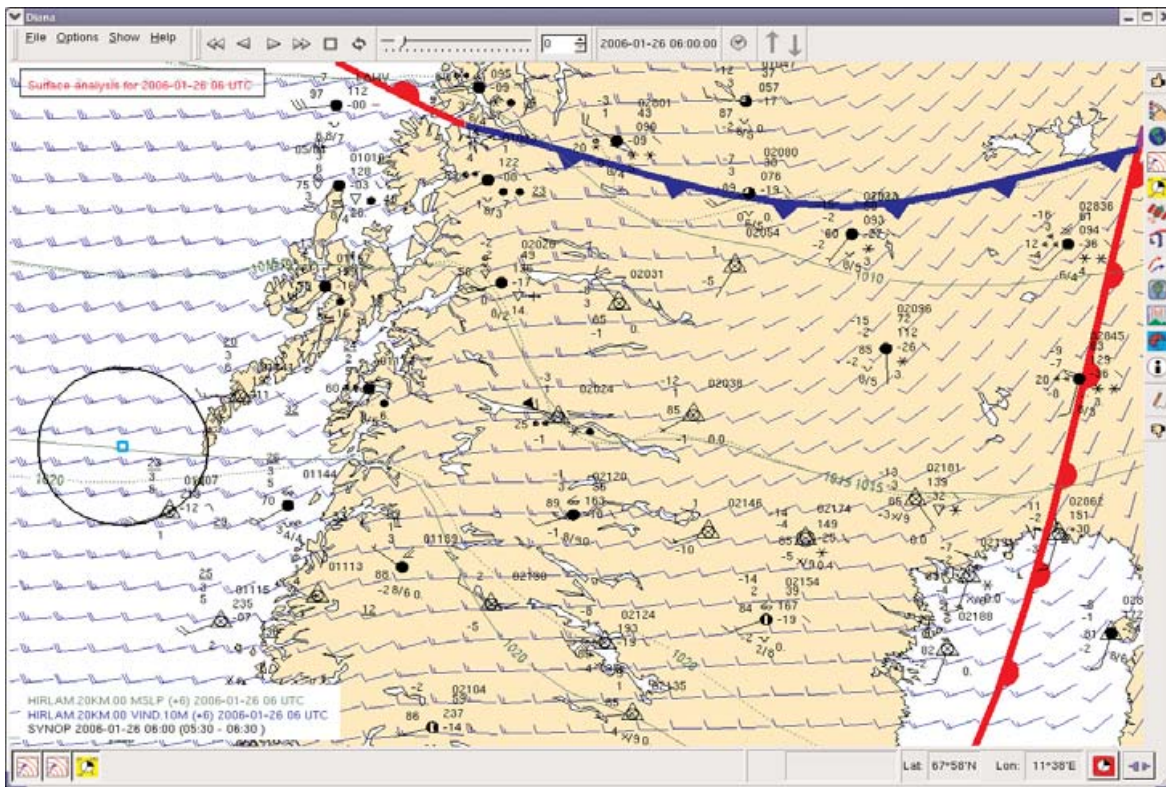
Fig 2   Editing: Surface analysis with field modification and drawing of fronts. The circle indicates the chosen area of influ-
ence when modifying the field.

Continuous display of lat/lon and data values under the mouse cursor (such as cloud top temperature, radar precipitation, etc).

Map projections

Diana supports a number of different map projections: polar stereographic, spherically rotated, geographic, mercator.

Graphical output

Maps, soundings, vertical cross sections, and time series graphics may be output as postscript and png.

Batch version

The batch version for non-interactive production uses the same graphical engine as Diana, with all features available. It is controlled by scripts with support for loops, variables, etc. The plotting commands are identical to those used by the quick menus in Diana, so it is easy to copy favourite products into the batch scripts.

Socket interface

Diana uses a socket interface for inter-application cooperation, allowing other programs to control the visualisation in Diana, adding features like: showing point and area information, selection of points/areas, Diana keyboard and mouse commands sent to the controlling application etc.

Documentation

Online user manual in HTML.

Operational use at met.no

Diana is the main visualisation tool at **met.no**. It is currently used for producing surface analysis, prognostic charts, significant weather charts, polar low warning charts and, on experimental basis, PV-analysis based on water-vapour images for use in PV-inversion. Using a socket interface, Diana is also visualising graphical information from other programs, such as point forecasts, aviation forecasts, verification, etc.

At the present time the forecasters typically use two screens, 3 GHz processor, 1 GByte RAM, but Diana can run with much less.
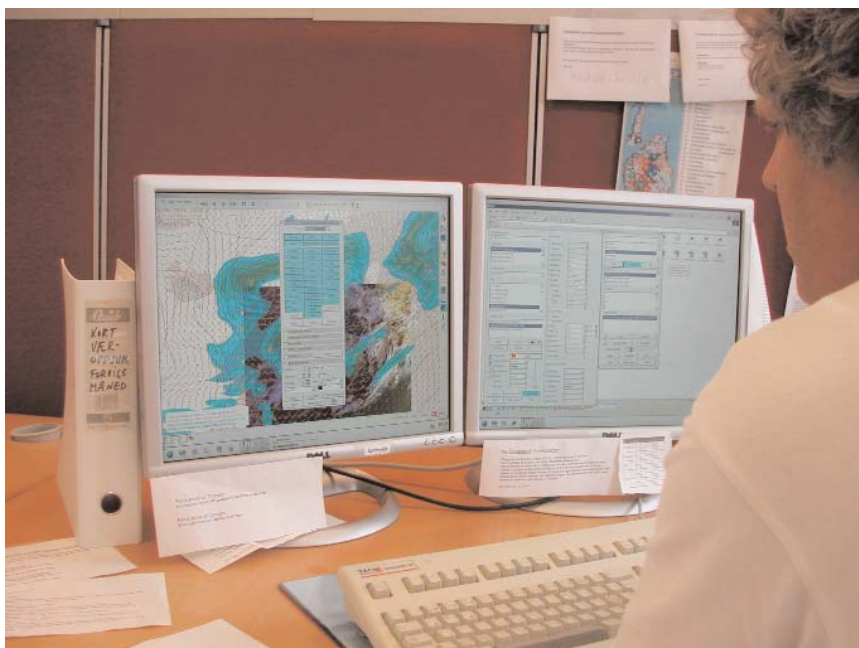
Limitations

Diana depends on an IT infrastructure with databases / file systems for fields, observations and images. There are no data acquisition or dissemination tools included.

Programming environment

- Linux (Fedora Core 3 is used on all **met.no** workstations)
- C++ (g++)
- Trolltech Qt for GUI and window handling, platform independent
- OpenGL (Mesa3D)
- MySQL databases
- Qt linguist for GUI translations
- A few other free libraries (freetype 2/FTGL etc.)
- Connections between applications by Qt QSocket
- Code documentation produced with doxygen

Formats

Diana has so far only been able to show data in in-house **met.no** formats, but in connection with the GPL-release, it has been extended to also include bufr (observations) and grib (model fields) formats. The data interface has also been modified to ease the process of adding additional formats in the future.

Immediate plans

We are going to include more data formats (geoTiff for images, NetCDF for model fields, XML-format for meteorological objects), more projections (the PROJ4-package), and make time series, vertical profiles and cross sections available on demand.

More information:
http://www.met.no/diana/

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