

** Web-GIS based **
Information System

... monitoring,
 analysis, warning ...
Decision Support System



WebGIS General Overview

About WebGIS

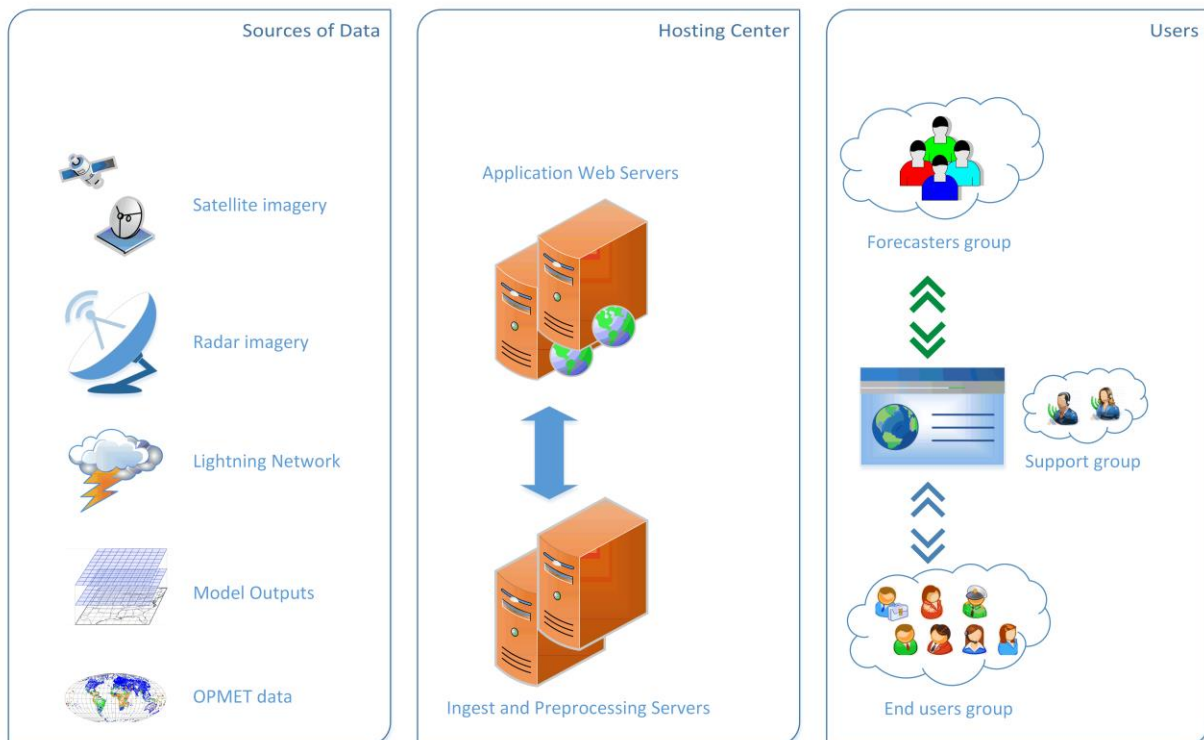
Info-Electronics Systems Inc. (IES) developed the WebGIS package to be a generic viewer and handler of geographical information-based data for Environmental applications.

The package supports multiple data sources and is customizable to a variety of customer applications by integrating a wide range of functionalities for data handling, processing, rendering and display.

The WebGIS package has the capabilities to be set up as a Decision Support System for applications such as hydro-met events monitoring, disaster management, weather aviation assistance, etc.



Platform for Decision Support System



The system supports any generic server platform and its configuration will depend on the client's application and needs. The configuration could vary from a single server with a dozen users to multi-nodes cluster, hundreds of users in critical and high availability operational environments.

The system's key elements are:

- Web-based interface for independent client platforms
- Harmonized processing and rendering to support additional GIS data
- Optimized product customization and generation for optimized Web data transfer
- Open design and development platform ready for support of handheld technology
- Support of generic affordable hardware and software environments
- Making maximum use of Open Source products



Domains of Application

The WebGIS software has a variety of applications in the area of hydrology, meteorology and environment, where users need to display data from different sources and formats for weather conditions and events assessment, analysis, monitoring and tracking. The software package is also beneficial for other industries that require usage of environmental conditions such as road, rail, marine and air transportation, disaster management, energy production and provision, crop management, pollution monitoring and many more applications.

The WebGIS software supports the visualization of the observed or forecasted information in its geographical context. It also allows the user to introduce ancillary layers of information from the available GIS database for further thematic assessment and more specialized analysis.

The WebGIS software introduces the concept of Area of Interest (AOI) and a data-driven setup to allow the right customization of the application and its optimization in terms of response time and ease of the product generation process. Therefore, both setups of the database as well as the Graphical User Interface are customizable to the exact needs of the client.

The concept of AOI also introduces the scalability of the application's geographical extent; it could vary from a municipality, a forestry area, and a watershed to a country, a continent or the whole world.

Examples of Web-GIS Information System Applications

- Collaborative Weather Forecasting System**
- Micro-Wave Radiometer Network Application**
- RADARSAT-2 for Canvec Hydrological Information Management System**

The second major concept in the WebGIS software is the Product Templates and Macros that allow the user to set its preferences of the products to be generated, create the right templates and schedule the automatic generation and distribution of the products using the most up to date ingested data. The Product Templates also make the manual operation quick, even with limited knowledge and interaction with the system. This makes it possible for a wide usage of the software once the application and domain experts have completed the setup of the product templates.



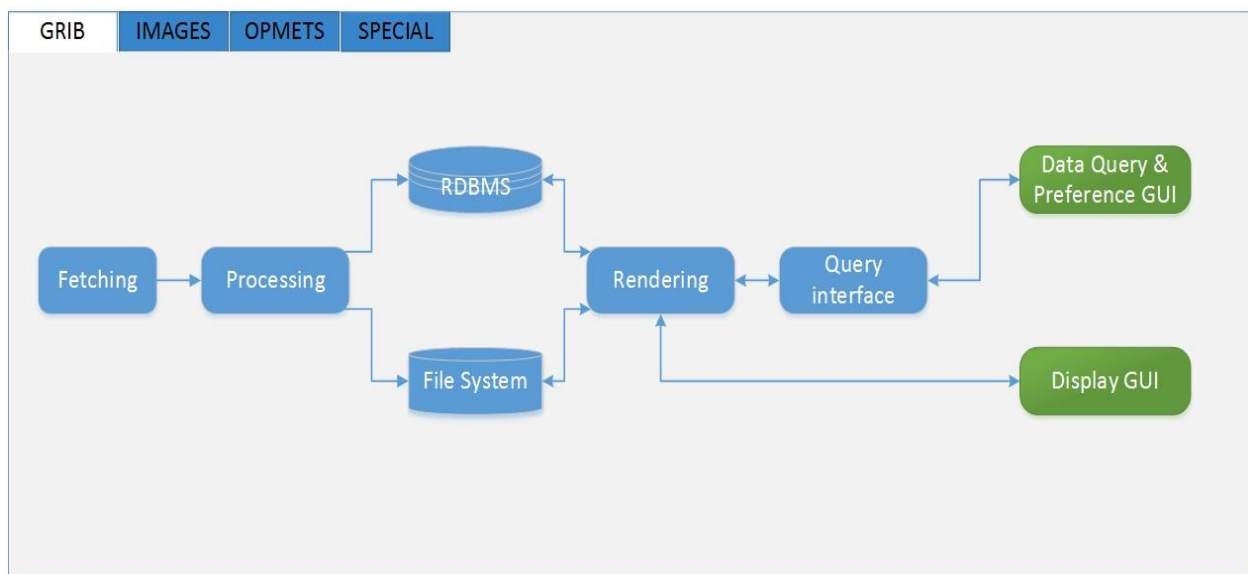
Open Design and Platform

The WebGIS application is open-platform, ready to integrate new sources of weather information as well as geographically based static information and to support the Web Map Service (WMS) and Web Feature Service (WFS) of the Open Geospatial Consortium (OGC).

WebGIS is compliant with the OGC's WMS and WFS and therefore it opens the possibilities of integrating more data sources and display functionalities required by the new generation of these kinds of applications that use geospatial data on a Web-based presentation platform.



Overall Design of Web-GIS App



The WebGIS brought the Web dimension to our previous applications and opened it to international standards for Geographical Information System (GIS) data handling and display.

The WebGIS supports a very demanding application for online collaborative assistance such as in the weather forecast domain through a Web environment, simply by using standard browsers and Internet connections, whereas these kinds of applications generally use Web-conferencing tools and video streaming and are still not able to share an online Geo-referenced board.

By developing the WebGIS, we have optimized the Web-based technologies in support of online collaboration and assistance such as in the field of weather forecasting, which can be useful in any application with similar requirements for sharing and interacting with a graphical display board.



Generic Functionalities

The WebGIS package supports the following generic functionalities to allow users in many application areas to ingest, process, handle and display data of interest at the area of interest for monitoring, assessment, and analysis of environmental events and generation of key products for decision making.

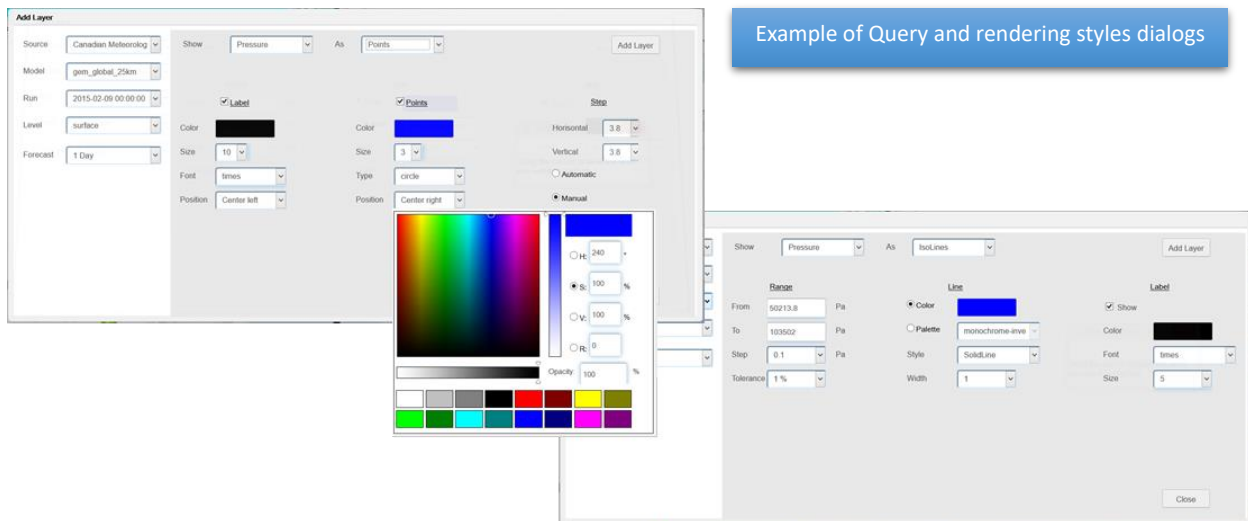
In general, the software supports the following main functions:

Data Ingest and Processing:

Allows the automatic fetch from the appropriate source at the appropriate frequency and the preprocessing of the data into uniformed types, such as points, polylines or images. This operation prepares the basic information layers that will be queried, rendered, displayed and distributed.

Databasing and Querying:

Based on our long experience with geospatial and weather information databases, we designed a database structure that will accommodate all information, both dynamic, in relation to the application type, as well as static GIS data that could be used as ancillary information for product generation and analysis. The Graphical User Interface for queries interacts perfectly with the database and optimizes user selections and requests for product generation.



Rendering and Visualization:

The rendering is based on open source powerful libraries and utilities using a uniformed design to handle files in both vectors and raster format. Therefore the basic information layers prepared by the fetching and preprocessing are used based on the user selection to generate the product to be displayed. At all times, the application keeps track of the display characteristics (on screen extend, projection, styles, etc.) and interactively renders modified products for display. The visualization offers the user all graphical display functions as well as required dialogues for querying data in sets of layers from both available dynamic and static information in the database. It also allows for the setup of the graphic styles and colors.

Furthermore, the WebGIS package uses the powerful Template and Macros concept to allow the user to save customized products to his preferences and selections and load them whenever he wants. The product generation could then be run in a reduced number of clicks or be scheduled in an automatic process.



Analysis Tools:

WebGIS has a set of tools permitting the contextual analysis of the information. These tools allow the compilation of relevant layers of the information into derived products, which generate a second level of information required for advanced assessment, analysis, monitoring and decision taking. Some examples of the available tools are:

- Information overlay for event and feature identification
- Multi-panels display for visual comparison and change assessment
- Time series, time/ space cross-sections for time and profile change analysis
- Spatial and data filtering for information uncluttering and detailed analysis
- Thresholds definition for alerts, warnings and records levels detection
- Advance mathematical functions for advanced derived products

Web Publishing and Distribution:

The WebGIS software is a Web-based application and all generated products are Web enabled. The Graphical User Interface runs from an ordinary browser and the access to all products is through a Web browser and an Internet connection.

The package also offers the appropriate product rendering for publishing and distributing images, .pdf reports and other possible formats, such as shape files and GML, depending on the products. The published product layout has all the relevant information for product identification and explanation, such as the data identification as well as the required legends and indexes.

User Functionalities

General Visualization Features:

The system supports generic visualization functions including:

- Zoom in/out, zoom to predefined AOI (such as watersheds, flight route, ICAO regions, etc.).
- Screen navigation via scrollbars or wheel mouse.
- Tooltip or browse function, which provides additional details about features.

The system supports the visualization of the geographically located data on a map background with the selection of:

- Geographical region with associated GIS data, such as land water contours, geopolitical lines, hydrological information, digital elevation models, etc.
- Projections such as Plate Carrée (Latitude/longitude), Mercator, Lambert Conformal Conic, Polar Stereographic, etc.

The system supports the visualization of hydro-meteorological and environmental data:

- Data from in-situ observation networks
- Data from forecasting models
- Standard compiled bulletins (in graphic or text format) from application experts (Weather forecaster, Hydrologist, etc.)
- Remote sensing data from Satellite, Radars, and other remote sensing systems (e.g.: Microwave Radiometer, Wind Profiler, etc.)



The system supports the display of other static contextual data, such as digital elevation models, rivers, roads and points of interest.

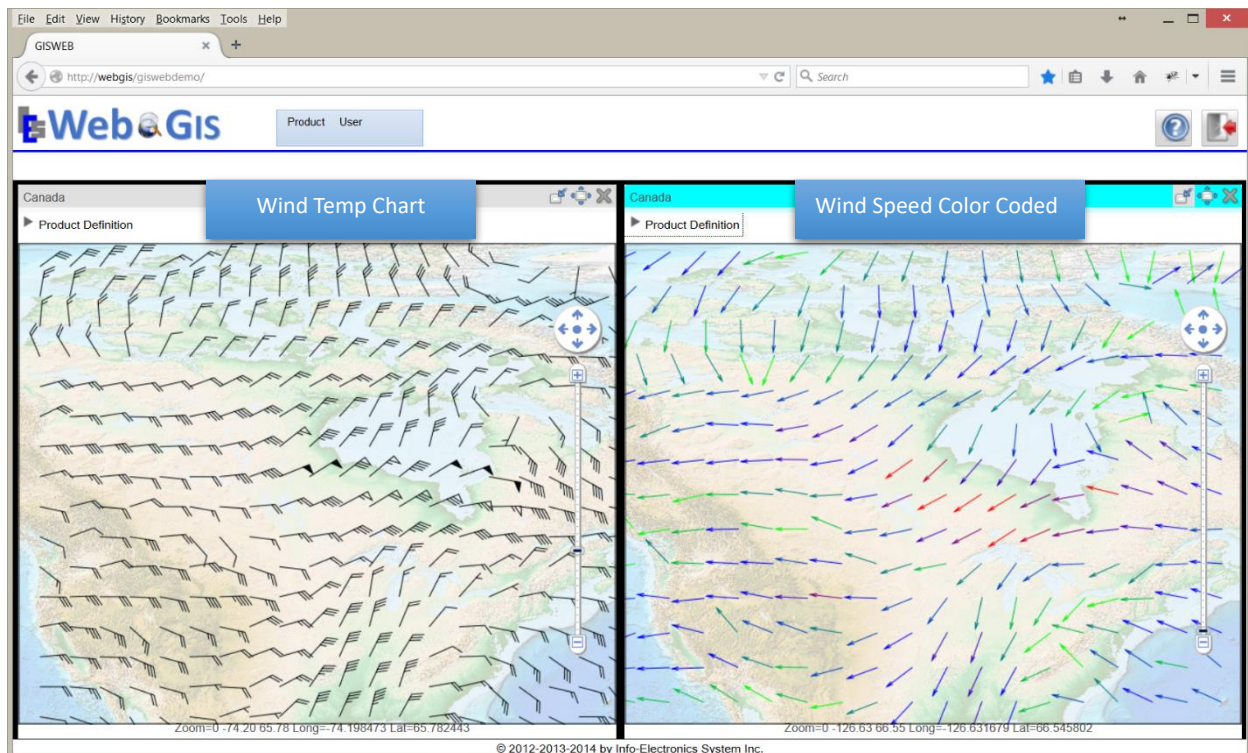
Detailed Features for Weather Applications:

To present the capabilities of the WebGIS application, we are listing in more detail the features that are applicable to a weather application setup. This setup is the most representative as it handles a large variety of data from different sources and various formats; it also involves multiple representations of the products, including charts with geographical backgrounds, profiles and cross-sections, time series, etc.

Map Chart Products:

The system allows the user to select from a range of existing chart templates including, but not limited to:

- Chart regions, the AOI or the Points of Interest (POI)
- Chart with geographical map background where multiple layers of data could be loaded
- Profiles and Cross-section
- Aerological diagrams
- Time series and meteograms



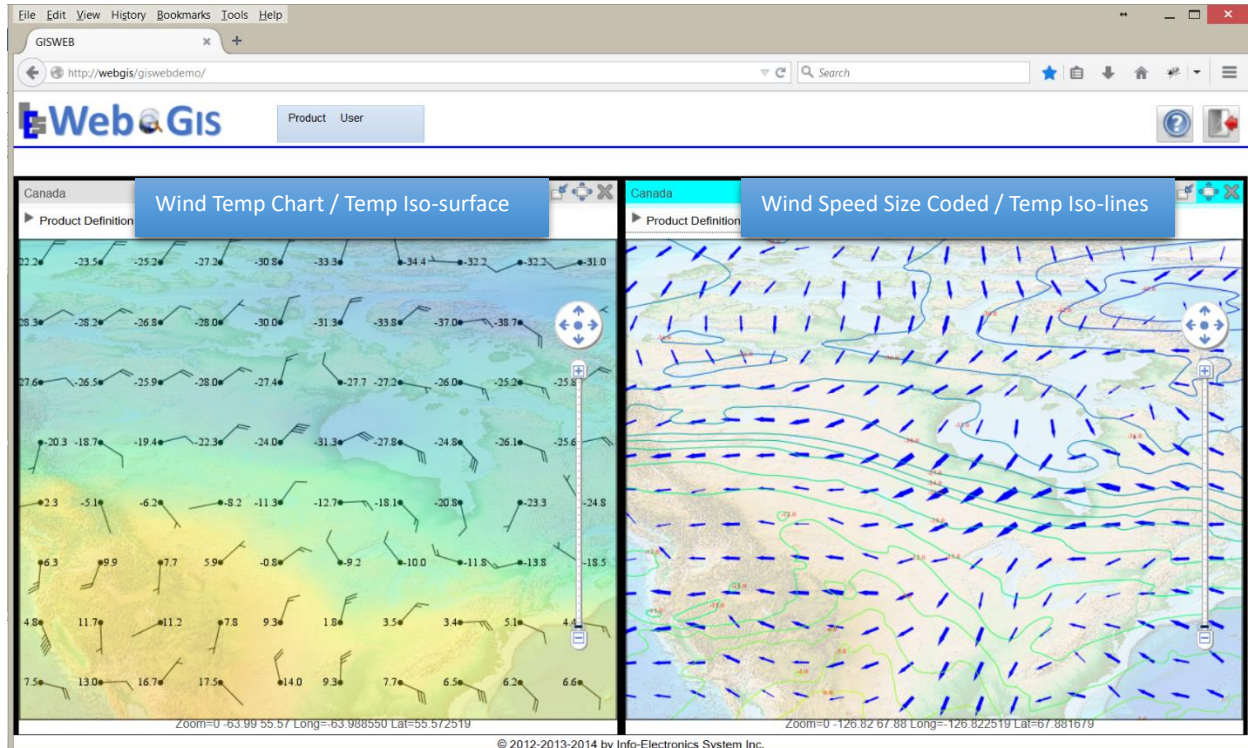
To generate the product, the application allows the user to select meteorological data from:

- Numerical models Gridded Data based on selections from all models' parameters, such as the Data Source (Centre), Model, Run, Parameter, Level and Forecast period.
- OPMET data including SYNOP data, METAR/SPECI, Upper Air based on selection of the time, the parameter, the station or Group of stations as well as WMO header attributes.
- Satellite and radar imagery.
- Other special data, such as lightning .



To enhance the product and allow contextual analysis, the applications permits the user to:

- Add static GIS data that would enhance the understanding of the observed events, such as Digital Elevation Models, hydrological network, etc.
- Overlay the information of multiple sources, multiple parameters, multiple times or multiple levels.
- Declutter displayed data based on the selected AOI and the priority defined in the list of the POI.
- Use multi-panels displays for visual comparisons.



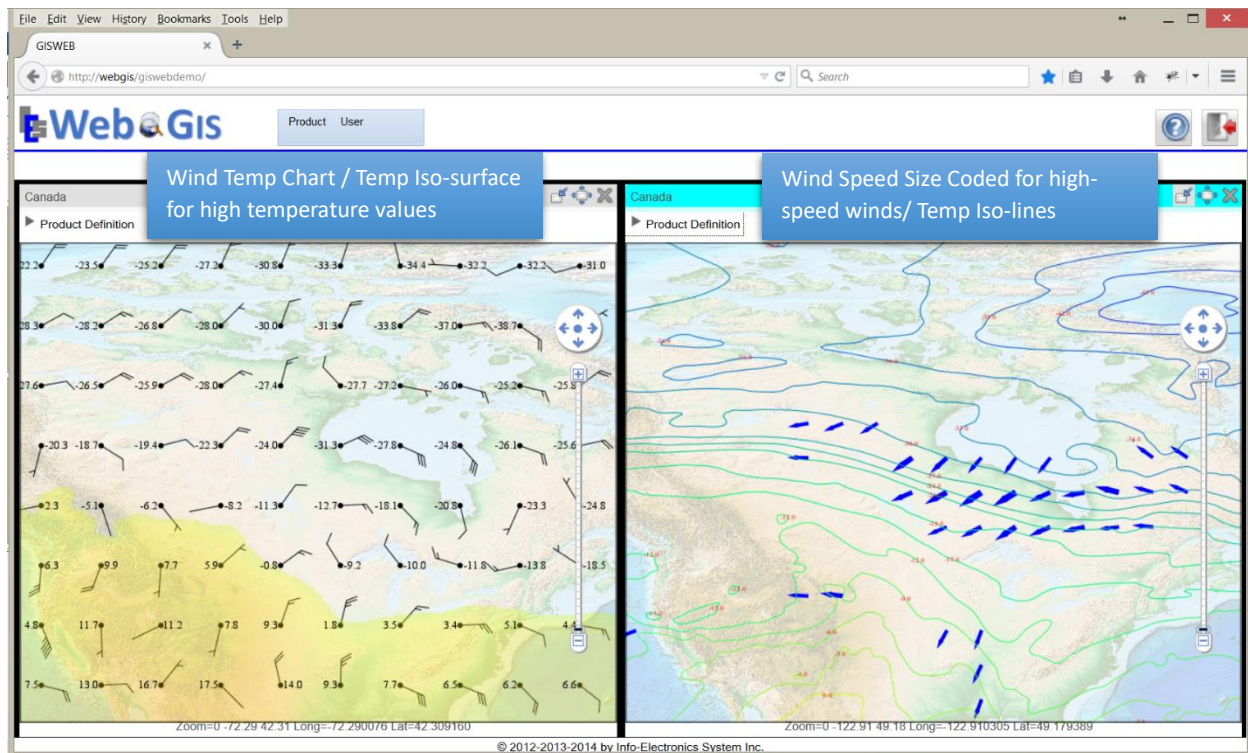
To render gridded and randomly spaced data into the following possible representations:

- Point representations using numerical values or selected symbols and usage of station models standard weather parameters in SYNOP and METAR plotting.
- Vector representations using arrows to show direction and module, where the module could be represented by variation of size, length, width, color or as attached numerical label. In the case of wind, the application supports the standard meteorological representation in windbarb symbols.
- Combined point and vector in one layer as Wintemp in the standard windbarbs symbol/label representation making sure not to overlay labels and symbols.
- Manual and automatic decluttering of the points and vectors representation to show adequate information depending on the zoom and to permit interactive zooming on information details.
- Present the points as iso-lines/ equal value contours, allow for selection of the line style, labeling, color and appliance of color palette for the associated attributes as well as permit the selection of iso-line steps/density. The application also allows drawing wind as streamlines.
- Present the point in form of iso-surfaces/ filled contours and allow for labeling and color palette selection as well as transparency level.



To display and overlay Radar and Satellite images, the application supports the following:

- Display of a single radar image.
- Display of multiple radar images.
- Display of satellite images from a single satellite channel, various satellite channels as well as a composite of mixed satellite imagery.
- Configuration of the color palette and the transparency.
- Band filtering.
- Overlaying of radar and satellite imagery with other layers of data.



Meteograms, Time Series Charts and Aerological Diagrams:

The application allows for the ingestion and storage of the meteorological information in a database structure offering the user the capability to retrieve data using SQL queries.

- The Web Graphical User Interface charts offer the user the possibility to generate and display tabular reports and time series charts.
- The application supports the generation of charts and reports for a station or group of stations for the selected parameter(s) over a selected period of time.
- The application allows the user to display a multi-graphic of the same parameter for multiple stations and multiple parameters for the same station.
- The application can compile on-the-fly maximums, minimums, average of time series, and display the data in a multi-graphics chart.
- The application allows drawing meteograms for selected POI over the selected period of time using GRIB forecasts. The application also computes and displays relevant indexes.
- The application allows for the generation of Aerological diagrams from forecast models as well as from observations. It also computes and shows the computed indexes.



Chart Sequence Animation:

The application allows the user to visualize a changing weather system by simply stepping through a sequence of time dependent charts. These charts could contain iso-lines, synoptic data, satellite and radar images, etc.

In addition, the application makes it possible to easily navigate through the levels of the atmosphere to assess the changing conditions over height.

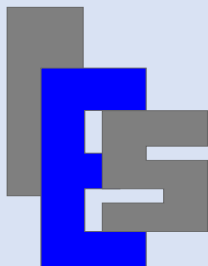
- The application allows the user to render a sequence of displays of the same selected product over time.
- The application allows the user to render a sequence of displays of the same selected product by height levels.
- The application allows the generated products to be shown in sequence using a simple click for previous/next, first/last or animate.

And much more ...

The application offers many more functionalities which can be customized to the user's domain of application and the level of analysis required. Moreover, the application allows for advanced analysis and monitoring by:


- Allowing any appropriate combination of the above representations in one rendered layer.
- Applying mathematical operations on the selected data, such as simple high / low pass, passband or stopband filters or more complex ones.
- Allowing the identification of features based on predefined conditions and consequent generation of alarms and warnings.

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