

ONE FOR ALL

Integrating multiple application solutions in a single weather workstation

The Brunei Darussalam Meteorological Department uses the Sutron-MeteoStar LEADS product suite for its weather hazards index system (WHIS)

The weather service in Brunei Darussalam began in the late-1950s, primarily to serve aviation activities. Over the years since, the demand for meteorological services from other stakeholders grew, as did the demand from the general population.

The Brunei Darussalam Meteorological Department (BDMD) is the country's national meteorological service and is responsible for provision of meteorological and climate services. The BDMD has the responsibility for not only forecasting the weather, but also providing specific forecasts to support other stakeholders within Brunei. These include aviation (terminal area forecasts – TAFs), fire weather (fire weather indices – FWI), TV weather reports, and hydrology (flood forecasting – planned).

As Brunei Darussalam is a small country, the BDMD has very limited resources and recognizes that the same weather information can be processed to support multiple uses. The approach was to build the BDMD weather support capabilities through applications around a common database and weather workstation. Through a competitive tender, the BDMD chose Rennovo Solutions (RSSB) as the prime contractor to implement the Sutron-MeteoStar LEADS product suite for the BDMD's weather hazards index system (WHIS). The following are the current and future applications that the BDMD has implemented within the LEADS system.

Integrating the weather database

The following figures show the concept of operations, as well as the data flow for the BDMD's WHIS. Data is ingested through a series of interface modules and stored in a gridded relational database for application processing by the weather workstation.

General weather forecasting

General weather forecasting consists of a set of Brunei weather products created by the

LEADS Automatic Product Generator (APG) and distributed through a web-based LEADS online interface.

The products are intended for Brunei stakeholders such as offshore operations and emergency managers. When requested by the users, BDMD meteorologists can also create forecasts on a manual basis specific to the user requirement. These special products can be delivered as email attachments or delivered through a LEADS web interface.

Aviation applications

Message and bulletin generation: The concept is to use the LEADS product suite to create a 4D database (dimensions in space and time) of the operational aviation weather over Brunei. This 'weather cube' is then used to create standard aviation forecasts, messages and bulletins.

The application is web-based and includes a user preview window along with accuracy checks, to ensure the content format is correct for messaging. The application also provides seamless integration with the Aeronautical Telecommunications Network message switch.

First guess TAFs: LEADS provides a web-based application to create a first guess TAF from one or more user-selected numerical weather model(s). The TAF can be displayed and graphically edited by the forecaster and compared to the previous TAF or historical climate data, and then published. Graphical changes are reflected in the TAF text format.

Fire weather application

Due to the changing land use within the country of Brunei, areas of tropical rainforest have been removed and replaced with roads, housing and commercial enterprises. The changing land use has created areas that are prone to forest fires during the dry times of the year. The BDMD application solution integrates the Canadian Fire Weather Indices (FWI) within the LEADS System. The FWI application provides 'indices forecasting' through the use of a weather research and forecasting numerical model, and 'situation assessment' of fire danger from a real-time Sutron Fire Weather Station surface network. A web interface provides notification and collaboration tools with other stakeholders.

FIRE WEATHER INDICES

Fine Fuel Moisture Code (FFMC): An indicator of the relative ease of ignition and flammability of fine fuel;

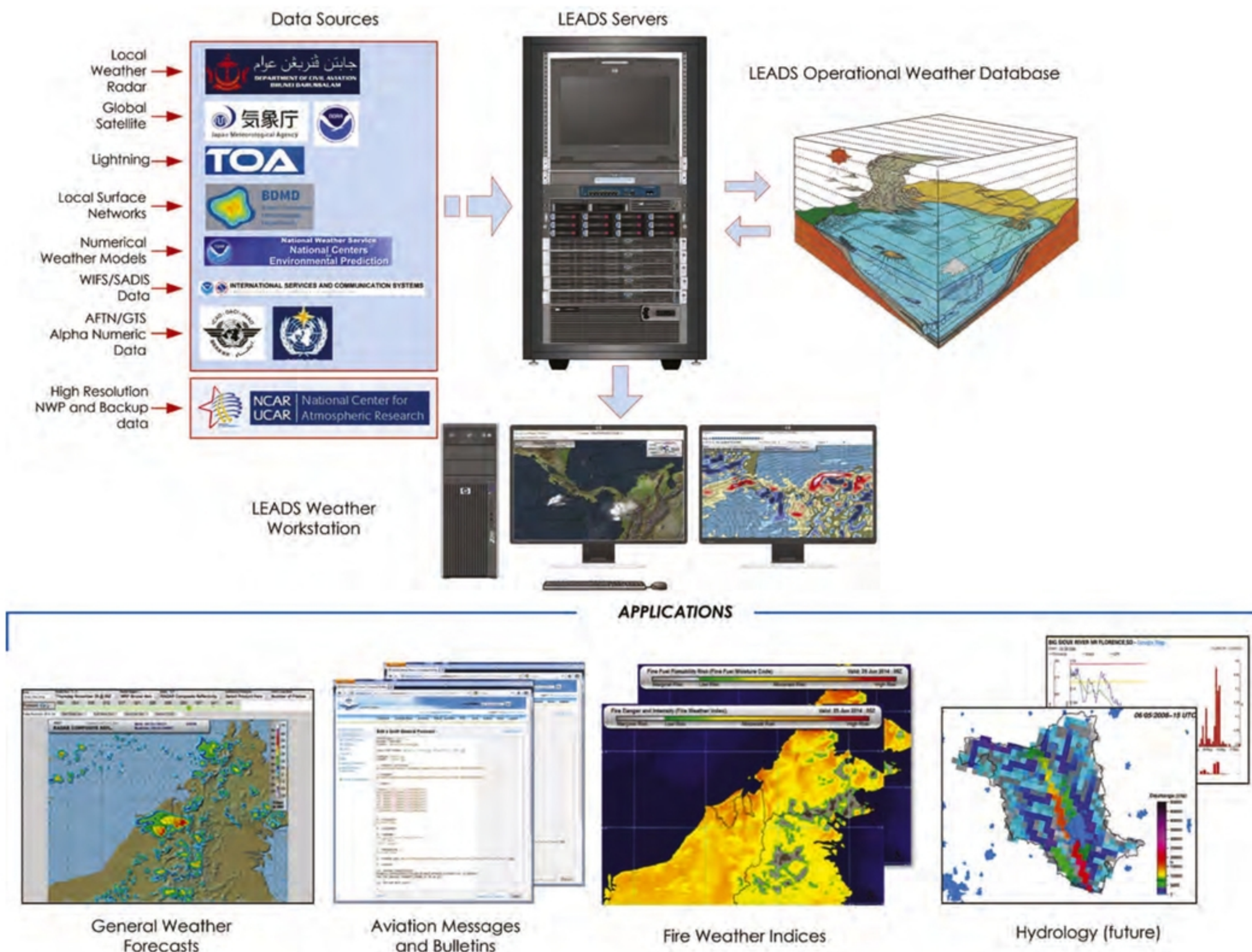
Duff Moisture Code (DMC): An indication of fuel consumption in moderate duff layers and medium-size woody material;

Drought Code (DC): A useful indicator of seasonal drought effects on the forest fuels, and the amount of smoldering in deep duff layers and large logs;

Initial Spread Index (ISI): A numerical rating of the expected rate of fire spread;

Build-up Index (BI): A numerical rating of the total amount of fuel that is available for combustion;

Fire Weather Index (FWI): A numerical rating of fire intensity that combines the Initial Spread Index and the Build-up Index.



Operations concept for sharing a common Hydro-Met database

Hydrology application (planned)

The Sutron LEADS-Hydro hydrologic modeling and forecast application is a fully integrated hydrologic and hydraulic modeling platform and flood forecast system based on the US NOAA/NWS Community Hydrologic Prediction System, and NCAR WRF Hydro technologies.

LEADS-Hydro provides a coupled model solution for Brunei (atmospheric and surface models). LEADS-Hydro is applicable to any location in Brunei, due to its LEADS-Hydro Research Distributed Hydrologic Model (RDHM) parameter estimation capability. LEADS-Hydro consists of several module components.

Flash-flood Guidance (FFG) Module: This is based on a relatively simple principle that for a given small area (4 x 4km or less), there

is a threshold of precipitation that, when exceeded for a short period of time such as one, three or six hours, flash flooding is likely to occur. LEADS-Hydro FFG uses the concept of threshold frequency, developed by NOAA and the US National Weather Service (NWS).

Hydrologic Model-based Flood Warning System Module: LEADS and LEADS-Hydro combine all the hydro elements into a tightly integrated system. The approach to the alert and warning process is simply based on hydrologic modeling, using the RDHM and its internal streamflow routing capabilities. This approach handles relatively free-flowing streams and rivers with minimal back-water effects. Flooding predictions can be made at any RDHM grid cell (pixel) location.

Hydrologic and Hydraulic Model-based Flood Warning System with Flood Inundation Mapping Module: LEADS-Hydro brings the hydrologic and hydraulic modeling components together in a tightly integrated system that makes seamless flood forecasting possible across all timescales and climatic regimes. Moreover, flood inundation mapping, which requires both hydrologic and hydraulic modeling, can be carried out routinely, in near-real-time mode, depending on the available computer hardware resources. ■

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