

New advances in wind profiling from Vaisala



Vaisala's strong commitment to continuous improvement and our long association with the world's leading experts in profiling technology ensures that we will continue to provide our customers with the latest developments. Our relationship with the National Oceanic and Atmospheric Administration (NOAA) Laboratories in Boulder, Colorado, through a Cooperative Research and Development Agreement (CRADA) dating back to 1991, provides a strong foundation for this effort.

Vaisala first entered the radar wind profiler business in the 1980s. Acquiring the Radian radar wind profiler group in 2001, Vaisala

strengthened and renewed its commitment to this technology. Recently, Vaisala acquired Sigmet, a leading weather radar signal processing company. The technology infusion from these acquisitions, combined with Vaisala's strong research and engineering culture, is leading to new advances in wind profiler design and signal processing technology.

Working with the US National Weather Service

In March of 2008 the U.S. National Weather Service (NWS) awarded Vaisala phase one of a contract for the Next Generation NOAA Profiler Network (NGNPN) upgrade project. The upgrade project is a multi-step, multi-year process for the design, development, manufacturing and installation of high capability upper air observation sites for the United States. Over 35 existing tropospheric profilers are expected to be replaced over the next several years. A successful preliminary design review for phase one was conducted in June 2008, and Vaisala was awarded the second phase of the contract. The critical design review is scheduled for March 2009.

The current NOAA Profiler Network was first deployed in 1990–1992 and has operated

*With over 160
installations
worldwide, Vaisala
is a world leader in
wind profiling radar
technology.*

continuously ever since. The NGNPN upgrade will enhance the mission critical data which is distributed in real-time to NWS Forecast Offices, the Storm Prediction Center, the National Centers for Environmental Prediction, government and university atmospheric researchers, private meteorologists, and foreign agencies responsible for weather prediction.

Upgrades in Germany

In the spring of 2008 Vaisala was awarded a contract from DWD (Deutscher Wetterdienst, German Weather Service), for the upgrade of the 482 MHz tropospheric profiler operating at the Meteorological Observatory at Lindenberg, Germany. This profiler is one of four in the German operational network.

Vaisala is developing new architectures, features and algorithms for the requirements of these two programs. Many of these new developments will become part of Vaisala's Wind Profiler feature suite and improve the capability and performance of all our wind profilers.

Significantly improved wind data quality

In addition to development driven by large customer programs, Vaisala has recently released improved



Vaisala Wind Profiler LAP®-16000 at Bayreuth, Germany.

versions of Vaisala wind profiler systems software packages. The new Vaisala Wind Profiler Software LAP-XM® v2.4.1.0 has several new and improved features, including an experimental boundary layer determination module, which automatically provides the altitude of the top of the planetary boundary layer. Our wind and temperature quality control module has been modified to provide significantly improved wind data quality. This new LAP-XM® version also includes a new module for archiving and distributing wind and virtual temperature data in XML format. Vaisala AviMet™ can ingest the XML data and provide a comprehensive and integrated awareness of the wind at and around an airport. Another new feature allows the integration of wind and temperature data from the Vaisala Weather Transmitter WXT520 surface weather multi-sensor with Vaisala wind profiler data.

Our new Wind Profiler Melting Layer Software LPS311 automatically determines the peak radar reflectivity level within the melting layer. The module is useful in estimating rainfall, freezing level and river runoff. The melting layer altitude data may be displayed with the new LAP®Mom version 3.0.5 software.

LAP®Mom v3.0.5 Vaisala Wind Profiler Moments Display Software includes the ability to display the data output from the boundary layer algorithm (LAP-XM® v. 2.4.1.0) and from the optional melting layer LAP-XM® Module LPS311 on top of normal reflectivity data. The graph-

What is a wind profiler?

A pulsed Doppler radar wind profiler is a remote sensing instrument that uses radar pulses to measure wind speed and direction in the atmosphere above the instrument. The pulses are transmitted in several directions and the reflected signals are measured with the highly sensitive receiver of the wind profiler. The signal is reflected from the irregularities in the reflective index of the atmosphere. The irregularities are caused by turbulence, convective activity and humidity. The horizontal wind is calculated from the Doppler shifts of the reflected signals.

When the wind profiler is equipped with a RASS (Radar Acoustic Sounding System), it can also provide virtual temperature profiles. The RASS modules emit sound waves, which are tracked by the radar. The speed of the sound waves can be measured from the reflected pulses. Since the speed of sound in the air is mostly dependent on the temperature, virtual temperature can be calculated.

ical display capability increases the usefulness of the boundary layer and melting layer data.

Vaisala is continuously developing LAP-XM® software to include new, beneficial algorithms and features. One future algorithm is a modern signal processing filter employing Gabor frame expansion. It will reduce the effects of intermittent clutter interference. This algorithm from Lehmann and Teschke is being developed in cooperation with DWD (Deutscher Wetterdienst, German Weather Service).

Thanks to input from our many valued customers, we are actively studying other new features which would increase the performance, reliability and maintainability of Vaisala wind profilers. When the features are mature enough to be released,

they will become part of our wind profiler offering. Backwards compatibility is an important concept for us and Vaisala strives to offer the new features for as many of the fielded profilers as possible. The new developments may include software features providing extra functionality, and data products specific to applications such as air quality. Another example is an approach integrating several measurement systems for the needs of airports. Vaisala welcomes open dialog with the users of its equipment. Direct and open feedback is the prerequisite for smart and informed decisions on new capabilities and features.

Further information:

www.vaisala.com/weather/products/windprofilers

Superior Vaisala software

Vaisala LAP® wind profilers are equipped with LAP-XM® software. LAP-XM® is a modular and configurable software for controlling the wind profiler hardware, performing the signal processing, calculating the wind and temperature results and providing a suite of output data formats. The LAP-XM® software is continuously improved and there is typically a major new release every year. Many of the advanced signal processing algorithms running in LAP-XM® are developed in cooperation with NOAA. Examples are algorithms to suppress persistent ground clutter, radio frequency interference, and the interference from intermittent clutter sources, (birds, aircraft, etc.) using filters employing Wavelet transforms.