

# Atmospheric insights in extreme polar environments

## Case Study



### The client:

Italian National Agency for New Technologies, Energy and Sustainable Economic Development

### Vaisala solution:

Ceilometer CL61

### THE CHALLENGE:

#### Extreme environment, limited measurements

For more than a decade, IAMCO researchers have used various ceilometers and rain gauges for understanding the characteristics and physical mechanisms underlying the formation of clouds. These factors underlying the formation of clouds are little known, especially in the polar environment, and studying clouds and their properties is important for understanding the climate and its variability. More information and data on cloud formation, composition and relevant phases would significantly improve meteorological model forecasting capabilities for both operational and climatic purposes at various time scales.

Satellites do not provide adequate temporal sampling due to the high periods of revolution of the sensors in orbit. In situ measurement campaigns are expensive, difficult, require a lot of maintenance and are possible only when researchers are in the station. All of these

limitations are amplified in the harsh Antarctic region where extreme weather conditions, limited energy sources and stations open only during the short Antarctic summers make traditional instrument measurements of the atmospheric profile almost impossible.

### THE APPROACH:

#### Ceilometer CL61

ENEA has used many Vaisala instruments in the past, and thanks to their long-time relationship with local Italian Vaisala partner, Eurelettronica Icas, researchers have appreciated their quality, versatility and robustness. The Ceilometer CL61 is the last instrument installed. Its technology combines standard ceilometer measurements, like cloud base and ceiling heights, with new depolarization capabilities.

*"The Vaisala CL61 ceilometer has improved our climate research. Now, we have in one instrument the capability of in situ cloud measurements and detailed liquid/solid differentiation. Furthermore we can collect data also during the closing period of the station, making research easier, less expensive and with minimal maintenance."*

*Paolo Grigioni  
Researcher, Italian National Agency for  
New Technologies, Energy and Sustainable  
Economic Development*

Depolarization allows for precise particle and precipitation type differentiation, enabling dramatically improved situational awareness and forecasting. With its easy integration, low maintenance and data-rich vertical profiles, the CL61 is an outstanding, cost-effective tool for improving decisions and safety across several key applications. It is suitable for continuous in situ measurements.

#### **THE RESULTS:**

##### **Critical insights for cloud characterization**

With the CL61, Observatory researchers are able to obtain information needed to improve the understanding of cloud formation and characterization, even discriminating the phase of the clouds themselves. This is critical for characterizing an area like Mario Zucchelli which is located on the coast of the Ross Sea.

The researchers are observing clouds at different phases (solid, liquid, mixed and supercooled) – a process that previously could only be obtained using much more expensive instruments that are less reliable in this harsh environment.

Installed in December, 2021, the CL61 ceilometer immediately proved to be suitable for this extreme environment including katabatic winds that exceeded 40 m/s. The ceilometer continued to function reliably, even after the seasonal closure of the station in February, 2022.

The data from the CL61 are giving researchers insight into the variety and coexistence of phases in the clouds. In particular, for the first time they are detecting supercooled liquid clouds in the Mario Zucchelli area through in situ measurements with temperatures well below  $-20^{\circ}\text{C}$  with very low depolarization.

IAMCO researchers are quickly gaining the measurements and insights needed to accelerate their important mission of climate studies with an accurate, reliable solution that will provide top performance for years to come.

## Why Vaisala?

As the global leader in weather and environmental measurements, Vaisala provides trusted weather observations for a sustainable future. With over 85 years of experience and customers in 170+ countries, from the North and South Poles to Mars, we help provide the most reliable and accurate weather and climate information for better and safer daily lives.

Our instruments and intelligence are known as the gold standard for precision and reliability. As a sustainability leader we enable meteorology professionals to better understand, forecast and explain climate change. We continue to channel our curiosity into climate action and new ways of enabling a better planet for all.

