

Innovative air quality application to increase the knowledge, control and management of air quality

Italian government-funded R&D agency utilizes Vaisala CL31 ceilometer in the development of an innovative air quality data processing system to study the interaction between pollutants and meteorological factors.

Dr. Maria Cristina Mammarella and Dr. Giovanni Grandoni of ENEA, the Italian National Agency for New Technologies, Energy and the Environment, have in recent years been involved in a comprehensive study of air quality. Together with Prof. Ari Karppinen (Finnish Meteorological Institute) and Prof. Sergej Zilitinkevich (University of Helsinki), they have studied the interaction between pollutants released into the atmosphere and meteorological factors.

In this context, particular attention was paid to the study and verification of using a Lidar ceilometer for the calculation of the mixing layer, as the main parameter to be monitored was the height of the “Planetary Boundary Layer” (PBL) that characterizes the air mass dynamics at local level in which pollutants dilute.

On the basis of the above studies, the Enea Scientific Team led by Dr. G. Grandoni as project leader, Dr.ssa M.C. Mammarella as scientific manager and P.I. Pasquale Fedele as information systems manager, proposed and implemented a



CL31 Ceilometer installed at COSIB in Termoli, Italy.

research project entitled: “*Applied research for an integrated system of global management of air quality information in Termoli industrial area and its environs*”. The project is co-financed by Molise Region and COSIB, the Consortium for Industrial

Development in the Biferno valley area.

The scope of the project is to study advection-diffusivity in the Biferno valley through an ad-hoc field campaign, in collaboration with Italian and foreign Universities



Enea scientific team with Prof. Harindra J.S.Fernando, receiving award for European Academi membership. From right: Giovanni Grandoni, Harindra J.S.Fernando, Maria Cristina Mammarella, Pasquale Fedele.

(University of Rome “La Sapienza” and University of Salento in Italy as well as Arizona State University in the USA). Through the use of comparison instruments, the operational use of a Lidar ceilometer is tested. The project also aims to create a global operational system of air quality management, understanding and communication, which takes advantage of the Lidar ceilometer.

Within this project, two field campaigns of meteorological measurements were organized. The measurement campaigns aimed to investigate the air mass dynamics between the mesoscale and the local scale, in particular sea breeze and hill fluxes, within the context of a valley with urban and industrial settlement.

Vaisala CL31 Lidar ceilometer utilized in experimentation

When looking for a ceilometer supplier who would meet ENEA’s scientific conditions for qualified experimentation, the project team assessed Vaisala as suitable. The chosen product is an experimental beta version of Vaisala’s CL31 ceilometer, which utilizes software

algorithms for calculating mixing layer height.

Vaisala introduced its first laser ceilometer generation CT12K in the 1980s, and has since then globally installed 5,000 units of field-proven laser ceilometers designed for measuring cloud base height and vertical visibility. The new CL31 generation represents state of the art ceilometer technology: second generation advanced single lens optics provide excellent performance even at low altitudes, improving the ability to investigate surface inversions as to the lowest 100 m of the atmosphere.

The use of the Lidar CL31 based system with mixing layer height algorithms has been under evaluation since early 2000 in cooperation studies between Vaisala, the Finnish Meteorological Institute, Helsinki University and other research institutes. Pilot customers worldwide

are using the application to gather valuable user experience.

The ENEA Scientific Team is the only pilot customer in Italy. This allows for the experimentation, within the subject project, of the Lidar ceilometer capability to calculate the mixing layer and to be a reliable measurement instrument in an integrated system that will be used by ENEA to better understand and communicate air quality.

Thanks to ENEA’s contribution, notably the initiative of Ing. Del Torto, the COSIB Industrial Consortium of Biferno Valley in Termoli has started an original project to study the interaction between pollutants in the atmosphere and meteorological factors using an innovative method: classical “static” measurement of pollutants from data loggers is integrated with “dynamic” elements of advection-diffusivity.

Applied research for an integrated system of global management of air quality in the Termoli industrial area and its environs:

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