



CAE MAGAZINE

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CAE IN AMSTERDAM FOR METEOROLOGICAL TECHNOLOGY WORLD EXPO AND WMO TECO-2026

This year, CAE will participate, as exhibitor, at the Meteorological Technology World Expo, the premier global exhibition for meteorological, hydromet, metocean, and environmental monitoring technologies. The 2026 edition will take place at the RAI International Exhibition and Congress Centre in Amsterdam from October 6 to 8, in conjunction with the WMO Technical Conference on Instruments and Methods of Observation (TECO). For more, read the programme [here](#).

An important event for any company or organization looking for services and technologies that measure climate change and weather forecasts in a more accurate and modern way. Indeed, it will bring together over 150 leading solution providers and thousands of industry professionals from 100+ countries.

This large international gathering will give the opportunity to explore the latest trends, solutions and strategies shaping the future of the meteorological and hydromet industry, connecting with professionals from everywhere around the world. An exclusive forum to present your company vision and build high-value, long-term collaborations. In this context, CAE has been selected to take part in the poster session of TECO dedicated to “Emerging Measurement Technologies and Integrated Observing Approaches.”



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 **CAE**
innovation for a safer world.



Meteorological Technology World Expo 6 — 8 October 2026

WMO Hosting TECO-2026
5-8 October, RAI Amsterdam

WORLD METEOROLOGICAL ORGANIZATION

We're Exhibiting

Discover our latest innovations and speak with our team

CAE S.p.A
Stand no. D15

REGISTER TO MEET US

CAE's contribution, entitled **"AI and Machine Learning into Environmental Monitoring Networks: From Data Quality Control to Adaptive Communications and Maintenance"** presents a number of applications developed to integrate **AI and Machine Learning** into environmental monitoring and early warning networks.

We look forward to seeing you at our **stand (n° D15)** to discuss the **impact Artificial Intelligence and Machine Learning** can have on our products and services designed to mitigate natural hazards and to discover the **solutions** developed for the implementation, management, and maintenance of **multi-risk monitoring and early warning systems** designed to address extreme weather events, hydrological and hydrogeological hazards, wildfires, and water pollution. **Different solutions, united by a common goal: improving reliability, operational continuity, data quality, and the effectiveness of maintenance activities.**

Join us to discover and test our multi-hazard monitoring and early warning technologies! We are willing to connect with global peers, to build tech synergies, and to find new ways to face future

challenges.

We will be at your complete disposal in order to provide you information, dedicated meetings, specific studies, solutions and proposals, always in the name of innovation for the protection of the environment and, especially, of human lives.

In order to better organize the event, schedule a meeting with us by sending an email to alberto.bertocco@cae.it.

See you this October in Amsterdam!

PREDICTIVE MAINTENANCE AND MEASUREMENT QUALITY CONTROL: THE HIDDEN INFORMATION WITHIN DATA COLLECTED BY MONITORING SYSTEMS



Monitoring systems developed by CAE manage **metadata** related to measurements, associating each data point with a parameter that defines its **estimated quality**. This assessment is verified and, if necessary, updated at every stage of the chain: from the sensor to the datalogger and up to the central software systems.

It is precisely at the central level, with the aim of offering high-value services to customers, that dedicated software solutions operate, such as **Detective**. This software is capable of analyzing in just a few seconds the vast amounts of data coming from sensors across all field-installed stations. Thanks to its ability to quickly process incoming data, Detective can report **potential anomalies in real-time and assigns a specific data quality marker to each one**. This evaluation is then made available to the operator for further assessment or, if the data is used as input for any forecasting model, to determine whether it should be included based on its reliability.

With the goal of assessing data reliability, among the numerous checks implemented by Detective are those defined by ISPRA in the "Guidelines for the validation of hydro-meteorological data." As a result, **dozens of algorithms perform checks on rain gauges, air thermometers, hydrometers, flow rates, and other variables**.

Following the philosophy of these checks, similar verifications have been implemented in Detective

for **pressure, radiation, relative humidity, wind direction, and wind speed**. In its current version, Detective includes **110 different checks on meteorological parameters, diagnostic data, and the operation of both the central system and the field network**. The program's structure allows for the **easy addition of new checks** or the extension of existing ones to other types of parameters in the future.

Here, thanks to **Machine Learning** techniques, the **identification of potential anomalous data** is both fast and effective, enabling operators to **detect drift phenomena and other malfunctions** that would otherwise be difficult to identify.

In addition to **measurement validation**, CAE has developed **specific expertise in analyzing diagnostic data from maintained systems**. Based on its experience, CAE has introduced control over numerous additional parameters to obtain a comprehensive view of field equipment performance. **Issues such as energy imbalance, component wear, vandalism, and many others can be identified**.

This is where **predictive maintenance takes shape**. **Identifying precursor behaviors of a malfunction before it turns into a failure, with the consequent loss of measurements, is an advantage** made possible by modern techniques, enabling improved efficiency, typically associated with well-planned maintenance activities.

PNRR – MASE IMPLEMENTS THE INTEGRATED MONITORING AND FORECASTING SYSTEM (SIM)



As part of the National Recovery and Resilience Plan (PNRR) Investment M2C4 I1.1, the Italian Ministry of the Environment and Energy Security (MASE) has launched the implementation of the Integrated Monitoring and Forecasting System (SIM), aimed at developing a system capable of **identifying and forecasting risks** affecting the national territory, **including those related to climate change**.

The SIM is based on a series of interoperable federated systems that integrate existing observation networks with new technologies, ensuring standardized management of processes, data, and models. Its core components include the collection and harmonization of territorial data through satellite observation, drones, and remote sensing technologies, the integration of existing information systems, continuously operating telecommunications networks, central and regional control rooms, and cybersecurity systems and services.

The SIM project is broad in scope and comprehensive in nature. It consists of a large-scale programme involving forty public administrations and is structured around two main areas of intervention:

- **Making environmental monitoring data accessible and shareable:** through a single access point, users will be able to access an extensive volume of information generated by a constellation of environmental monitoring systems;
- **Integrating and enhancing the monitoring networks already used to collect environmental data,** including information on air quality, wildfires, landslides, and water quality.

This article focuses on the second area of intervention, for which the procurement procedure included the modernization, enhancement, and integration of the following monitoring networks distributed throughout the national territory:

- **Radar Network**, an integrated national infrastructure that collects and processes data from weather radars distributed across the country.
- **HydroMeteo Network**, dedicated to monitoring the main meteorological, rainfall, and hydrometric parameters.
- **In Situ Landslide Monitoring Network**, designed to monitor landslide bodies, define warning thresholds, and help safeguard people and assets.
- **Seismic Network**, consisting of the National Accelerometric Network (RAN) and the Seismic Observatory of Structures (OSS), responsible for recording ground motion and assessing its effects on buildings.
- **High-Precision Levelling Network**, Italy's national vertical reference network managed by the Italian Military Geographic Institute (IGM). It comprises approximately 13,000 benchmarks distributed along an equivalent number of kilometres of the country's main road network.
- **AgroMeteo and Greenhouse Gas (GHG) Network**, dedicated to monitoring agrometeorological variables and greenhouse gas fluxes.
- **National Dynamic Network**, the country's geodetic infrastructure for high-precision monitoring of the official national reference frame. A network of permanent stations continuously observes GNSS satellite signals and transmits them electronically to a central processing facility.
- **Wildfire (Meteorological) Network and National Gravimetric Network**, dedicated respectively to wildfire prevention monitoring and the measurement of variations in the Earth's gravity field.
- **Additional monitoring equipment**, including air and marine sensors, meteorological sensors, environmental monitoring instruments, mobile photovoltaic panels, and drones.



Another key objective of the project is to make all of these monitoring networks **fully interoperable with the SIM**. This represents a major national infrastructure initiative that significantly strengthens Italy's capability to **forecast, prevent, and manage environmental risks**.

The temporary consortium awarded the contract, of which CAE is a member, has signed a single framework agreement with MASE covering the management of activities related to all of the monitoring networks described above.

PNRR – HYDROMETEOROLOGICAL, AGROMETEOROLOGICAL AND GHG NETWORKS: ONGOING WORKS

Thanks to the funds allocated under the **PNRR**, the Italian Ministry of the Environment and Energy Security (MASE) has issued activation orders under the framework agreement awarded to the consortium (RTI) of which CAE is a member. These orders require the implementation of the **hydrometeorological, agrometeorological, and GHG monitoring networks within the Integrated Monitoring and Forecasting System (SIM)**.

Each Italian region has autonomy in defining the various components of its own hydrometeorological network; however, all data flow into the integrated system managed by the National Department of Civil Protection. Through this new project, turnkey solutions are being provided: **each installed component is fully interoperable with existing networks**, according to the characteristics and requirements defined by the individual regions.

The objective is to **increase both the quantity and quality of data available** to those responsible for managing the increasingly frequent **emergencies** caused by climate change and other environmental factors. These data are also essential for **studying natural phenomena** and, consequently, for developing **forecasting models**.

Furthermore, the project recognizes the importance of measuring and understanding **agrometeorological and climatic variables for agricultural management**, both from a **prevention perspective** (such as the development of plant diseases) and from a **forecasting perspective** (such as irrigation and fertilization planning). In this context, the project will **strengthen and expand the National Agrometeorological Network** in order to provide an

adequate representation of the main meteorological phenomena affecting agricultural areas throughout the country, in line with the requirements and needs collected from the Administrations responsible for managing existing stations.

Last but not least, the **GHG** flux measurement network, managed by **CREA** (Council for Agricultural Research and Analysis of Agricultural Economics), plays a key role. This network supports high-quality research on climate change and contributes to increasing the usability and accessibility of related data.

This is a major challenge: the ongoing activities include field interventions across a total of **4,300** sites. Among these, **550 are new monitoring stations equipped with 3,800 new sensors**.

The required **instrumentation** includes a wide range of technologies, such as: albedometers; ultrasonic, mechanical, and sonic anemometers, including heated versions; barometers; disdrometers; sunshine recorders; radar water level sensors; piezometers; snow gauges; rain gauges; global and UV radiometers; leaf wetness sensors; Photosynthetically Active Radiation (PAR) sensors; surface snow temperature sensors; soil temperature sensors; present weather sensors; soil moisture sensors; surface and immersion water velocity sensors; neutron probes for Snow Water Equivalent (SWE) and soil moisture measurements; thermo-hygrometers; air thermometers; and webcams.

PNRR – HYDROGEOLOGICAL INSTABILITY: STRENGTHENING LANDSLIDE MONITORING

Italy's National Recovery and Resilience Plan (PNRR) provides for the strengthening of environmental risk observation and forecasting capabilities through the implementation of the **Integrated Monitoring and Forecasting System (SIM)**. The system is designed to integrate and enhance the existing monitoring networks across the country, improving the collection, processing, and sharing of data related to the main natural hazards. Among the infrastructures included in the project is the **in situ landslide monitoring network**, a strategic asset for the prevention of hydrogeological instability.

The national context clearly highlights the importance of this issue. Italy is one of the European countries most exposed to landslide risk. According to the Italian Landslide Inventory (IFFI), developed by ISPRA together with the Regions and Autonomous Provinces, **more than 621,000 landslides** have been mapped across the country, covering approximately **24,700 km²**, or 8.2% of the national territory. A significant share, around **28%**, consists of rapid-moving landslides, such as rockfalls and rapid mud or debris flows, which are characterized by high velocities and considerable destructive potential. Despite the widespread occurrence of these phenomena, **only a few thousand landslides are currently monitored using in situ systems**.

To provide a comprehensive overview of active and decommissioned in situ monitoring networks across the country, ISPRA developed and implemented the National Registry of Monitoring Systems in 2021. **The registry currently includes information on 1,222 monitoring systems**.

With regard to their purpose, **79% of the systems surveyed in 2021** were intended for **knowledge and observation purposes**, while **only 21% were also used for early warning and therefore operated in real-time**.

As a result and considering the original objectives for which many of these systems were installed, data acquisition in numerous landslide areas was still carried out manually, while only a limited number of sites were continuously monitored.

Among the most commonly used instruments in landslide monitoring systems are **inclinometers and piezometers**, followed by **topographic surveying equipment** (total stations and GNSS instruments), **crack meters**, **meteorological and rainfall monitoring instruments** (rain gauges, thermometers, and snow gauges), **extensometers**, and **in-place inclinometer or multiparameter chains**. Direct monitoring of landslide bodies provides essential data for understanding the evolution of these phenomena, including the definition of landslide extent and geometry, the assessment of pore water pressures and their changes over time, and the identification of **potential warning thresholds to help safeguard people and assets**.

Strengthening monitoring networks is therefore a key step toward improving knowledge of landslide processes and supporting forecasting and hydrogeological risk management activities at the national level.

For this reason, during the preparation of Investment 1.1 under the PNRR, coordinated by the Ministry of the Environment and Energy Security (MASE), ISPRA, the Regions and Autonomous Provinces, the National Working Group of the Italian Landslide Inventory (IFFI), and the Regional Environmental Protection Agencies (ARPAs) identified **135 priority sites** for in situ instrumental monitoring. An **additional 35 monitoring sites**, located in Southern Italy, were also selected to be equipped with instrumentation and services for monitoring surface displacements.

For some of these sites, the project involves the installation of entirely new monitoring systems, while for others it focuses on automating or upgrading existing instrumentation. In several cases, the intervention also aims to establish fully operational **early warning systems**.

In line with the SIM framework, in situ landslide monitoring data will be made available to all institutional bodies responsible, in various capacities, for hydrogeological risk management. Early warning procedures, however, will continue to be managed and coordinated, according to their respective institutional responsibilities, with the Regional Functional Centres. These centres will also be able to use in situ landslide monitoring data to support the preparation of Hydrogeological Criticality Bulletins.





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