I. Environmental Hazard Detection

Illegal waste management and spills in surface waters are significant environmental issues in both industrialized and developing countries. These phenomena require the detection of pollution sources or polluted sites to make public authorities fully aware of the necessary actions for the prosecution of criminal actions and the restoration of the environment.

Detection of potential polluted sites (micro-dumps) obtained through the analysis of VHR satellite images.

Case study: Province of Caserta, Italy

II. Progressive monitoring

The concept of “progressive monitoring” defines various stages of the monitoring process, each one suitable to be implemented with a specific platform (satellite, aerial, close range) to be integrated, together with on-ground surveys, in a Decision Support System (DSS).

In particular, satellite VHR images are employed to generate (unvalidated) micro-dump detection maps for subsequent validation by photo-interpreters. The detection is based on machine learning and deep learning techniques.

When needed a detailed analysis is performed with low altitude platforms which guarantee the signal acquisition with a finer ground resolution.

Data fusion allows the integration of ground survey data with remote sensing data for updated estimation of environmental risk maps.

Detected area with VHR satellite images

Selected References

- C. V. Angelino, L. Cicala, S. Parrilli, D. Amitrano, F. Gargiulo, M. De Micco, V.R. Baraniello, G. Persechino, CIRA Scpa - the Italian Aerospace Research Centre via Maiorise, snc 81043 Capua (CE) - Italy

III. Decision Support System

DSS based on progressive monitoring aims to support public decision makers in illegal dumps monitoring and in the prioritization of field operations based on the available resources.

Monitoring process steps:

1. **STEP1:** Insert information from various sources into the system with different reliability and descriptive completeness
2. **STEP2:** Consolidate information
3. **STEP3:** Evaluate the environmental risk
4. **STEP4:** Prioritize areas to visit for confirmation and characterization
5. **STEP5:** Allocate resources on the territory

The design of the monitoring system can be performed after a cost-benefit analysis.

IV. Towards persistent monitoring

HAPSs (High Altitude Pseudo Satellites) represent a new era for Earth Observation since they allow a continuous monitoring thanks to the station keeping feature and a good compromise in terms of spatial resolution vs area coverage.

To face this challenge, CIRA is developing a research program on an Hybrid Stratospheric LTA platform that will allow the detection of environmental criticalities, also of short duration, in real time.

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