Geophysical Research Abstracts
Vol. 12, EGU2010-6658-4, 2010
EGU General Assembly 2010

A mobile laboratory for surface and subsurface imaging in geo-hazard monitoring activity

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A new research infrastructure for supporting ground-based remote sensing observations in the different phases of georisk management cycle is presented. This instrumental facility has been designed and realised by TeRN, a public-private consortium on Earth Observations and Natural Risks, in the frame of the project "ImpresAmbiente" funded by Italian Ministry of Research and University.
The new infrastructure is equipped with ground-based sensors (hyperspectral cameras, thermal cameras, laser scanning and electromagnetic antennae) able to remotely map physical parameters and/or earth-surface properties (temperature, soil moisture, land cover, etc...) and to illuminate near-surface geological structures (fault, groundwater tables, landslide bodies etc...). Furthermore, the system can be used for non-invasive investigations of architectonic buildings and civil infrastructures (bridges, tunnel, road pavements, etc...) interested by natural and man-made hazards.
The hyperspectral cameras can acquire high resolution images of earth-surface and cultural objects. They are operating in the Visible Near InfraRed (0.4÷1.0μm) with 1600 spatial pixel and 3.7nm of spectral sampling and in the Short Wave InfraRed (1.3÷2.5μm) spectral region with 320 spatial pixel and 5nm of spectral sampling.
The IR cameras are operating in the Medium Wavelength InfraRed (3÷5μm; 640x512; NETD< 20 mK) and in the Very Long Wavelength InfraRed region (7.7÷11.5 μm; 320x256; NETD<25 mK) with a frame rate higher than 100Hz and are both equipped with a set of optical filters in order to operate in multi-spectral configuration.
The technological innovation of ground-based laser scanning equipment has led to an increased resolution performances of surveys with applications in several field, as geology, architecture, environmental monitoring and cultural heritage. As a consequence, laser data can be useful integrated with traditional monitoring techniques. The Laser Scanner is characterized by very high data acquisition repetition rate up to 500.000 pxl/sec with a range resolution of 0.1 mm, vertical and horizontal FoV of 310° and 360° respectively with a resolution of 0.0018°. The system is also equipped with a metric camera allows to georeference the high resolution images acquired.
The electromagnetic sensors allow to obtain in near real time high-resolution 2D and 3D subsurface tomographic images. The main components are a fully automatic resistivity meter for DC electrical surveys (resistivity) and Induced Polarization, a Ground Penetrating Radar with antennas covering range for 400 MHz to 1.5 GHz and a gradiometric magnetometric system.
All the sensors can be installed on a mobile van and remotely controlled using wi-fi technologies. An all-time network connection capability is guaranteed by a self-configurable satellite link for data communication, which allows to transmit in near-real time experimental data coming from the field surveys and to share other geospatial information. This ICT facility is well suited for emergency response activities during and after catastrophic events. Sensor synergy, multi-temporal and multi-scale resolutions of surface and sub-surface imaging are the key technical features of this instrumental facility. Finally, in this work we shortly present some first preliminary results obtained during the emergence phase of Abruzzo earthquake (Central Italy).