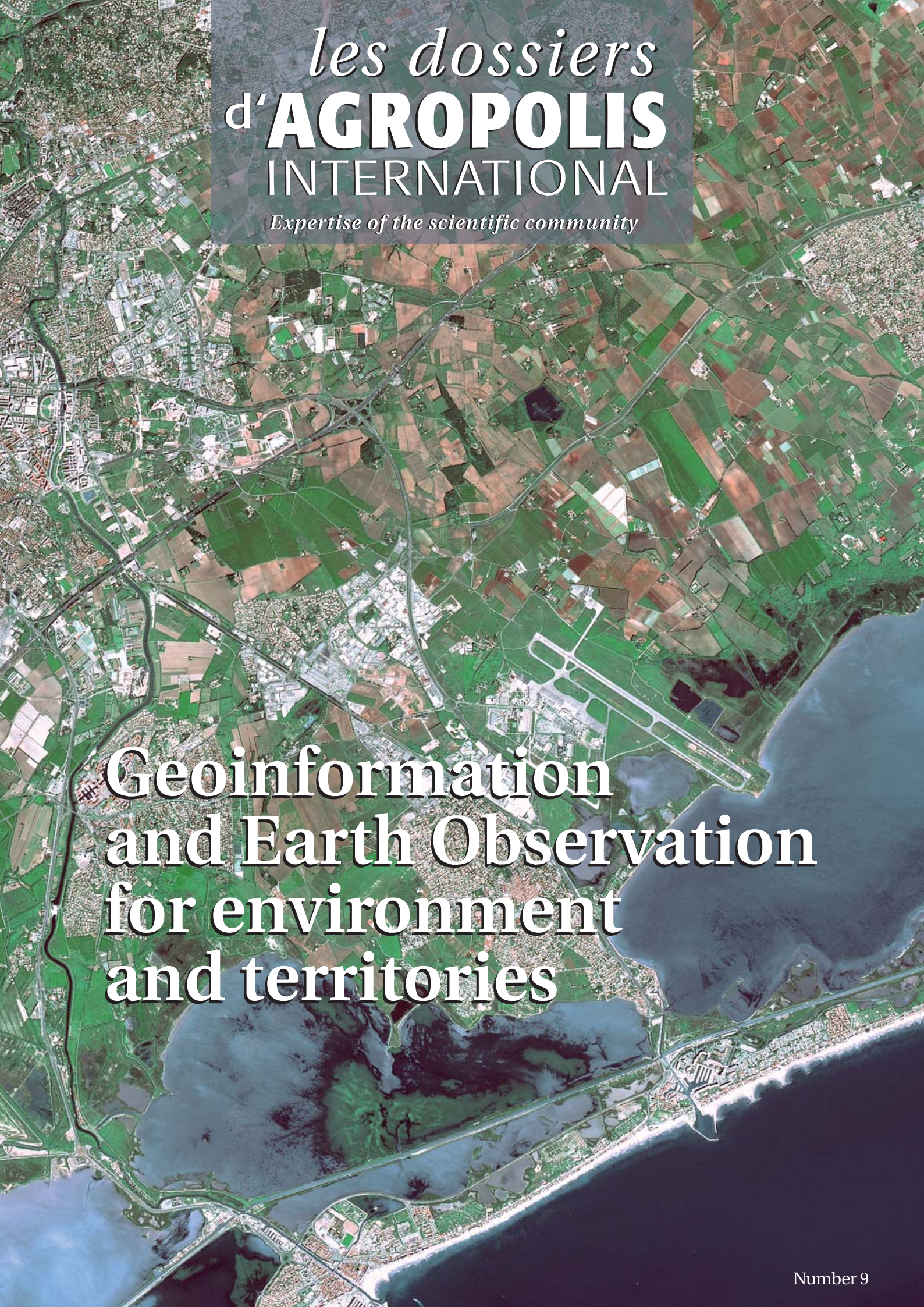
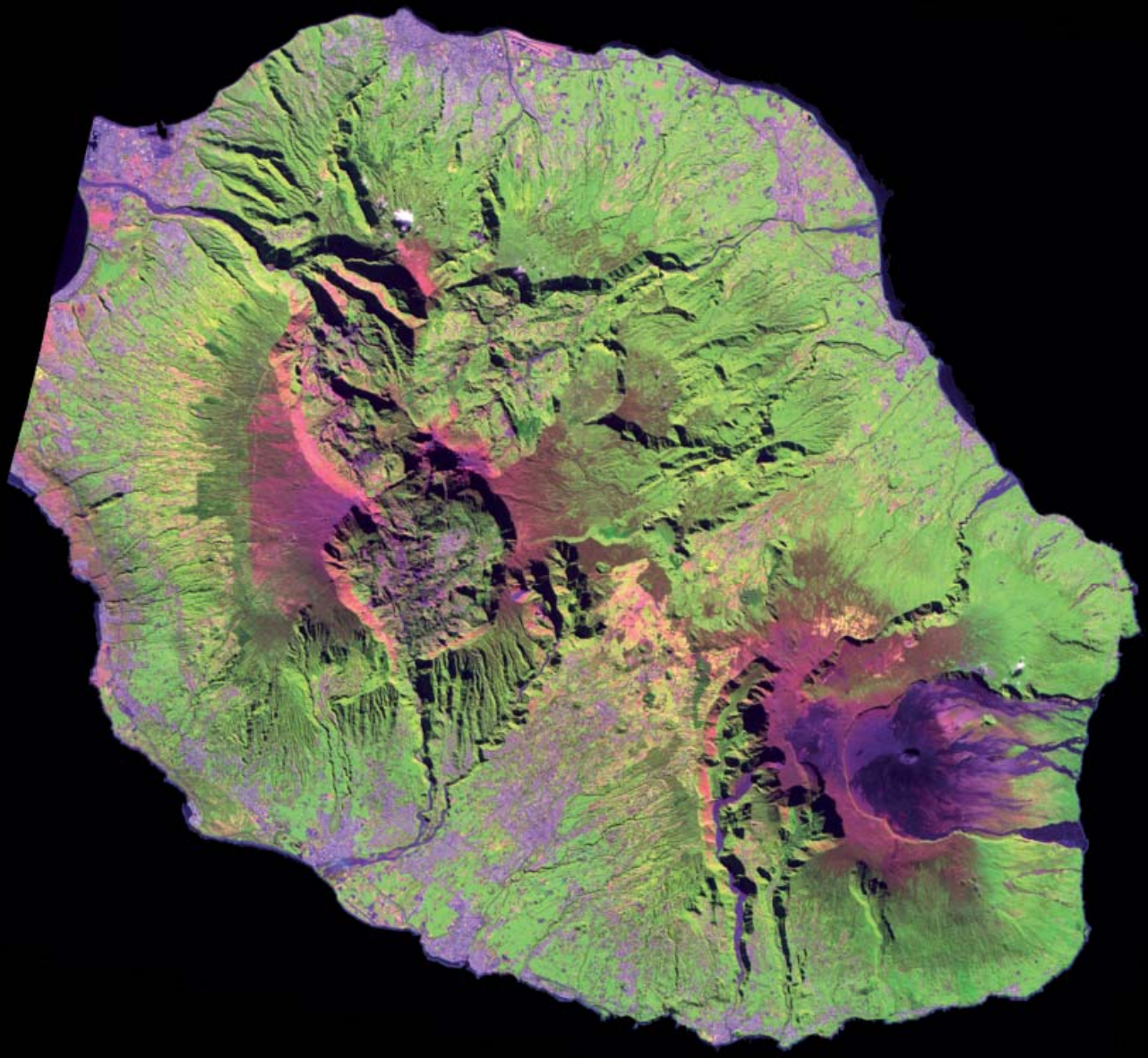
les dossiers d'**AGROPOLIS** INTERNATIONAL

Expertise of the scientific community



Geoinformation and Earth Observation for environment and territories

Number 9



▲ *SPOT 4 image of 19/05/2009, Réunion island: false colour image (MIR/PIR/R), CNES Kalideos programme.*

Satellite and airborne *remote sensing*

In 2009, around 60 satellites are seamlessly monitoring the Earth's atmosphere, oceans, and land surfaces. Satellite remote sensing has many advantages for environmental and territorial inventories and surveys as compared to conventional ground measurement systems (objectivity, homogeneity, repeatability, completeness, archiving, etc.). Acquired images and data are inputs for global surface process models while–on a more local scale–providing essential information for environmental and territorial resource management. The launching and development of new satellite and airborne systems has substantially enhanced the management of natural and agricultural areas. Specific innovative algorithms for image and signal processing are thus being developed in order to take full advantage of the technological potential of these systems.

■ **Light aircraft systems:** So-called 'light' data acquisition systems are currently being developed as a complement to 'heavy' satellite and airborne systems. With these systems, images are acquired via drone or microlight aircraft equipped with commercial digital cameras that have been modified for acquisition of images in spectral bands other than red/green/blue. These inexpensive and easy-to-use systems can generate images that require specifically tailored techniques to preprocess and convert them into quantitative thematic maps.

■ **Very high spatial resolution (VHSR):** Very high spatial resolution (metric and submetric) remote sensing systems first appeared around year 2000 for visible and infrared wavelengths (multispectral imaging) and 2008 for microwaves (radar imaging). Although initially limited to airborne acquisition, VHSR technology has radically changed satellite remote sensing and made it possible to map most landscape and urban environment constituents. Techniques implemented for object detection (extraction) and for splitting images into different entities (segmentation) are booming but, as the quality of the results may vary, adaptations may be required depending on the topic being investigated.

■ **Very high temporal resolution:** The scientific community and users can have access to time series images in low (100-1000 m) and, recently, decametric spatial resolutions, with a repeatability of around 1-3 days. Extraction of information from time-series images is a major future remote sensing challenge. Such work requires analysis and debate on time (season, year, etc.) and space (plant, plot, region, etc.) scales at which dynamic functioning, evolution and change phenomena are perceived and detected, and on tailoring models to these new data sources.

■ **Lidar techniques:** Lidar (light detection and ranging) is an observation technology system based on laser beam transmission-reception. Onboard range-finder systems determine the distance between the sensor and the target by analysis of the main lidar echo and may be applied to bathymetrical or topographical measurements. On the other hand, full wave form systems measure the entire reflected signal, thus providing access to the vertical structure of a target surface. They generate information that cannot be accessed by other remote sensing techniques, such as the digital terrain model in forested areas and 3D vegetation structure mapping.

■ **Radar techniques:** An essential feature of radar is its capacity to acquire images irrespective of the meteorological and sunlight conditions through active microwave transmission and reception of their echo after interaction with a surface. SAR radar imaging thus provides information on the surface roughness, radar altimetry generates information on ocean surface and continental water levels, while radar interferometry can be used to measure relief (spatial interferometry), movements and deformations (temporal interferometry) in soil and water.

The expertise pooled at Agropolis International in the fields of satellite and airborne remote sensing is highly original. There is substantial potential for developing remote sensing methods that could be mobilized to help in dealing with issues concerning environmental and resource knowledge and management, at regional and local scales in Europe and developing countries. The research teams thus invest in data acquisition, image and signal processing. They conduct studies directly associated with thematic fields of research, with support from the technological research platform of the Remote Sensing Center in Montpellier (France) and its development via the GEOSUD project.

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