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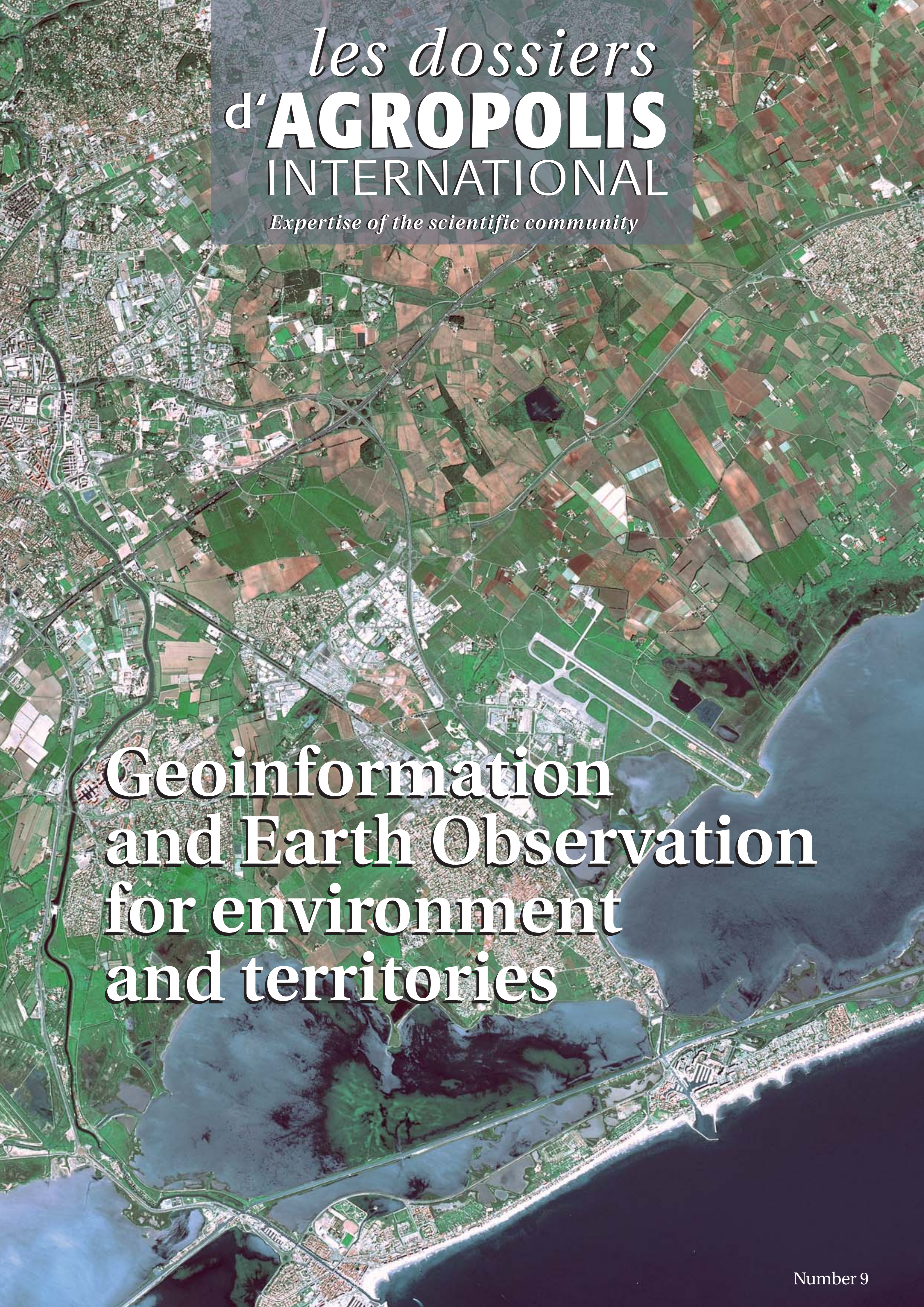

Geoinformation and Earth Observation for environment and territories

Number 9

Agriculture, *fisheries and forestry*

As population growth, climate change and the impact of human activities on ecosystems increase, sustainable management of our environment and its renewable resources–especially food–is crucial. This requires being able to describe the past and current state of the environment, understand the underlying processes and simulate management scenarios by predicting how it could evolve under the impact of human pressure.

Continental surfaces form a spatially complex system resulting from a combination of features, including the geology, topography, soils, climate, fauna, flora and human land-use patterns. This extremely high spatial variability occurs on all scales: plant, farm plot, small region, country and continent. Besides this spatial structure, temporal changes also take place on different scales: daily cycle, meteorological event, season, and longer term climate change. This trend also applies to oceans, seas and continental waters, whose characteristics vary markedly on spatial and temporal levels.

It is essential to have access to methods for spatial description of the environment and also for organizing spatial information of different types and origins. Remote sensing techniques, geographic information systems (GIS) and spatial modelling techniques are favoured tools for this. Moreover, it is necessary to describe and gain insight into the evolution of these spatial variables–this is the focus of dynamic modelling studies supported by remote sensing data.

In the renewable resources field presented in this chapter–agriculture, forestry, ecosystems and fisheries resources–variables that characterize studied environments must first be determined spatially: topography, soils (mineralogy, humidity, surface state), vegetation (type, status, growth and development, height, solar radiation interception and albedo), landscape spatial organization (plot patterns, ditch networks), cropping practices (management strategies, tillage operations, pesticide treatments), water temperature, nutrients and plankton for fisheries resources. Furthermore, it is essential to gain insight into temporal changes that most of these variables undergo. In a number of these cases, this spatial information is used directly for management purposes (precise agricultural techniques, harvest management in cropping areas, controlling nonpoint source pollution). Moreover, this information is often used as parameters or inputs for models describing processes under way in target environments (crop models, hydrological models, surface-atmosphere exchange models).

Due to the complexity in the spatial organization of terrestrial environments–especially cultivated landscapes–there is an urgent need for spatial information representation and processing methods. GIS technology is widely implemented to combine spatial information of different types and origins in the fields of agriculture and ecosystem characterization. In addition to this conventional use, there are more specific needs, such as the application of spatial modelling to simulate an entire area based on information acquired in just a small part of this area, especially when other parts of the area are hard to monitor, for mapping purposes (spatial interpolation techniques, spatial stochastic simulations). Finally, substantial lateral flows run through these highly heterogeneous environments: water transfers via runoff, stream flow, groundwater movements, atmospheric gas and particle transport (pollen, pesticides, etc.). Spatial characterization of these environments and flow modelling are required to represent these flows–which is a current focus of active research.

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