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DATA FUSION FOR A BETTER EXPLOITATION OF DATA IN ENVIRONMENT AND EARTH OBSERVATION SCIENCES

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ABSTRACT

Earth Observation (EO) data are currently used in several applications. Some achievements are reached which are fairly satisfactory from the point of view of customers. However it is recognised that each application only uses a small amount of the available EO data. Numerous EO missions exist. The number of sensors and of possible observations is huge. According to the instruments, the observations can be done in several wavelengths, (visible and infrared, thermal infrared, microwave domains), with different modes: passive (radiometer, spectrometer) or active (imaging radar, scatterometer, altimeter), with different spatial resolution (from 1 to 50 km), and with various observation frequencies (from 1/4 hour to 30 days). A judicious use of the whole capabilities of EO missions and data should lead to an increase of the quality of the product or information delivered to the customer or of the decision taken by the customer. This wealth of data is presently not fully exploited by the customer, mostly because methods, techniques and tools are not yet available.

Data fusion has been defined by a group of European experts as "a formal framework in which are expressed means and tools for the alliance of data originating from different sources. It aims at obtaining information of greater quality; the exact definition of 'greater quality' will depend upon the application".

Three examples will be given, illustrating the benefits of data fusion relative to standard approaches.

The first example will demonstrate how mapping features in the cities can be enhanced by the fusion of images of different spatial and spectral resolutions. A panchromatic image of Marseille (France) downtown with a spatial resolution close to 2 m is merged with a multispectral image of lower spatial resolution. The synthesised high resolution multispectral image provides a much better description of the city features.

Ground measurements are usually the only information of the distribution of pollutants. In the second example, these measurements are fused with satellite images in order to map the concentration in pollutants in the city of Nantes (France). Local authorities, in charge of pollution are supplied with a more accurate knowledge of the spatial distribution of the pollutants.

The third example shows how accurate digital elevation models can be constructed from multi-sources satellite images. For each point, the best source is selected according to the associated error and taking into account the overall coherency of the digital elevation model.