Geophysical Research Abstracts, Vol. 7, 06203, 2005
SRef-ID: 1607-7962/gra/EGU05-A-06203

High spatial and temporal resolution operational remote sensing of land surfaces from space. A mission proposal in the framework of GMES.

G. Dedieu (1), B. Beghin (2), O. Hagolle (2), H. Jeanjean (2) and A.Meygret (2)
(1) CESBIO, 18 avenue Edouard Belin 31401 Toulouse Cedex 9, France, (2) CNES, 18 avenue Edouard Belin 31401 Toulouse Cedex 9, France (gerard.dedieu@cesbio.cnes.fr / Fax: +33 5 61 55 85 00 / Phone: +33 5 61 55 85 26)

The aim of this presentation is to describe and discuss the main objectives and the preliminary design of a land remote-sensing mission which will be proposed as one of the space infrastructure as needed by the European Global Monitoring for the Environment and Security (GMES) services. The phase 0 preliminary study of this mission analyses several scenarios. It is performed by CNES with the support of laboratories and of a mission user group. This study is intended to provide part of the inputs to the discussions that will be held at the European level to decide on the future GMES space infrastructure programme.

A large number of applications such as land cover and land use mapping, water, forest and land management, crop production monitoring, the implementation of water and nitrates EU directives, the control of the Common Agricultural Policy and of the Kyoto Protocol as well as research issues on water, carbon and nutrient cycles requires robust information over large areas that could be provided by remote sensing observations from space, in complement to in-situ observations. However, the high temporal and spatial variability of land surface processes requires corresponding high spatial resolution and high temporal repetitivity, with spatial coverage ranging from local to continental scales. Current sensors do not offer this unique combination of global coverage with high spatial and high temporal resolutions.

The provision of efficient GMES services to the users is currently being studied with the support of EU-FP6 and ESA, amongst others. However, and except for the oper-

ational meteorology, the continuity or the development of these services will have to rely on new Earth observation missions, still not yet decided, since most current ones (e.g. Envisat, SPOT, VEGETATION) will approach their nominal end of life around the year 2008. One alternative to maintaining the continuity of current missions, while making major improvements in the derived information, is to ensure concurrently high spatial and temporal resolution observations. This will foster the current applications and allow the development of new ones related to local to regional scales which are relevant for monitoring human activities.

The mission under study put the emphasis firstly on the temporal repetitivity and global coverage, secondly on the space resolution, and lastly on the spectral richness. Two other strong requirements are i) to lower the overall cost of the mission and of its operation ii) to build a programme for at least 20 years, in order to decrease the costs through recurrent spacecrafts and motivate users investment. While conventional processing and use will be still possible, the design of the mission considers that most of the operational information will be derived by combining the mission data together with in-situ data into models, through several techniques including data assimilation.

The mission space segment is based on a constellation of 4 mini-satellites that will acquire mid-morning data with a space resolution of 20m everywhere on the Earth, every two days. Using only one receiving station located in northern Europe, it will be possible to receive and archive 20m resolution images covering the whole Europe and Africa, as well as 100m resolution images with a global coverage. The 100m resolution images will result of an onboard averaging or sub-sampling process. In addition, it will be possible to acquire 20 m resolution images in direct mode everywhere on the Earth provided the availability of a receiving station. From the data acquired every two days, and daily at high latitude, geographical mosaic and temporal composite will be produced every week in order to screen out the clouds.

The instrument has 9 spectral bands in the solar domain, ranging from the blue to the short-wave infrared (1600 nm), that will be used to monitor the temporal evolution of variables such as the Leaf Area Index and the canopy chlorophyll content. Other information, such as water balance and vegetation productivity, will be retrieved through surface functioning models. The possibility to embark two or three thermal infrared bands is being studied. A strong emphasis is put on the radiometric and geometrical quality of the images that will be delivered and on their consistency with time. A set of spectral bands will allow to characterise atmospheric water vapour and aerosol optical depth, which will facilitate the correction of the atmospheric effects. Finally directional effects will be minimised since a given location will always be observed under a constant angle.

The presentation will first summarise and illustrate the main objectives of the mission. Then, the specifications of the space and ground segment will be given and justified. Finally, the design of a polar orbiting, heliosynchronous mission that satisfies these specifications will be presented.