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GMES/Sentinels in Land-Surface Earth System Science: temporal series and data synergy

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The Global Monitoring for Environment and Security programme (GMES), the European contribution to the international Global Earth Observation System of Systems (GEOSS), will provide accurate, up-to-date and globally-available information on an operational basis, which will open new possibilities for improved Land Models within the context of Earth System Science, providing a global view of environmental parameters of prime importance for climate and environmental research.
The opportunity to have consistent long-term series of global data with high spatial resolution, as those time series to be provided by the Sentinel missions, will make available the necessary elements for consistent provision of inputs to local/regional land surface processes into global models. Even though the Sentinel series represents continuity over current systems, it will be the systematic availability of the data simultaneously at rather high spatial resolution with global coverage and with good temporal sampling what will make the Sentinel data especially attractive for this purpose.
On the other hand, a key element in the exploitation of the Sentinels will be the adequate use of data synergy, because of the different spectral coverage provided by each Sentinel and the different spatial / temporal sampling of the different satellites.
Two critical issues in Land Surface Earth System models are the adequate parameterization of spatial heterogeneity and the prescription of temporal changes, also differentiating from changes in composition and structure or changes in functioning. The prescription of temporal changes is currently quite empirical, even for smooth changes as seasonal dynamics, and very poor parameterizations exist for abrupt changes in structure, which leads to a simplistic treatment of such processes in Earth System models. With Sentinel data, systematic global information will be available at high spatial resolution (up to 10 m), while the high temporal repetition of measurements will also allow to monitor changes at scales of days to weeks. The synergistic exploitation of data coming from the different Sentinels systems, extracting the maximum potential of the combined time series, will provide more advanced science results through data assimilation into adequate Land models describing the processes and feedbacks.
The long term commitment of guaranteed consistent data provision over decades (>20 years) will motivate modellers and the scientific community in general to develop the necessary tools. While the scientific knowledge and capabilities, and the required technologies, are all already available, the motivation to develop such advanced Earth System Models and the corresponding Data Assimilation Techniques will only come if the data streams are identified, and the role of Sentinel data in such approach is probably unique in the current envisaged long-term Earth Observation capabilities at the international level.