Geophysical Research Abstracts
Vol. 18, EGU2016-14697, 2016
EGU General Assembly 2016

From HYSOMA to ENSOMAP – A new open source tool for quantitative soil properties mapping based on hyperspectral imagery from airborne to spaceborne applications

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Soil spectroscopy from the visible-near infrared to the short wave infrared has been shown to be a proven method for the quantitative prediction of key soil surface properties in the laboratory, field, and up to airborne studies for exposed soils in appropriate surface conditions. With the upcoming launch of the next generation of spaceborne hyperspectral sensors within the next 3 to 5 years (EnMAP, HISUI, PRISMA, SHALOM), a great potential for the global mapping and monitoring of soil properties is appearing. This potential can be achieved only if adequate software tools are available, as shown by the increasing demand for the availability/accessibility of hyperspectral soil products from the geoscience community that have neither the capacity nor the expertise to deliver these soil products. In this context, recently many international efforts were tuned toward the development of robust and easy-to-access soil algorithms to allow non-remote sensing experts to obtain geoscience information based on non-expensive software packages where repeatability of the results is an important prerequisite. In particular, several algorithms for geological and mineral mapping were recently released such as the U.S. Geological Survey Processing Routines in IDL for Spectroscopic Measurements (PRISM) software, or the GFZ EnMAP Geological Mapper. For quantitative soil mapping and monitoring, the HYSOMA (Hyperspectral Soil Mapper) software interface was developed at GFZ under the EUFAR (www.eufar.net) and the EnMAP (www.enmap.org) programs. HYSOMA was specifically oriented toward digital soil mapping applications and has been distributed since 2012 for free as IDL plug-ins under the IDL-virtual machine at www.gfz-potsdam.de/hysoma under a close source license. The HYSOMA interface focuses on fully automatic generation of semi-quantitative soil maps such as soil moisture, soil organic matter, iron oxide, clay content, and carbonate content. With more than 100 users around the world, HYSOMA has allowed non-experienced hyperspectral imagery users that have access to ground-truth data to develop fully quantitative maps of common soil properties after few button-clicks.
Currently for more applicability to global spaceborne applications, soil algorithms are being further developed in the context of the EnMAP satellite mission, for the HYSOMA extension and implementation in the EnMAP Box. The EnMAP Box is a freely available, platform-independent open source software designed to process hyperspectral remote sensing data, and particularly developed to handle data from the EnMAP sensor. The soil masking and mapping functions and soil analyses tools of the HYSOMA software were now implemented in EnMAP Box applications tools as EnSOMAP suite (Environmental Soil Mapping) and further extended to include new soil parameters such as salt and hydrocarbon mapping. In this paper, we will present an update of the status of the soil algorithms developed at GFZ from HYSOMA to open source ENSOMAP and additional soil mapping functions.