Geophysical Research Abstracts
Vol. 16, EGU2014-15788, 2014
EGU General Assembly 2014
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Monitoring agricultural crop growth: comparison of high spatial-temporal satellite imagery versus UAV-based imaging spectrometer time series measurements

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In 2012, the Dutch National Satellite Data Portal (NSD) was launched as a preparation to the launch of the European SENTINEL satellites in the framework of the Copernicus Programme. At the same time the Unmanned Aerial Remote Sensing Facility (UARSF: www.wageningenUR.nl/uarsf) has been established as research facility at Wageningen University and Research Centre. The NSD became available for the development of services and advice through an investment from the Dutch government in collaboration with the Netherlands Space Office (NSO) in order to develop new services for precision agriculture. The NSD contains Formosat, Radarsat as well as DMC satellite imagery. The processing of the DMC imagery resulted in the Greenmonitor service (www.groenmonitor.nl). The Greenmonitor is an unique product that covers the Netherlands with a high spatial and temporal resolution. The Greenmonitor is now being exploited for various applications, amongst others crop identification, crop phenology, and identification of management activities. The UARSF of Wageningen UR has three objectives: 1) to develop innovation in the field of remote sensing science using Unmanned Aerial Vehicles (UAV) by providing a platform for dedicated and high-quality experiments; 2) to support high quality UAV services by providing calibration facilities and disseminating processing procedures to the UAV user community; 3) to promote and test the use of UAV in a broad range of application fields such as precision agriculture and habitat monitoring. Through this coincidence of new developments the goal of our study was to compare the information for the measurements of spatial variation in crops and soils as derived from high spatial-temporal satellite imagery from the national data portal compared to the exploitation of UAVs, in our case an Altura octocopter with a hyperspectral camera. As such, the focus is on the applications in precision agriculture. Both primary producers and chain partners and service providers are involved in the consortium. First results show that the Greenmonitor is much more suitable for comparison in growth between fields at regional scale, while UAV based imagery is much more suitable for mapping variation in crop biochemistry (i.e. chlorophyll, nitrogen) within the fields, which requires in the Netherlands a spatial resolution of a few meters. Finally, the spatial and spectral dimension of satellite and UAV derived vegetation indices (i.e. weighted difference vegetation index, chlorophyll red-edge index) to evaluate to which extent UAV based image acquisition could be adopted to complement missing data in satellite time-series.