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Guest Editorial

Special Issue: Proximal Soil Sensing – Sensing Soil Condition and Functions

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Proximal soil sensing (PSS) is defined by McBratney et al. (2011) as the use of ground-based sensors for: 1) *in situ* and mobile field measurements, which is a narrow sense definition, and 2) *in situ* and *ex situ*, mobile and stationary measurements, which is a wide sense definition. Proximal soil sensing has gained broad attention from scientists across different disciplines in the last decade. This led to the establishment of the International Union of Soil Science (IUSS) Working Group on PSS in 2008. Since then four Global Workshops on PSS have taken place, successively in Sydney, Australia (2008), Montreal, Canada (2011), Potsdam, Germany (2013) and Hangzhou, China (2015).

The 4th Global Workshop (GWPSS2015) was organised by Zhejiang University and held in 12-15 May, 2015 in Hangzhou, China. The theme of this workshop was "***Sensing soil condition and functions***", which was chosen to reflect advances and new applications of PSS in soil science, environment, archaeology, land use, and precision agriculture. It provided a forum for researchers, professionals and engineers from all over the world to present their latest research and development results, and exchange and share information and experiences in the fields of PSS, such as *in situ* measurement of soil properties, proximal sensing of soil carbon and biota, sensor data processing and fusion, sensor-based digital soil mapping, combining proximal and remote sensing, development of multi-sensor platforms, advances in soil electromagnetic technologies, and new applications of PSS. The authors working on different topics within PSS, including more than 140 members participated in the 4th Global Workshop, were invited to submit high quality papers to this Special Issue. It is worth noting that another Special Issue on PSS was published in Geoderma (Adamchuk and Viscarra Rossel, 2013), based on a collection of papers presented at the 3rd Global Workshop on PSS in Potsdam, Germany (2013).

We received 30 submissions to this Special Issue; out of which 13 papers (43%) were finally accepted (and one paper was transferred to a regular issue in Biosystems Engineering due to an extended revision process). These papers are a mix of laboratory and field PSS methods, with the majority concerning visible and near infrared (vis-NIR) spectroscopy applications (seven contributions). Four papers addressed electromagnetic induction (Jiang et al., 2017), mid infrared spectroscopy (Ji et al., 2016), ground penetration radar (Cavallo et al., 2016) and microscope-based computer vision to characterise soil texture and organic matter (Sudarsan et al., 2016) and the remaining two papers (Rosero-Vlasova et al., 2016; Cho et al., 2016) can be classified as multi-sensor and data fusion approaches.

The seven vis-NIR papers covered measurement of cation exchange capacity (Ulusoy et al., 2016), prediction of total dissolved salts and soluble ion concentrations (Peng et al., 2016), prediction of selected soil properties with machine learning methods (Morellos et al., 2016), classification of soil classes (Zeng et al., 2016), improving spatial estimation of soil organic matter (Xie and Li, 2016), evaluation of possible prediction of subsurface salinity from surface spectra (Liu et al., 2016) and estimation of wet aggregate indices (Waruru et al., 2016). This demonstrates the importance and superiority of vis-NIR spectroscopy over other PSS techniques for both field and laboratory measurement conditions. However, another interesting point to note is the increasing number of applications adopting multi-sensor and data fusion approach in PSS, with two papers published in this Special Issue on combining vis-NIR with short wave infrared (SWIR) for characterisation of soils from wildfire burns (Rosero-Vlasova et al., 2016) and soil strength with apparent electrical conductivity to estimate physical soil properties (Cho et al., 2016). This can be attributed to the complex nature of soil, which necessitates accounting for more than a single sensor to measure a key soil property (Kuang et al., 2012). This is in-line with conclusions made in a previous Special Issue published on reflectance and fluorescence spectroscopy in soil science (Mouazen et al., 2016), suggesting the need for future work to focus on adoption of the multi-sensor and data fusion approach, including in particular vis-NIR spectroscopy.

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Sincerely Yours,

Abdul Mouazen, Managing Guest Editor

Zhou Shi, Guest Editor

Marc Van Meirvenne, Guest Editor

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