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One's soil is another one's regolith – let's combine our efforts in investigating the critical zone

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Earth observation is invaluable for the agricultural sector as well as the critical metals sector, providing cost-effective, spatially comprehensive information about Earth's surface composition from the regional to paddock/mine-scale. A wide range of remote sensing instruments are used to monitor soils, to give information on properties such as moisture and mineralogy. At the same time, remote sensing data facilitate the discovery and mining of mineral deposits, including iron ore, copper and other metals critical for the transition of the fossil fuel-based energy sector to a sustainable, renewable energy future. One common factor of these two sectors is that all Earth observation systems require calibration sites that help to ensure the data being collected is of high accuracy. Another common factor is that both sectors require ground validation of the remotely sensed data, producing a plethora of publicly available Earth surface data distributed across numerous web portals and platforms. Both sectors aim, ultimately, towards characterising the composition of the subsurface - which starts in both sectors at Earth's surface and reaches to 10s or even 100s of metres below. This can be achieved by developing conceptual models that describe the weathering of bedrock in the soil/regolith. In mineral resource exploration, specific weathering-resistant minerals (e.g. talc) can be traced at Earth's surface by means of Earth observation to characterise the type of bedrock through cover (i.e. beneath the soil/regolith). Another example is the mapping of differences in kaolin crystallinity at Earth's surface and in the subsurface (e.g. drilling, trenches) to infer the distribution of in-situ versus transported regolith, which is of key importance for raw materials exploration. Remote sensing is also commonly used for collecting baseline environmental data prior to mining and for monitoring its impact on the environment during and after the process. In soil science, infrared spectral measurements have been conducted on soil samples in laboratories for estimation of soil properties, such as soil carbon, pH, EC. These estimations require a training library as well as standardised preparation of the samples and measurement technique. The ultimate goal is the accurate measurement of these soil properties using remote sensing, where complex variance of the nature of the materials and illumination conditions exists.

This paper discusses opportunities for sharing facilities, data, workflows and methods for collecting, processing and interpreting remote and proximal multi- and hyperspectral sensing technologies. For this, publicly available mineralogical and geochemical data sets collected from the critical zone, such as in the frame of the National Geochemical Survey of Australia (NGSA; https://www.ga.gov.au/about/projects/resources/national-geochemical-survey) project and

AuScope's National Virtual Core Library Infrastructure Program (NVCL; https://www.auscope.org.au/nvcl), as well as publicly available Earth observation products, such as the Australian ASTER Geoscience Products, will be used to demonstrate the multidisciplinary applications of multi- and hyperspectral remote and proximal sensing data. For the benefit of meeting the United Nations' Sustainable Development Goals, agriculture, resources and environment sectors should overcome unnecessary competition and work hand in hand.