Q-DAI: design and implementation of a QGIS plugin for disaggregation of soil moisture content at 30 m spatial resolution

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Soil moisture content (SMC) plays a significant role in land surface water and energy cycle and is essential in performing various field-related studies. It is a crucial parameter provided by passive L-band sensors on soil moisture active passive/soil moisture ocean salinity satellite missions at a resolution of ~36–40 km. To obtain inference from the SMC data and apply it to different applications, its study and analysis are required that is achievable using any geographic information systems software. Quantum Geographic Information System (QGIS) is an open-source software with a user-friendly graphical user interface (GUI) and a repository of application-specific plugins. However, no plugin provides SMC or downscales the SMC product for a required location. Q-Daily Arial Image (Q-DAI), the QGIS plugin proposed here, implements a downscaling algorithm to obtain the low-resolution SMC product from SMAP/SMOS at fine resolution using inputs from high-resolution satellite imagery. The plugin is developed by designing a GUI using Qt Creator and defining its functionality using Python. Q-DAI is tested on QGIS 3.16.16 on Windows 10, 8 GB RAM PC and QGIS 3.22 on a macOS Ventura laptop. Q-DAI can be used to obtain high-resolution SMC for any location, and in this article, sample results of Q-DAI implemented for Delhi region data have been shown.

Keywords: DisPATCh, SMAP/SMOS, soil moisture content, QGIS, Qt creator.

wavelength. In contrast, the microwave is near the end of the spectrum with a wavelength of a few centimetres. Microwave remote sensing can retrieve soil moisture content (SMC) more accurately than optical sensing due to its better penetration depth and sensitivity to the soil surface. Most promising results are observed in the L-band as it can pass through the canopy and even penetrate the soil to obtain the SMC.

SMC is one key parameter that plays a significant role in land surface water and energy cycle and is essential in performing various field-related studies like yield estimation, drought monitoring, drought prediction, crop water stress, crop water requirement estimation, etc. The soil moisture active passive (SMAP) mission from NASA and soil moisture ocean salinity (SMOS) use the L-band to observe soil moisture and provide daily global SMC products. But, these accurate observations come in hand with a coarse resolution of ~36–40 km, which is not sufficient if we want to acquire point-level information, study changes in soil moisture, deploy irrigation decision support systems (DSS) based on the SMC information, validate against *in situ* data, etc. However, employing techniques that relate the coarse-level SMC product with fine-scale environmental variables can enhance spatial resolution. This is termed the disaggregation of soil moisture products, and researchers have proposed algorithms to achieve this. The downscaling techniques primarily belong to (i) satellite-based methods, (ii) geo-information-based