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ESTIMATION OF SOIL ORGANIC CARBON CONTENT USING GROUND, AIRBORNE, AND SATELLITE HYPER-SPECTRAL IMAGERY

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BACKGROUND

* Soil Organic Carbon (SOC) is the measurable carbon component of soil organic matter.
* SOC is crucial for fertile soils. It enhances soil structure, improves water retention and aeration.
* Soils are the largest terrestrial carbon reservoir on the planet.
* Unsustainable land management, including intensive tillage, deforestation, and overuse of fertilizers, has led to a significant decline in global SOC stocks.

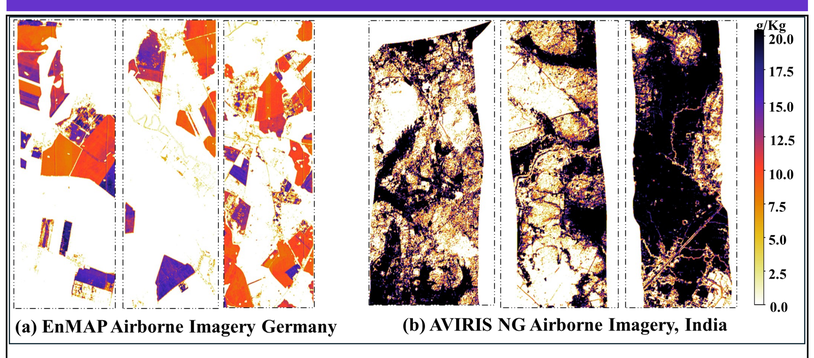
RESEARCH GOAL

* To create high quality SOC maps using the hyperspectral data.
* To access the SOC model transferability from Germany to India.

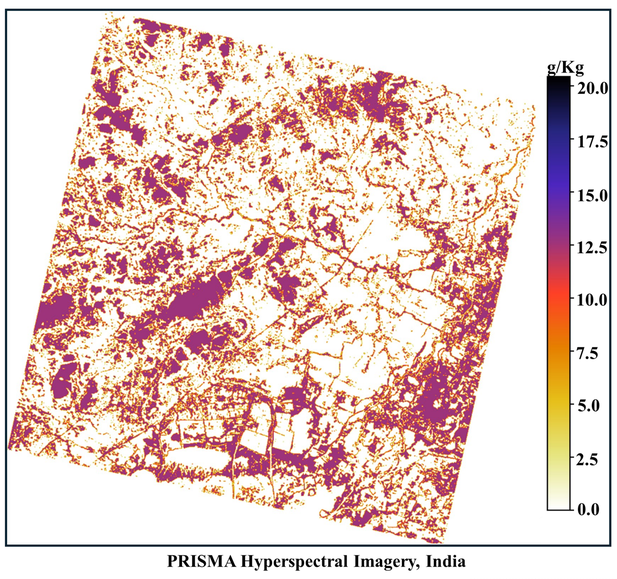
DATASET

* In-situ hyperspectral data from Germany and India.
* EnMAP and AVIRIS-NG hyperspectral airborne image (Germany, and India).
* PRISMA hyperspectral satellite image (India).

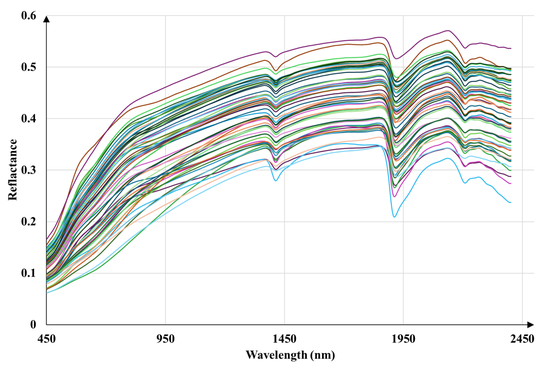
Results



(a) EnMAP Airborne Imagery Germany (b) AVIRIS NG Airborne Imagery, India



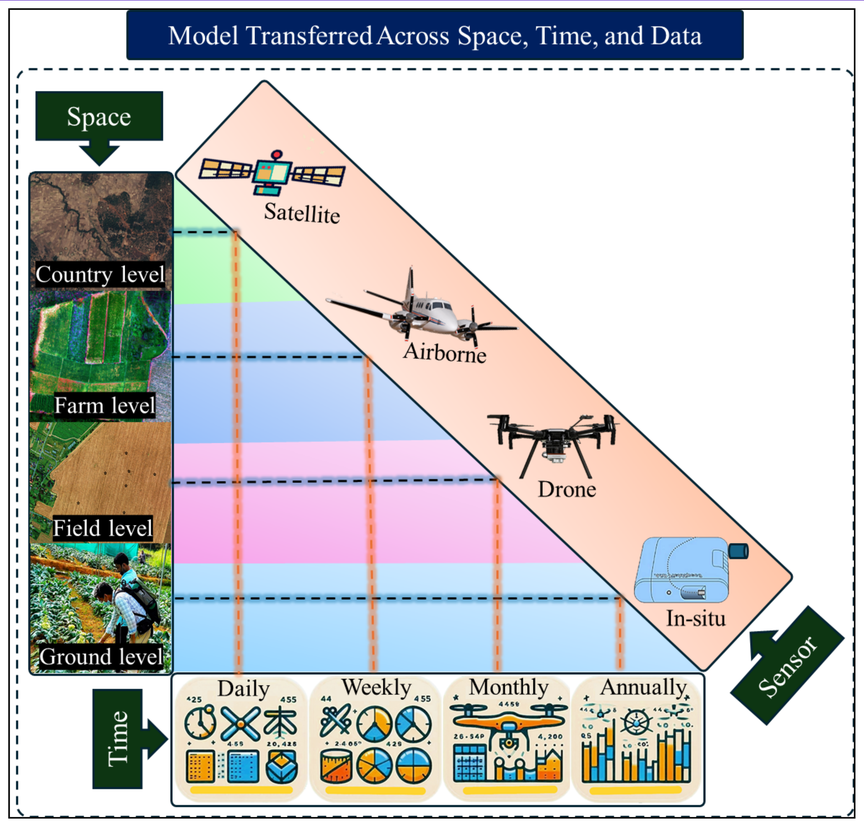
PRISMA Hyperspectral Imagery, India



Scores:

* Germany: 78% R^2 and 1.82 RPD
* India: 71% R^2 and 1.66 RPD

Transferability



References

* Neofytou, E., Neophytides, S. P., Eliades, M., Papoutsa, C., Tzouvaras, M., & Hadjimitsis, D. G. (2024). A review of soil organic carbon (SOC) prediction techniques in agricultural lands using remote sensing. In 2024 IEEE International Geoscience and Remote Sensing Symposium (pp. 1273-1279).
* Guarini, R., Loizzo, R., Facchinetti, C., Longo, F., Ponticelli, B., Faraci, M., Dami, M., Cosi, M., Amoruso, L., De Pasquale, V., & Taggio, N. (2018). PRISMA hyperspectral mission products. In 2018 IEEE International Geoscience and Remote Sensing Symposium (pp. 179-182).
* Chang, N., Jing, X., Zeng, W., Zhang, Y., Li, Z., Chen, D., Jiang, D., Zhong, X., Dong, G., & Liu, Q. (2023). Soil organic carbon prediction based on different combinations of hyperspectral feature selection and regression algorithms. Agronomy, 13(7), Article 1806.
* Abbaszad, P., Asadzadeh, F., Rezapour, S., Khosravi Aqdam, K., & Shabani, F. (2024). Evaluation of Landsat 8 and Sentinel-2 vegetation indices to predict soil organic carbon using machine learning models. Modeling Earth Systems and Environment, 10(2), 2581

METHODOLOGY