**Session Proposal**

**1. Session Title**

Digital Soil Mapping and Assessment: Advances, Applications, and Future Directions

**2. Session Organizers**

Alessandro Samuel-Rosa, Federal Technological University of Paraná, Brazil

Chair of the Digital Soil Mapping Working Group

George Van Zijl, North-West University, South Africa

**3. Session Description**

Spatial soil information is fundamental for effective environmental modeling and sustainable land use management. This session provides a forum to advance the science of creating and utilizing this critical information.

The session will focus on a central theme in the evolution of the discipline: the **incorporation of knowledge** to create more accurate, interpretable, and useful soil maps. We invite contributions that showcase the latest developments in Digital Soil Mapping (DSM), particularly those that integrate pedological principles and novel data sources into quantitative models. A key emergent issue is the rapid advancement of **Artificial Intelligence (AI) and Machine Learning (ML)**. We specifically encourage presentations that address the challenges and opportunities of these new technologies, moving beyond "black box" prediction to explore model **interpretability, the ethical use of AI**, and the fusion of data-driven approaches with scientific understanding.

Furthermore, the session emphasizes the translation of these knowledge-rich maps into practical applications through Digital Soil Assessment (DSA). We encourage the submission of case studies demonstrating how DSM products are used to inform decision-making in diverse disciplines, such as agricultural and environmental modeling, and for the assessment of soil functions and ecosystem services. Presentations that address the critical challenge of quantifying and communicating map uncertainty to stakeholders (e.g., farmers, planners, and policymakers) are especially welcome.

Potential Topics for Submission:

* **Incorporating Knowledge into DSM (Advances in Methods & Tools):**
  + New and creative environmental covariates from remote and proximal sensing.
  + Hybrid methods integrating pedological principles with machine learning and deep learning.
  + Advances in interpretable AI, generative AI, and Natural Language Processing (NLP) for data rescue and model explanation.
  + Optimized and cost-effective sampling designs for model calibration and validation.
  + Strategies for harmonizing, improving, and reducing errors in legacy soil data.
  + Methodologies for quantifying, explaining, and communicating prediction uncertainty.
  + Ethical considerations in AI for soil science, including data sharing and model bias.
* **Extracting Knowledge from DSM (Applications in Digital Soil Assessment):**
  + Frameworks and case studies for assessing soil functions, soil health, and ecosystem services.
  + Application of DSM products for decision support in agriculture, environmental management, and infrastructure planning.
  + Integration of DSM outputs with hydrological, climate, and crop productivity models.
  + Development of useful and accessible DSM products for end-users, such as farmers and land managers.
  + Quantifying pedodiversity and its application in land management.

**Keywords:** Digital Soil Mapping (DSM), Digital Soil Assessment (DSA), Artificial Intelligence (AI), Machine Learning (ML), Pedology.

**Format:** Oral presentations

**4. Proposed Speakers**

None