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Geographic Process Modeling Based on Geographic Ontology

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Abstract: In geo-information science, which has traditionally focused on representations of spatial and temporal information, the representation of geographic processes like soil erosion are becoming more important. Exploring an appropriate method to express a geo-process is significant in revealing its dynamic evolution and underlying mechanisms. This research proposes a process-centric ontology model. It describes geographical environment through three aspects: geographic scene, geographic process and geographic feature. Geographic scene is a unified expression of environment that considers the integrity of geo-processes as well as the spatial temporal pattern of geo-features. Geographic process defines the existing actions of geo-features, and represents spatial, temporal and semantic changes. Geographic feature is the smallest unit of a geographic object, which contains basic geographic information and the affiliation between geo-process and geo-features. The above three aspects are represented through the proposal of a framework and the construction of ten sub-ontologies. These include Feature Ontology, Scene Ontology, Process Ontology, Space Ontology, Time Ontology, Spatial Relation Ontology, Time Relation Ontology, Representation Ontology, Substance Ontology and Operator Ontology. An instance for the soil erosion process is then selected to demonstrate the practicability of this framework. The entire process is separated into three sub-processes (soil detachment, soil transport and soil deposition), and each sub-process is described by when and where the process happened, identifying which features were present and how they reacted (interaction between features, processes, scenes), and what kind of changes were present in the geo-scene. Furthermore, different relationships between features, scenes and processes are defined to explain how and why soil erosion occurred. This proposed approach can reveal the underlying mechanism of geo-scenes, explore the occurrence and causes of geo-processes, and support the complex representation of geo-features.

Keywords: Geographic Process Modeling; Geographic Ontology; Geographic Scene; Soil Erosion Modeling