Geophysical Research Abstracts Vol. 19, EGU2017-11198-1, 2017 EGU General Assembly 2017 © Author(s) 2017. CC Attribution 3.0 License.



Ontology of Earth's nonlinear dynamic complex systems

Hassan Babaie (1) and Armita Davarpanah (2)

(1) Georgia State University, Geosciences, Atlanta, United States (hbabaie@gsu.edu), (2) Spelman College, Department of Environmental Science and Studies (armita_davarpanah@yahoo.com)

As a complex system, Earth and its major integrated and dynamically interacting subsystems (e.g., hydrosphere, atmosphere) display nonlinear behavior in response to internal and external influences. The Earth Nonlinear Dynamic Complex Systems (ENDCS) ontology formally represents the semantics of the knowledge about the nonlinear system element (agent) behavior, function, and structure, inter-agent and agent-environment feedback loops, and the emergent collective properties of the whole complex system as the result of interaction of the agents with other agents and their environment. It also models nonlinear concepts such as aperiodic, random chaotic behavior, sensitivity to initial conditions, bifurcation of dynamic processes, levels of organization, self-organization, aggregated and isolated functionality, and emergence of collective complex behavior at the system level. By incorporating several existing ontologies, the ENDCS ontology represents the dynamic systems variables and the rules of transformation of their state, emergent state, and other features of complex systems such as the trajectories in state (phase) space (attractor and strange attractor), basins of attractions, basin divide (separatrix), fractal dimension, and system's interface to its environment. The ontology also defines different object properties that change the system behavior, function, and structure and trigger instability. ENDCS will help to integrate the data and knowledge related to the five complex subsystems of Earth by annotating common data types, unifying the semantics of shared terminology, and facilitating interoperability among different fields of Earth science.