Mapping CF Standard Names to SWEET Ontology

Rob Raskin
NASA/Jet Propulsion Laboratory

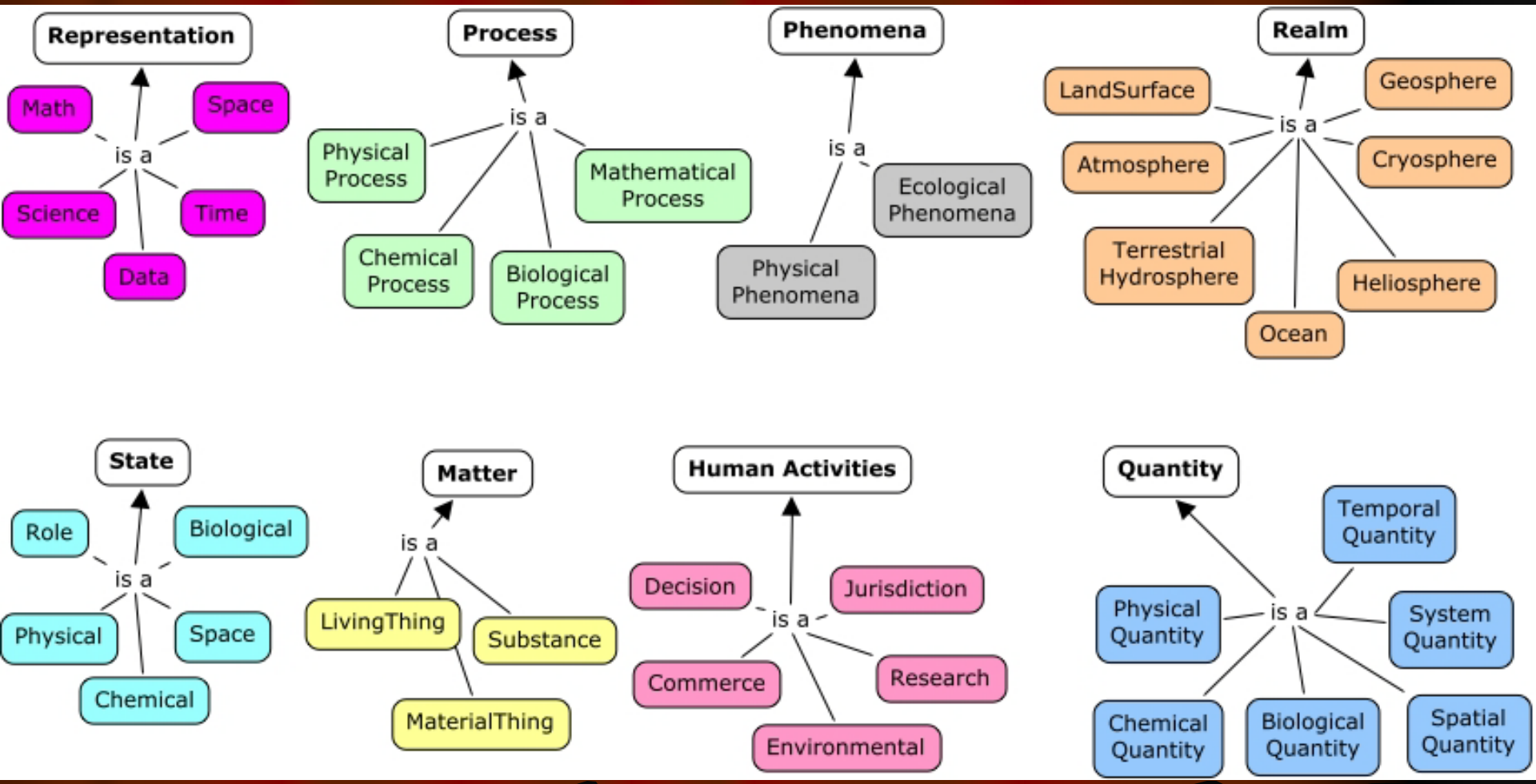
Semantic Web for Earth and Environmental Terminology (SWEET)

- Upper level ontology for Earth system science
- Enables *scalable classification* of Earth system science and applications
- Concept space written in OWL-DL
- Version 2.1 organized into 200 modular ontologies

Scope of SWEET

- Integrated ontologies
  - Earth system science
  - Earth science applications
  - Scientific units
  - Space/time
  - Data quality
  - Data provenance
  - Data types
  - Data services

SWEET Top-Level View



New in SWEET 2.1

- Version 2.1 provides a large module set for STATE
  - Mostly **adjectives** and **adverbs**
  - Examples: Role, color/band, shape, size, equilibrium type, activity level, connectedness, impact, substance form
  - Qualitative analog of “Quantity”
  - Enables greater separation of adjective from object to improve modularity
  - Mostly represented by OWL individuals
    - “types” of categorical, ordinal, and cardinal values

SWEET 2.1 Statistics

- Classes: 4400
- Individuals (mostly States): 2200
- Relations: 600

These elements can be combined arbitrarily to create complex representations

CF vs SWEET Representation

CF (*traditional single-attribute parameter name*):
tendency_of_mole_concentration_of_dissolved_inorganic_phosphorus_in_sea_water_due_to_biological_processes

SWEET *(multi-attribute parameter name):*

- Quantity= mole_concentration
- Transformation= tendency
- State= dissolved, inorganic
- Substance= phosphorous
- Medium= sea_water
- Process= biological_processes

Mapping to CF Standard Names

- Conversion table expresses each of the 2150 Standard Names using SWEET elements
- Available as Excel spreadsheet from SWEET web site
- Also available are the “Tables” (Components) such as Energy, Transformations, Mass used in CF
  - *Analogous to the CF “Area Type” Table*

CF Energy Table

- Available potential energy
- Basal heat
- Dry energy
- Dry static energy
- Energy
- Enthalpy
- Gravitational potential energy
- Heat
- Kinetic energy
- Latent heat
- Mixing energy
- Potential energy
- Sensible heat
- Sublimation heat
- Thermal energy

CF Statistics Table

- bias
- change (=change_in)
- correction
- deficit
- difference (=difference_from)
- excess
- forecast
- mean
- probability
- reference
- threshold

CF Transformation Table

- concentration [X/m3]
- content [X/m2]
- derivative_of….._wrt_ [X/Y]
- directional [X rad-1]
- divergence_of [X m-1]
- flux [X m-2 s-1]
- histogram_of… _over_
- integral_of….._wrt_ [XY]
- lapse_rate [X m-1]
- ln [X]
- magnitude_of [X]
- minus_one_times [X]
- per_unit_mass [X kg-1]
- per_unit_area [X m-2]
- product_of….and_ [XY]
- rate [X t-1] *(=rate_of)*
- ratio_of….._to_ [X/Y]
- shear [X m-1]
- specific [X kg-1]
- spectral_ [X m-1]
- square_of [X2]
- tendency_of [X t-1]
- transport [X m-1]
- variance_spectral_density [X2 s-1]

CF State Table

- Ambient
- Aerosol
- Anthropogenic
- Aromatic
- Atomic
- Biogenic
- Black
- Divalent
- Dry
- Calcareous
- Condensed
- Crystal
- Dissolved
- Droplet
- Dry
- Elemental
- Frozen
- Floating
- Gaseous
- Ice
- Inorganic
- Liquid
- Miscellaneous
- Moist
- Molecular
- Organic
- Oxygenated
- Particle
- Particulate
- Saturated
- Suspended
- Undersaturated
- Unfrozen
- Vapor

SWEET-CF Comparisons: Spectral Ranges

- shortwave
- photosynthetic
- longwave
- microwave
- spectral

SWEET-CF Comparisons: Relations

- Scientific processes and assumptions
  - due_to, assuming, defined_by, by, expressed_as, from, with, without, excluding, to
  - subpropertyOf sweet:relation
- Directional
  - In, out_of, reflected_by, at, over, above, below, into
  - subpropertyOf sweet:spatialRelation
- Other
  - Of, wrt, since

Satellite Observational Data

- Spectral ranges are very important
  - Independent variable in many measurements
  - Should be specifiable by name or quantitative range
- Source
  - Instrument
  - Satellite orbital parameters

Resources

- SWEET ontology:
  http://sweet.jpl.nasa.gov

Rob Raskin raskin@jpl.nasa.gov