Computing the Geobiosphere Emergy Baseline: A Novel Approach

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ABSTRACT

We demonstrate a new and novel approach to calculate Earth’s geobiosphere emergy baseline (GEB). In this method we use gravitational potential energy dissipated in the generation of Earth’s main renewable energy sources. From this gravitational perspective, we recognize three refinements to our understanding of Earth’s driving energies. First we acknowledge the recent literature suggests that Earth’s geothermal energy is from two separate sources, decay of radioisotopes and primordial heat, thus warranting separate solar equivalence ratios (SERs). Second, tidal energy dissipation can be viewed as the loss of Earth’s rotational kinetic energy (KE), due to gravitational interaction between Earth/Moon/Sun and frictional forces in Earth’s oceans. Seen in this way we draw an equivalence between loss of Earth rotational KE and tidal energy dissipated. Third, Earth’s rotational KE and primordial heat are coupled processes of the gravitationally induced accretion of Earth.

The four sources of available energy to the geobiosphere, solar radiation, tidal energy dissipation, primordial heat, and radiogenic heat, are expressed as a ratio of gravitational emergy needed to produce them. After all four sources are expressed by their gravitational transformities, solar equivalences are computed by dividing their gravitational transformatity by the gravitational transformity of solar radiation, resulting in solar equivalent ratios. Using solar equivalences, we combine the four sources to express the emergy driving all planetary phenomena. The method yields four different baselines depending on the allocation procedure used to assign gravitational emergy of Earth’s accretion to its rotational KE and primordial heat. The GEBs ranged between 11.1E+24 seJ J−1 and 13.8E+24 seJ J−1.

Citation

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