A reexamination of the emergy input to a system from the wind

Daniel E. Campbell[1] and Laura E. Erban[1]

[1] United States Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Atlantic Ecology Division Narragansett, RI 02882

Campbell.dan@epa.gov

Erban.laura@epa.gov

Poster

With the establishment of a new, rigorously-determined, solar equivalence baseline for the geobiosphere, 12.0E+24 seJ y^{-1}, it is now appropriate to reexamine the calculation of the emergy delivered by the major secondary products of the geobiosphere, e.g., wind and rainfall, which are derived from the transformation of the solar equivalent joules supplied through the baseline. In this study, the methods for calculating the available energy of the wind dissipated in the planetary boundary layer are revisited and further elucidated. Particular consideration is given to the method used to estimate the geostrophic and gradient wind from measurements of surface wind and to the role of the drag coefficient in determining the available wind energy dissipated in the boundary layer (900 to 1000 mb or the lower 1000 m of the atmosphere) as it passes over various surfaces. In addition, we made a more rigorous estimate of the transformity of the available wind energy dissipated in the planetary boundary layer based on a synthesis of the results from three evaluations of a model of the general circulation of the atmosphere. The rounded estimate of the transformity of the wind from these combined studies was 1230 sej J^{-1}. We consider the variability of the transformity of the wind dissipated in the boundary layer between summer and winter and between the Northern and Southern hemispheres. We conclude that the properties of the system and its spatial and temporal boundaries will dictate the appropriate transformity to use for the wind in any particular evaluation; however, the average global value for general application is 1230 sej J^{-1}.