

Entropic Balance Theory and Variational Field Lagrangian Formalism

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The entropic balance theory has been applied with outstanding results to explain many important aspects of tornadic phenomena. The entropic balance theory was originally developed in variational formalism with Lagrangian appropriate for supercell storm and tornadic phenomena. The entropic balance theory shares the same foundation as, symbolically called with keywords, "variational field Lagrangian formalism" in short "variational formalism". It is broadly used in modern physics, not only in classical mechanics, with Lagrangian density and action designed for each physical problem properly. The Clebsch transformation (equation) was developed in the classical variational formalism, but has not been used because of the unobservable and non-meteorological Lagrange multiplier.

The Lagrange multipliers appeared in the Clebsch transformation are analogous to the mathematical vector potential (and gauge field) of the theoretically found Aharonov-Bohm effect. Its experimental verification has been difficult and has not been made until two decades later. The Lagrange multipliers in the Clebsch transformation seem similar to the vector potential and gauge of electromagnetic field and in advanced physics disciplines.

The entropic balance condition is thus developed from the Clebsch transformation, changing the unobservable non-meteorological Lagrange multiplier to observable meteorological rotational flow velocity with entropy and making it applicable to tornadic phenomena.