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Ocean Science Discussions

Interactive comment on "Understanding mixing efficiency in the oceans: do the nonlinearities of the equation of state for seawater matter?" *by* R. Tailleux

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Michael,

I believe that saying that "energy conversions are inherently non-unique" is looking at energetics from a mathematician's viewpoint, not a physicist's viewpoint. My impression is that many colleagues will find it ok, starting from the following equations:

$$\frac{d(E_1)}{dt} = C_1$$

$$\frac{d(E_2)}{dt} = C_2$$

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in which there is no conversion between the reservoirs E_1 and E_2 (C_1 and C_2 being source/sink terms for E_1 and E_2), to rewrite the equations as follows:

$$\frac{d(E_1)}{dt} = (C_1 - C_3) + C_3 = C_1^* + C_3$$

$$\frac{d(E_2)}{dt} = C_2 + C_3 - C_3 = C_2^* - C_3$$

and then say that C_3 is a conversion term between E_1 and E_2. If this approach were ok, then it would basically amount to say not only that energy conversions are inherently non unique, but in fact that energy conversions are completely arbitrary as well, since I can define C_3 as it pleases me.

In contrast, the approach undertaken in Tailleux (2008) takes the (physical) viewpoint that in nature, the energy must flow in a specific and determined way, and that there must exist a rigorous way to look at the issue of energy conversions that eliminates the above arbitrariness. The conclusions I have reached is that in order to derive a rigorous theory of energy conversions, a number of non-standard energy reservoirs have to be introduced in the context of the fully compressible Navier-Stokes equations. As far as I can judge, my approach allows to make energy conversions well-defined and unique, and establishes that the kind of approach described above is just a mathematical game with no physical justification.

Interactive comment on Ocean Sci. Discuss., 6, 371, 2009.