Review of Dörffel et al., egusphere-2026-2918

GENERAL

This reviewer has some fundamental problems with the approach adopted here. Many of the flaws are common to virtually all attempts at modelling and diagnosing tropical cyclones. The arbitrary selection of scales (scale analysis) fails in the face of scaling and scale invariance. The treatment of the kinetic energy as a small fraction of the internal and gravitational energies needs to be recognised and made explicit. The role of radiative transfer is inadequately represented. The identification of spectral wavenumbers with physical waves is incorrect in the absence of driving and restoring forces for each.

I sympathise with the difficulty of the subject, and the amount of work involved. If this paper is to be published, it needs to make major revisions that at least recognise the existence of the shortcomings listed.

COMMENTARY

Line 16: Define RI and RW. Guessing Rapid Intensification and Rapid Weakening; more importantly what is "rapid"?

Lines 19-29: Lagrangian trajectories calculated from a model analysis or assimilation are really Lagrangian sampling of an Eulerian field. Note that the energy of the wind field is a small fraction of the internal energy and the gravitational energy [1,2].

Lines 30-54: The inherent symmetry of air is that of continuous translation. That symmetry is broken on all scales from the smallest (the mean free path) to the largest (a great circle) in the atmosphere by the persistence of molecular velocity after collision [3]. There is unbroken scale invariance over the whole range [4]. It follows that the selection of particular scales is incorrect [5]. The identification of Fourier wavenumbers with physical waves without specified forcing and restoring forces has been questioned [6].

Lines 55-83: This discussion does not acknowledge the scale invariant reality and the associated nonconvergence of variance. The selection of particular scales is therefore arbitrary. This view impacts lines 99-103. It has implications for the whole methodology as well, in particular the identification of Fourier wavenumbers with actual waves without specification of the driving and restoring forces for the latter.

Line 209: Atmospheric radiation should be represented by something better than the Rotunno and Emanuel parametrization. See [7].

Lines 243-247: Hardly surprising given that reanalyses make scale assumptions too. They have systematic shortcomings regarding their energy content [8].

Lines 378-383: This reviewer regards the DRI as based on faulty assumptions, per previous comments.

Lines 398-404: What drives the deep convection? The Gibbs free energy of water evaporation from the surface. There are longitudinal gradients of winds, temperature and pressure: angular momentum is not conserved in those circumstances.

Lines 416-423: Any "more sophisticated framework" needs to recognise scale invariance and the energy shortfall in reanalyses and climate models. Selecting scales is arbitrary and leads to error. Both radiative and thermodynamic approaches are inadequate.

REFERENCES

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[4] Lovejoy S. 2023. Scaling, dynamical regions and stratification: How long does weather last? How big is a cloud? *Nonlinear Process. Geophys.* **30:** 311-374.

[5] Lovejoy S, Tuck AF, Schertzer D, Hovde SJ. 2009. Reinterpreting aircraft measurements in anisotropic scaling turbulence. *Atmos. Chem. Phys.* **9:** 5007–5025.

[6] Tuck, A.F. The generation of wind velocity via scale invariant Gibbs free energy: Turbulence drives the general circulation. *Entropy* **27:** 740.

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[8] Tuck, A.F. 2025. Why the real atmosphere has more energy than climate models: Implications for ground-based telescopes. *Atmosphere* **16:** 56.