Nonlin. Processes Geophys. Discuss.,
https://doi.org/10.5194/npg-2020-43-RC2, 2020

Nonlinear Processes in Geophysics
Discussions

Interactive comment on "The Effect of Quadric Shear Zonal Flows and Beta on the Downstream Development of Unstable Baroclinic Waves" *by* Yu Ying Yang et al.

Anonymous Referee #2

Received and published: 3 December 2020

The authors study the instability and weakly nonlinear development of a zonal jet having a specific meridional shape. Using the methodology of Pedlosky (2019), they try to generalize his results by including the effects of beta and shear of the background flow on the nonlinear flow behavior. Although weakly nonlinear theory is quite limited in describing the nonlinear development of baroclinic instabilities, such studies can still be useful to discover new physics or dynamics.

However, I suggest to reject the current manuscript because of the following reasons.

1. The manuscript is very immature, in particular in the presentation of the results in section 3 (and figures 1 and 2). It contains also too many typos and errors in language

and formulation.

2. In the context of available recent work (Pedlosky, 2019 and Zhang et al., Tellus A, 72, 1843330, (2020), why is this one not cited?) the result that the weakly nonlinear flow development is influenced by beta and the zonal shear flow (top of section 4), without any more analyses on the physics involved or new dynamics, does not warrant publication.

Some other issues to consider when the authors continue this work:

1. Is the terminology of 'quadric shear' correct? A quadric is an algebraic surface of degree 2. Here the horizontal shear (I think this what the authors have in mind), is linear in y (as U(y) is quadratic in y).

2. When the basic state (2.2) is substituted into the perturbation equations, indeed equations (2.3) result, but these have non-constant coefficients, because they contain terms U_B and U_T which depend on y. Pedlosky (2019) uses constant U_T and U_B in his analysis. The eigenvalue problem for determining the neutral curve in general has to be solved numerically (see e.g. Van der Vaart, Physics of Fluids, 9, 615 (1997)), as traveling wave solutions with exp(ily) do not exist. Even when considering velocity profiles of the form U(1 - a yˆ2), with small a, one has to justify that neglecting the a yˆ2 term does not affect the neutral curve.

Interactive comment on Nonlin. Processes Geophys. Discuss., https://doi.org/10.5194/npg-2020-43, 2020.