Comment on wcd-2021-21
Anonymous Referee #2

Referee comment on "Observed wavenumber-frequency spectrum of global, normal mode function decomposed, fields: a possible evidence for nonlinear effects on the wave dynamics" by André Seiji Wakate Teruya et al., Weather Clim. Dynam. Discuss., https://doi.org/10.5194/wcd-2021-21-RC2, 2021

This is a good contribution that uses two methods of analyzing propagating signals in the atmosphere, Hough normal mode decomposition and Wheeler-Kiladis (W-K) diagnostics. The analyses uncover some surprising results such as propagation of some linear normal modes in the opposite sense of their linear modal propagation and strong suggestions of slaving and nonlinear wave breaking. These results are independent of my request for a major revision which is related to the comparative utility of the W-K analyses. I question why the authors have used different normalizations in each of the W-K diagrams shown in manuscript. This choice of normalizing each energy with the background red noise spectrum for each individual modally filtered projection determines that the W-K diagram for the Kelvin wave with all vertical modes included is NOT the superposition of the Kelvin wave W-K diagrams of the barotropic and baroclinic parts. It also hides the true energy amplitude of every W-K diagram. I believe this study would be much improved if either a uniform normalization was used for all the W-K analyses or, at least, a uniform background normalization for each mode type (Rot, EIG, WG, MRG, K).

Very minor editorial suggestions:

Line 10 replace 'on the' with 'in'

Line 22 replace 'among others, each of these topics with crucial' with 'among others. With each of these topics there are associated crucial'

Line 143 The vertical resolution of the ERAI data should also be noted
Line 215: m=1-5 should planetary-scale not synoptic-scale

Line 227 states 'From Fig. 4 one observes that the spectrum is dominated by disturbances with large spatial scales (k = 1−5) and a barotropic structure in the troposphere m = 1−5, which agrees with the spatial structure displayed in Figure 2 that exhibits most part of total energy concentrated in the subtropical jets.' but Figure 2 shows that the subtropical jets are mostly baroclinic in structure. Which is it?