

Interactive comment on “African Easterly Waves in an Idealized General Circulation Model: Instability and Wavepacket Diagnostics” by Joshua White and Anantha Aiyyer

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We thank the reviewer for their time and effort.

The reviewer makes an important point regarding our interpretation of Fig. 1. Since it is derived from global reanalysis – our proxy for observations – it is important to acknowledge that the signature seen in the figure is not guaranteed to be a pure AEW packet that is evolving independently of external influences. Indeed, as the reviewer points out, the modulation of AEWs by the Madden-Julian Oscillation, convectively coupled Kelvin waves, and breaking extratropical waves can give the appearance

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of a dispersing wavepacket if there is a preferential amplification of one part of the packet compared to the other. As recommended, we have now added a paragraph that explicitly states the caveat in our interpretation in section 2.1.

Furthermore, our numerical simulations produce AEW packets that decay or grow monotonically. Per the construct of our experiments, there is no possibility of the modulation of their growth by external sources listed above. It is important to document the impact of interactions with externally imposed sources of wave forcing on the group dynamics of AEWs. This is an area of further investigation that will be reported separately. We have now added text that explicitly states the caveat in our interpretation in section 5.

1 Specific Edits made

1. The following text has been included in Section 2.1 of the revised paper:

An important caveat should be recognized in relation to Fig. 1. We have interpreted it as a pure AEW packet. In nature, however, a variety of tropical and extratropical systems ranging from synoptic (e.g., equatorial waves, breaking extratropical waves) to intraseasonal (the Madden-Julian Oscillation) can modulate the amplitude of AEWs (e.g. Matthews, 2004; Leroux and Hall, 2009; Ventrice et al., 2011; Alaka and Maloney, 2012, 2014). This modulation could, in principle, present itself like the dispersion of a linear wavepacket if it leads to preferential amplification of one side of the packet. In a related issue, Aiyyer et al. (2012) showed that cloud signatures associated with tropical cyclones can artificially project onto a wide range of eastward and westward propagating equatorial

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modes as a result of the filtering in the wavenumber-frequency domain. The use of idealized numerical models, where the primary response in the model is the AEW stormtrack, mitigates some of this concern and provides an independent assessment of the relevance of group dynamics for observed AEW packets.

2. The following text has been included in Section 5 (Discussion) of the revised paper:

In addition, our simulations do not include the modulation of AEWs by external phenomena such as the Madden Julian Oscillation, convectively coupled Kelvin waves, or breaking extratropical baroclinic waves that are commonplace in nature. The impact of these externally imposed source of wave forcing on the group dynamics of AEWs also needs to be examined in future studies.

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