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# *Interactive comment on* "Effects of horizontal resolution and air-sea coupling on simulated moisture sources for regional East Asian precipitation" *by* Liang Guo et al.

**Anonymous Referee #2**

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The paper deals with the sensitivity of climate models to grid resolution and atmosphere/ocean coupling in simulating moisture transported from ocean/land moisture sources ending up as precipitation over East Asia. The study is innovative and the subject itself is of great interest, especially for the climate modelling community. The manuscript is well introduced, well organised and well written. Their analysis of biases is well founded and findings are robust. However I have some concerns about the discussion section and the use of reanalysis and observational data which need to be addressed prior to publication (see major comments below).

Major points



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Discussion paper

- It is not clear what is the exact period used to calculate the climatological annual mean precipitation for MetUM simulations, ERA-interim and Aphrodite datasets. Is this the common matching period 1982-2007 (if MetUM AN & CN512 is included the common period would be limited to 1992-2007), or different periods i.e. 1979-2007 for Aphrodite, 1982-2012 for MetUM AN/CN 96/216, etc. If significant trends are present in these timeseries (which is the case over several regions of East Asia in the Aphrodite timeseries) the choice of period may have significant impacts on the calculated climatological annual mean patterns. Ideally a common matching period for all datasets should be used, or, at least the associated inconsistencies when comparing annual mean precipitation patterns of products of different periods should be discussed in the text (i.e. in addition to inconsistencies related to AN/CN 512 shorter period simulations already discussed in the text).

- Along with Aphrodite, I could use an additional observationally-based dataset for land EA precipitation such as the CPC Unified Gauge-Based Analysis of Global Daily Precipitation (at 0.5 deg. resolution, available from 1979-present) which, in contrast with Aphrodite, is fully matching ERA-I and MetUM simulation periods, to estimate precipitation biases w.r.t. ERA-I and MetUM. Although these datasets are based more or less on the same gauge data stations, different interpolation methods to fill the gaps and different periods can have significant impacts on calculating the climatological mean pattern of precipitation.

- Discussion section 5.1 is too short. Although the paper is focusing on the impact of model grid resolution and air-sea coupling on biases in moisture transport from ocean/land moisture sources ending up as precipitation over East Asia more text could be included in the discussion section about representation of physical processes involved in moisture transport in East Asia in the reanalysis and MetUM simulations. You could briefly compare your findings with previous moisture source/transport diagnostic studies in East/Southeast Asia using Langragian models and reanalysis data (e.g. Sun and Wang, 2015; Baker et al. 2015; Chu et al. 2017).

- Although ERA-Interim shows indeed a good skill in simulating mean and inter-annual variations in land precipitation over East Asia this is not always the case for water cycling over the ocean. For example, P-E interannual variability in the tropical Indian Ocean is not well represented in ERA-Interim as compared to observationally-based products (see Skliris et al. 2014). This may affect the simulation of moisture transport from Indian Ocean moisture sources for SE Asia precipitation in ERA-Interim. In general there are large discrepancies between the different reanalyses in representing E & P variations over the ocean (see Schanze et al. 2010). A more critical discussion is needed in the text concerning the use of a single reanalysis product as a benchmark to compare moisture sources traced from climate model simulations.

- I would suggest to additionally use the ERA5 dataset (which replaced ERA-Interim a year ago) in your analysis which has much higher horizontal resolution ($\sim$30km) and with considerable improvements w.r.t. ERA-interim including better global balance of precipitation and evaporation and better precipitation over land, especially in the tropical regions. In addition, this way you may also investigate the impact of higher model resolution on the reanalysis biases and compare changes due to increasing resolution in products with similar resolution in ECMWF and MetUM products (i.e. ERA-Interim/AN216 vs. ERA5/AN512). Although I recognise that this requires a considerable extra effort and while the paper is publishable in its current form, I think it could strengthen your analysis and further improve the robustness of your findings.

Minor points - You should provide the ERA-Interim space grid resolution in section 2.1

- I would suggest to use MetUM AN216 (rather than AN96) to compare with ERA-Interim in figures 2 & 4 as these two datasets have similar horizontal grid resolution

- Table 1: Please indicate units for horizontal grid resolution (degrees) and vertical resolution (levels)

Typing errors Line 274: " . . . the eastern Tibetan Plateau, where the sruface is wetter . . ." Change into "surface"

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