Editor Comment

Dear Anja and Anders,

Sorry for the long time it took me to make a decision about your paper. I went personally through your manuscript and read the replies to reviewers. I am mostly satisfy and ready to publish it. I have only one remark that I think you should address in your paper.
EASM is a different kind of monsoon than tropical ones that are linked to ITCZ dynamics. According to "Zhisheng, A., Guoxiong, W., Jianping, L., Youbin, S., Yimin, L., Weijian, Z., ... & Juan, F. (2015). Global monsoon dynamics and climate change. Annual review of earth and planetary sciences, 43, 29-77" EASM is a part of subtropical monsoons, which dynamics is more related to interactions between large-scale topography, the Rossby radius of deformation and the jet stream (Molnar et al. 2010). How this would fit with your conclusions, namely "The rainfall increase in South-East china is due to a northward shift of the southwest winds associated with a northward shift of the ITCZ that strengthens the water supply towards this region"? Additionally, simply pointing to Xue et al., 2023 regarding thermodynamics vs dynamics at lines 241-242 is not enough in my view: you have still space in conclusions to expand a bit on mechanisms.

Small typo at ln 23: May with capital M.

All the best,
Roberta D'Agostino

Answer to Editor

Dear Dr. Roberta D'Agostino,

We thank you for personally going to all reviewer comments and our response and are very delighted to hear that you are almost satisfied with the revised manuscript. We also very much appreciate the remaining remark about the dynamics and reviewed further literature as well as discussed this aspect in detail. As a result, we came to the conclusion that the additional moisture supply associated with the ITCZ northward shift as proposed in the earlier version of our manuscript is a minor dynamic effect that is not sufficient to explain the projected EASM rainfall increase. Rather, the lack of circulation changes in the study region itself underlines a minor role of the dynamic component and points to the dominating role of the thermodynamic component instead. This is also in line with the findings of existing studies (e.g. Li et al. 2015; Lee et al. 2017; Li et al. 2021). We adapted the manuscript accordingly. We also expanded the discussion about the components as requested and corrected minor typos. You can find the updated conclusion on the next page or in the revised manuscript. Thanks to the Editor's valuable comments, we now believe to submit a significantly improved version of the manuscript and are looking forward to hearing from the editor.

All the best,
Anja

“The multi-model mean of the wind pattern reveals relatively minor changes in the circulation in the region. This indicates that there are only small changes in the dynamic component within East Asia pointing to the dominant contribution from the thermodynamic component. Indeed, this is in line with the CMIP6 study of Li et al. (2021) who quantified the role of the different components contributing to the EASM increase throughout the 21st century. In East China (Japan and Korea Region) long-term, they quantify the change in moisture advection to be +9.6% (+9.2%), evaporation +19.9 % (+16.1%) and moisture convergence +70.6% (+74.4%). Additionally, they split the moisture convergence term into a term that relates to circulation changes (dynamic changes), one that refers to moisture content changes (thermodynamic changes) and a residual term that can be assumed to be small. In East China (Japan and Korea Region) long-term, the thermodynamic term clearly dominates with +98.1% (+153.0%) over the dynamic term of +3.0% (-34.9%). The authors find that the dynamic term might even be cancelled out due to the large intermodel spread (Li et al., 2021). This intermodel spread might also at least partly explain that the dynamic component has been found to contribute positively as well as negatively to the budget (Wang et al., 2014; Li et al., 2015; Lee et al., 2017; Li et al., 2021). However, most studies coincide with the dominant thermodynamic role in the region (Li et al., 2015; Lee et al., 2017; Li et al., 2021). But there is also one study that finds that the dynamic component might be dominating in the region with 67% over the 33% of the thermodynamic component (Xue et al., 2023). However, as pointed out by the authors of this study, the projections are based on a single model (CESM2) that in our study was also not among the best performing regarding the EASM characteristics.

The relevance of evaporation and moisture convergence has already been reported in the context of CMIP5 (Seo et al., 2013; Qu et al., 2014). Seo et al. (2013) found that these changes are induced by the (north) westward shift of the North Pacific subtropical high. Along the northern and northwestern flank of the strengthened high, intensified southerly or southwesterly winds lead to an increase in moisture convergence, intensifying precipitation particularly over the Baiu region to the east of Japan and the continental region to the north of the Korean Peninsula. Qu et al. (2014) also add the increased vertical transport of moisture in the EASM region and the capacity of warmer air to hold more moisture following Clausius-Clapeyron as relevant contributing factors. In other studies, the role of the strengthening of the land-sea thermal contrast under global warming is discussed (Endo et al., 2018).”