

General assessment

The manuscript uses a coupled GR2M–lake water-balance model to reconstruct 1985–2024 lake-area variability of the Afambo–Gemer–Abhe system. It then relates the lake's multi-decadal expansion to large-scale circulation trends. The lake record is a valuable integrator of basin hydrology in a data-scarce region, and the topic is relevant to WCD readers. However, the paper currently tries to do too much. It combines a hydrological model development and evaluation, a basin water-budget analysis, a teleconnection analysis and a four-jet circulation attribution. None of these is developed far enough to support the strong causal language of the abstract and conclusions. I agree with Referee 1 on the model-related concerns and on the need to separate results from interpretation. My comments focus on the atmospheric analysis, the scope, and the link to climate simulations.

Recommendation: Major revision. The lake reconstruction is of interest, but the atmospheric attribution needs to be narrowed, better tested, and tied to the processes (AEWs, MCSs) and to the climate model evidence that would make it informative for prediction.

Major comments

1. Missing synoptic and mesoscale drivers (AEWs and MCSs). The Ethiopian highlands and surrounding region are where African Easterly Waves and mesoscale convective systems preferentially form, and the region lies at the eastern end of the AEJ. In [Núñez Ocasio et al. \(2021\)](#), is shown that this region is the origin of most AEWs that develop into Atlantic tropical cyclones. This is directly relevant here, because most Awash JJAS runoff is generated by organized convection rather than by the seasonal-mean flow. Yet the manuscript never examines AEW activity (for example 2–6 day filtered variance or wave tracks) or MCS frequency, intensity and duration. It also does not ask whether changes in either contribute to the JAS rainfall trend. The authors themselves note that GR2M's monthly step cannot capture the flash-flood-driven expansions of 2020 and 2024 (L262–266), which points to precisely this synoptic/mesoscale gap. I would ask the authors to:

- analyse trends and interannual variability in AEW activity and MCS occurrence over the Awash and the Ethiopian highlands;
- relate them to the rainfall and lake-area record;
- discuss how the mean-state changes in the AEJ and TEJ (Figs. 10, 13) modulate wave and MCS genesis.

Without this, the "mechanism" remains a mean-flow argument, and the stated drivers are not shown to act on rainfall at the scale where it is generated.

2. The attribution is stronger than the evidence.

- Correlation versus causation. The evidence consists of trends in ERA5 fields (Figs. 8–12) and correlations with indices (Figs. 6–7). The text and abstract use "driven by", "attribute" and "reflects". No analysis shows that the Somali Jet, TEJ, ITCZ or AEJ changes cause the Awash rainfall changes. No lagged or composite analysis, regression or moisture-budget decomposition is presented, and the basin moisture convergence (Fig. 4d) is described as only weakly related to lake area (L277).
- Weak teleconnection statistics. In Fig. 7 the PDO–lake correlation is not significant ($r = -0.23$, $p = 0.15$), and the Niño 4 correlation is modest ($r = -0.34$). The abstract nevertheless lists ENSO, PDO and SIOD as drivers of the variability. The indices and months were also selected for highest correlation (Fig. 7 caption), which inflates significance.

- Unsupported jet and ITCZ links. The AEJ and ITCZ analyses are Sahel-centered and are connected to the Awash only speculatively (L471–473). The Somali Jet is argued to intensify (Fig. 10b), but the authors themselves cite studies reporting weakening, which they attribute to "methodological differences" (L420–424). This reads as unresolved rather than as support. ERA5 trend reliability (which is known to be questionable for jets, humidity and winds over Africa) needs discussion. See this recent paper of ERA5 biases over Ethiopia for example: [Christensen et al 2026](#).
- Natural variability versus forced change. The paper does not separate the two. It invokes anthropogenic warming at several points, but a 40-year window in a region with strong decadal variability (PDO, AMV, Indian monsoon multidecadal variability, all raised in the text) cannot support this without further evidence.
- Possible tension in the circulation story. Reduced ascent between 5–15°N and a northward ITCZ shift (L373–375) sit uneasily with increased JAS rainfall over the Awash (~8–12°N). This needs to be reconciled explicitly.

3. The paper lacks focus and is too extensive. The manuscript combines model development, a basin water budget, PET seasonality, SST teleconnections, the Walker and Hadley cells, three jets and a Sahel analysis. The central message is diluted, and some sections (3.3.4, 3.4.3) read as reviews of Sahel dynamics rather than analyses of the Awash. I recommend a single narrative: a validated lake reconstruction, the JAS rainfall and PET-seasonality shift, and one or two tested circulation mechanisms, with the remaining analyses (Figs. 8–14) condensed or moved to the Supplement. The title should also reflect that the study covers the Awash Basin, not the whole Horn of Africa.

4. Connection to climate simulations and to prediction over East Africa. The only link to climate models is a closing remark that the framework could be driven by CMIP6 and PMIP4 output. This is a missed opportunity, because the central claims are about circulation trends (a northward shift of the ITCZ and AEJ, and strengthened jets), and these are exactly what climate simulations can test. I would ask the authors to:

- Evaluate whether CMIP6 historical and projection runs reproduce the JAS rainfall trends and the Somali Jet, TEJ and AEJ changes identified here. This should include a discussion of the well-known East African rainfall "paradox", given the MAM drying and OND wetting cited in the Introduction.
- Discuss the findings of convection-permitting (3 km) future-climate experiments, which are particularly relevant because the manuscript's rainfall, flash-flood and lake-expansion signals are driven by organized convection that coarse models parameterize. [Núñez Ocasio and Dougherty \(2024\)](#) and [Núñez Ocasio et al. \(2026\)](#) find, in 3-km convection-permitting simulations of future climate scenarios, a shift of convective rainfall and precipitation maxima toward the equator, consistent with an expansion of convection. These authors also find a northward shift of the AEJ and monsoon and strengthening of both. This is a notable point of comparison, because the present manuscript infers a northward displacement of the ITCZ and AEJ from 1979–2024 trends.
- State clearly what their results imply for prediction of Ethiopian rainfall and for the future trajectory of the lake system, rather than leaving it to the final paragraph.