



EGUsphere, referee comment RC3  
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## **Comment on egusphere-2022-449**

Anonymous Referee #3

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Referee comment on "Seasonal forecasting skill for the High Mountain Asia region in the Goddard Earth Observing System" by Elias C. Massoud et al., EGU sphere,  
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This paper examines the seasonal prediction skill of the NASA's Goddard Earth Observing System (GEOS) S2S prediction system over High Mountain Asia for a series of hydrological variables. A set of observational data and the MERRA-2 and ERA-5 re-analyses are used as benchmarks.

Monthly means of reforecasts over the period 1981 to 2016 are analysed.

The paper provides a clear and well written description of the system and presents a clear analysis the forecasts of these hydrological variables. It provides a solid detailed reference to further assess more specific aspects of the performance of the GEOS S2S prediction system over HMA. The Figures are clear but, while many detailed descriptions are provided, I find the paper a little thin on new science and on understanding potential sources of predictability. At the very least, some more discussion points should be included.

### MAIN COMMENTS

1) The skills over this large, heterogenous region are small, especially when measured against independent data. I wonder if such small skills are relevant at all. The prediction system may have higher skill in some variables, in more limited domains or at certain times of year.

Low skill is not unexpected given the large area, the varied topography (from lowlands to high mountains) and land cover, and the different regional climates of this large region. For example, only a small Southeastern part of the Tibetan Plateau (and hence, only parts of the HMA) is influenced by the Indian summer monsoon (ISM).

It is well-known that the skills depend on the verification data, and they would be higher, in most cases, when verified MERRA-2 given the parent model. It would be of interest to verify some variables against several datasets, or better, against merged datasets that take into account uncertainties in the various observations. I realise that such merged dataset might not exist over this region, but the point could be mentioned in the Discussion.

2) Concerning actual societal needs, the reliability of such forecasts is a question of utmost importance that needs to be addressed in a probabilistic context. Is it possible to quantify the reliability of the forecasts with the current system using standard metrics? At least, the outlook could be mentioned in the Discussion.

3) I wonder about the relationship between surface temperature and the snowpack. Is there a strong coupling between the two in the forecasts during some months? This could provide a source of skill.

4) Improved prediction of the circulation could lead to improved skill. The authors mention the importance of the ISM. I believe that wintertime precipitation over the northern part of HMA is brought by the so-called westerly disturbances. The authors could mention in the Discussion, whether the dynamics and the associated with precipitation is well represented in the forecast.

5) There has been a significant effort in recent years to assess the impact of land initialisation (esp. snow, soil moisture) in S2S and seasonal forecasts and some studies are relevant for the HMA region yet there is little mention of that relevant literature.

Koster, R. D., Mahanama, S. P. P., Yamada, T. J., Balsamo, G., Berg, A. A., Boisserie, M., et al. (2011). GLACE2: The second phase of the global land atmosphere coupling experiment: Soil moisture contribution to subseasonal forecast skill. *Journal of Hydrometeorology*, 12(5), 805–822.

Senan, R., Orsolini, Y.J., Weisheimer, A. et al. Impact of springtime Himalayan–Tibetan Plateau snowpack on the onset of the Indian summer monsoon in coupled seasonal forecasts. *Clim Dyn* 47, 2709–2725 (2016). <https://doi.org/10.1007/s00382-016-2993-y>

MINOR COMMENTS

- The words Seasonal forecasts and S2S forecasts seem to be used loosely throughout the paper. The seasonal forecasts are 9-month long but only the first 3 months are analysed. Some operational centers have different set-ups for Seasonal and S2S prediction systems. The authors could double check that S2S is used as it is meant.
- It was not clear to me whether total precipitation is liquid precipitation or if it contains also solid precipitation.
- The information on ensemble size should be presented more clearly (Abstract, or Table)

## Wording

L58: the foothills of the Himalayas perhaps better than the foot of the Himalayas (?)

L560: precipitation is used twice in same sentence.