Response to Reviewer 2

Comment	**Answer, changes**
The methods of this study are similar to past studies that have used ECMWF or other seasonal climate forecast systems to drive a hydrologic model and generate and evaluate skill of hydrologic forecasts. The main difference is that the authors claim that the Global BROOK90 framework may be computationally inexpensive and relies on open-access input datasets, presumably making it applicable anywhere in the world.	Agreed, we do not state that our study is the first in ECMWF forecast applications. As the reviewer correctly pointed out (and mentioned in the introduction and GBR90 description), the framework is computationally inexpensive, meaning that the user gets results in a couple of hours and in contrast to global or regional models. The framework can be run on a normal PC (considering its 'local scale' application). No high performance computer is needed to run the framework. Furthermore, as the land cover, soil and other datasets used to parameterize the model are covering almost the entire terrestrial earth, it is indeed applicable with few exceptions all over the globe, which was one of the main aims of the concept and was proven in (Vorobevskii et al 2021) for a variety of different geographical conditions. However, one more important feature, which the reviewer did not mention, is that GBR90 runs in automatic mode, providing a 'boxed' and 'A-to-Z' solution, which serves in a second version as not only a reanalysis, but already as forecast tool. No specialist is needed to run the framework. Besides, the framework is following a "data smart"-approach, by not producing Terabytes of global data garbage for regions which will never be analyzed. Which is by the way an economic and climate friendly approach. Moreover, the framework and its data is open source. To our knowledge, such a combination of a abovementioned features in a hydrological framework is unique at a current state (Vorobevskii et al 2020).
Other than that, the results of this study lack robustness and novelty as it is focused on a small number of catchments in Europe and over a short period of analysis. It is well established that the skill of soil moisture forecasts is higher over the first 1-3 months (often partly due to the skill coming from the initial hydrologic state) and decreases as the lead time increases. Therefore, the results of this study do not add any novelty beyond what is already well known.	Partly agreed. We see the novelties of the study as follows: 1) We attempted to hindcast one of the severest large-scaled European soil drought of 2018 on a small-catchment scale for different geographical conditions. 2) We presented a workable global tool to apply large-scaled meteorological forecasts to a local scale, getting spatially high-resolution soil moisture predictions using a physically-based model and open-source datasets. 3) We confirmed that as for a large and medium scale, forecasts of soil moisture on a local scale have a skill of around 1-3 months, which is valid for drought conditions as well. 4) We found that ensemble mean from simulations using ECMWF forcing results in higher soil moisture content in comparison to ERA5 reanalysis. Even considering a probabilistic forecast using all ensembles does not cover that difference. We elaborated the conclusion and introduction to emphasize the abovementioned statements.
If the study had focused on a longer period of analysis, evaluated multiple basins across the globe (which would have helped highlight the value of this framework for global applications), and evaluated the skill relative to relevant benchmarks, the study could have been more appropriate for publication. A suitable benchmark in this case, given the focus on local soil moisture forecasts, could have been	Partly agreed. The choice of 2017-2020 period was conditioned by the extent of the observed drought event in 2018-2019 plus two 'normal' years to see the difference in forecasting skills for two hydrological conditions. According to documentation on ECMWF (https://confluence.ecmwf.int/display/CKB/Seasonal+forecasts+and+the+Copernicus+Climate+Change+Service), the used version of the forecast system (SEAS5) was operationally launched in 2017. The hindcast data is advised to be used for bias correction only as the ensemble number is reduced in comparison to the operational dataset. Thus, possible extension of the modeling time-period to earlier dates will lead to mixing of system versions (e.g. 4th and 5th)

statistically interpolated soil moisture forecasts from global models.	or hindcast-forecast data. This could lead to another source of uncertainty, which may significantly influence the results and thus is not in the scope of the study. Within the last years the European drought of 2018 was one of the most drastic with regard to extension, water shortages and impacts in the world. We intentionally wanted to focus the paper on predicting soil moisture in severe conditions by taking this study case. Since exactly these conditions are typically hard to forecast. The pilot catchments were chosen in such a way that they are distributed over Europe, possibly cover different geographical conditions and showed good discharge validation skill-score (Vorobevskii et al 2021). Thus potentially giving reliable estimations of soil moisture with regard to site-specific parameterization. However, to avoid possible confusion, we suggest adding a 'case study' part to the title ('Seasonal forecasting of local-scale soil moisture droughts with Global BROOK90: A case study of the European drought of 2018.'). We would argue that other global datasets besides ERA5 (or its derivatives) could serve as an appropriate benchmark. Pure comparison of two forecast datasets will not lead to meaningful conclusions regarding quality of one or another, from our point of view, thus an observation dataset should serve as a benchmark for a prediction. Since there is a lack of reliable soil moisture measuremnts on a global scale, it is reasonable to use existing quasi-observations - composite as i.e. satellite-model assimilation products for a benchmark. SMAP and the last generation of ERA5 are exactly that kind of products, commonly accepted as state-of-the-art for soil moisture reanalysis. The SMAP dataset assimilates satellite L-band brightness into GLDAS Catchment Land Surface Model. ERA5 uses a combination of the Integrated Forecasting System. One of each is the soil hydrology scheme of the Tiled ECMWF Scheme for Surface Exchanges over Land. Besides surface temperature, relative humidity observations, and Advanced Scatterometer (ASCAT) data from satellites are assimilated and build the soil moisture reanalysis (Hersbach et al 2020, Cerlini et al 2021). There is also the ERA5-Land dataset, which has higher spatial resolution (around 9 km) and uses ERA5 reanalysis as a land surface model forcing. However, the differences in soil moisture estimates for Europe between parent and derived datasets are minor (Muñoz-Sabater et al 2021). Therefore to use it as a new benchmark dataset is not feasible. Consequently, as GBR90 initially provides soil moisture estimates applying ERA5 forcing, it is reasonable to show the added value of forecasted (with ECMWF forcing) soil moisture using ERA5 reanalysis. Since both products (meteo forecast and reanalysis) come from the same model and assimilation system. We elaborated the methodology section to emphasize the abovementioned statements.
The question remains whether the Global BROOK90 framework adds to soil moisture forecast skill at the local scale beyond what could be attained by simply statistically interpolating soil moisture forecasts from a global soil moisture forecast system.	To our knowledge, there is no existing framework, which provides long-term soil moisture and other water balance components like interception, transpiration or discharge forecasts for a local scale. Based on the framework's results local actions like harvesting, forest seeding or irrigation can be planned accordingly since the simulations provide details about the catchment hydrotops for a resolution of 100 m.

	It is unclear to us how to bridge global-local or even regional-local physical scale gaps using only statistical interpolation. Even in the presence of existing operational models with open-source data policy (which is quite a short list), this interpolation and its justification is quite challenging itself (Blyth et al 2004) and seems to be unrealistic for a given scale difference. For example, the state-of-the-art European Flood Awareness System (EFAS) forecasts produced with the LISTFLOOD model and based on ECMWF forcing (Thielen et al 2009) have only data available from 2020. In this case, soil moisture data is available for 3 standard soil layers on a 5 km grid and for 24 h time step (Arnal et al 2019). At the same time GBR90 using the same meteorological forcing provides data for variable (non-fixed)-layered horizons on a 100 m scale in daily resolution. It acts actually as a physically based downscaling model by physically bridging the gap between coarse meteorological input to high-resolved land and soil characteristics of a single site or a small catchment. Thus, the framework offers more detailed and site-specific information on soil moisture than the 5 to 100 km grids from global forecasts. This scale is not and in the near future probably will not be considered in global models due to multiple reasons (Wood et al 2012, Beven & Cloke 2012, Sood & Smakhtin 2015), and in our opinion cannot not be reached by statistical interpolation. We elaborated the introduction to include important references mentioned above.

References:

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