Dynamic wetland datasets are no doubt essential in monitoring and estimating global methane budget. The efforts made by the authors to combine available wetland datasets including those from remote sensing, ground survey and modelling are com- prehensive and valuable. There are, however, a few concerns related to the rationale of the data fusion and comparison results as follows:

We thank the reviewer for the interest in our study and for the constructive and insightful comments that help us to improve our manuscript. Each comment is addressed below in detail.

(a) A better justification of "fwmax to match the wetland maps for pixels where fwmax is less than the static distribution" in the data fusion is needed. According to Schroeder et al., 2015, SWAMPS retrievals represent "water surface within open areas and under low density vegetation" due to the relatively low penetration ability of the microwave frequency used. Therefore, it is likely that SWAMPS will have overall underestimated water fraction for vegetated areas. In addition, both SWAMPS and the static water datasets have biases, uncertainties and inconsistency in their representative season/periods. Ideally, all these factors should have been carefully accounted for when fusing the datasets, though it might not be practically achievable. The information of relative changes of SWAMPS water area seems more important to me than the absolute values when merging the datasets.

The reason for matching the fw_{max} of SWAMPS with the static inventories is based on the assumption that the area of sparsely vegetated inundation captured by SWAMPS follows the same seasonal cycle as the densely vegetated area within a 0.25 deg grid cell. While it is conceivable that densely vegetated wetlands only get inundated during the wet season, we have no data source allowing this differentiated correction. As a result, our conservative approach preserving the seasonal amplitude of SWAMPS seems most reasonable. Moreover, we agree with the reviewer it would be ideal to improve the fusing approach by considering the biases and uncertainties in each of the mapping products, which require more ground-based monitoring for wetland areal dynamics. We have addressed these issues in the Discussion for future studies.

(b) The use of GSW to identify and mask out inland open water bodies seems over- simple to me. Assuming a lake with seasonal inundation changes, the pixels detected as water for less than 50% of the months were not classified as inland water (section 2.2.2), but they may be part of the lake over the wet season.

We agree with the reviewer that the correction using GSW is simplified, such that WAD2M includes some seasonal lake in its estimate of vegetated wetland inundation. However, given that the current version of WAD2M has already been distributed and used in other studies such as Global Carbon Project Methane (Saunois et al., 2020) and FLUXNET-CH4 upscaling (Delwiche et al., 2021), we feel it is important to document the methodology for the current version of WAD2M. We share the reviewer's concern about adequately excluding open water from this dataset, because the current version may still lead to some double-counting of methane fluxes from wetlands and open water. Hence, we will improve the resolve and remove the monthly GSW areas from WAD2M in the next version, planned for the next Global Methane Budget.

(c) What caused the overestimation of water fraction in dry areas such as central Australia (Fig.2a, 3a)? Did the uncertainty associated with drylands also affect wetland areas?

The overestimation of water fraction in dry areas is due to the limitation of SWAMPS, which is affected by the low surface emissivity due to the cretaceous outcrops of limestone deposits for semi-arid and arid regions. We have added descriptions to address this issue.

(d) Is it possible to examine data quality and accuracy for an area where ground/aircraft- based wetland mapping is available?

We agree with the reviewer that it's ideal to examine the data quality throughout with ground/aircraft-based wetland mapping. However, there are limited number of wetland mapping products and it is difficult to reconcile such vastly different wetland datasets. Thus, we are only able to evaluate the spatial distribution with independent regional datasets for West Siberian Lowland and Amazon and the temporal distribution with different large-scale water proxy datasets.

Minor comments: (a) For Fig. 9: please provide statistics on correlations between WAD2M times series and the others.

We have included the correlation between WAD2M and other sources in Fig. 9.

(b) For Fig. 9: did you miss GRACE time series in the upper-left figure?

Corrected

(c) Line 91-92: please revise the sentence, which is not accurate.

We have revised the sentence to "*L-band (~1 GHz) synthetic aperture radar (SAR) sensors are suitable for large scale wetland mapping because of their ability to penetrate clouds and detect flooding beneath most vegetation canopies (Melack et al., 2004)*".

(d) Line 101-102: please revise to improve clarity.

We have revised the sentence to "*1) higher-spatial resolution optical sensors can only detect open water in the absence of clouds and vegetation while SAR measurements can penetrate cloud and dense canopies but have limited temporal coverage;*"

(e) Line 104: did you mean "inundation under snow"? Any reference to support this?

We have revised the sentence to "*1) higher-spatial resolution optical sensors can only detect open water in the absence of clouds and vegetation while SAR measurements can penetrate cloud and dense canopies but have limited temporal coverage;*"

(f) Line 193-194: "The coastline..." Not sure about the meaning. Please revise or clarify.

We have revised the sentence to "*The coastal region is defined as areas along the coastline within 4 pixels (~1 km) and was then intersected with the ocean-labeled pixels from MOD44WA1 to separate the ocean from inland water.*"