Supplementary of

Assessing global surface water inundation dynamics using combined satellite information from SMAP, AMSR2 and Landsat

1. Comparisons of fw_{LBand} and MOD44W for different latitude zones

Inundation areas derived from SMAP fw_{LBand} and MOD44W data were compared for five latitude zones. The comparisons were based on fw_{LBand} monthly composites from June 2015 to May 2016, and with both SMAP and MOD44W data projected in the same 36-km EASE-Grid v2 format. We excluded grid cells dominated by large water bodies (coverage ≥ 50%) to mitigate coastal contamination (Schroeder et al., 2015); we also excluded grid cells dominated by permanent snow/ice cover, identified by a MODIS IGBP land cover classification. Both monthly maximum SMAP fw_{LBand} and MOD44W results show that the largest inundation areas are spatially distributed in tropical and Northern high latitude regions, while the SMAP results generally detect greater inundation than the MOD44W results (Table S1).

Table S1

Inundation areas estimated by SMAP monthly $\boldsymbol{fw_{LBand}}$ composites and MOD44W over the global domain and five major latitudinal zones, excluding 36-km grid cells with open water or permanent snow/ice coverage ≥ 50%.

Latitude Zone	SMAP water extent (MKM^2)			MOD44W water extent (MKM^2)
	Minimum	Maximum	Average	
90°S-90°N	4.61	7.15	6.16	4.04
50°N-90°N	0.24	2.17	1.25	1.95

30°N-50°N	1.19	2.13	1.57	0.70
30°S-30°N	2.51	3.22	2.83	1.18
30°S-50°S	0.32	0.62	0.45	0.17
50°S-90°S	0.04	0.05	0.05	0.04

2. Comparisons Between SMAP fw_{LBand} and River Discharge Data for Amazon river basin

The Amazon basin (Fig. S1) is one of the most important and largest river basins, where the Amazon river and its tributaries carry water through the world largest tropical rain forest. We analyzed the performance of the SMAP fw_{LBand} retrievals over the Amazon basin by comparing SMAP derived inundation areas against monthly mean discharge measured at Obidos, Brazil located near the mouth of Amazon river. The discharge data were provided by the Observation Service for the Geodynamical, Hydrological and Biogeochemical Control of Erosion/Alteration and Material Transport in the Amazon, Orinoco, and Congo basins (SO HYBAM) (http://www.ore-hybam.org/). Strong correlation (R=0.72) was found between the monthly fw_{LBand} inundation dynamics and observed river discharge data (Fig.2S). The fw_{LBand} correspondence was further enhanced (R= 0.95) after introducing a one-month lag between surface inundation and downstream river discharge to account for the delayed movement of water from the uplands to the basin outlet. The relatively strong correlation occurs despite 67.2% of the basin having VOD levels above the expected threshold for reliable SMAP L-band *fw* retrievals (e.g. Fig. 3). However, the favourable correspondence is consistent with a prior regional study of *fw* dynamics in Amazon rainforests using similar L-band T_b retrievals from SMOS (Parrens et al., 2017).

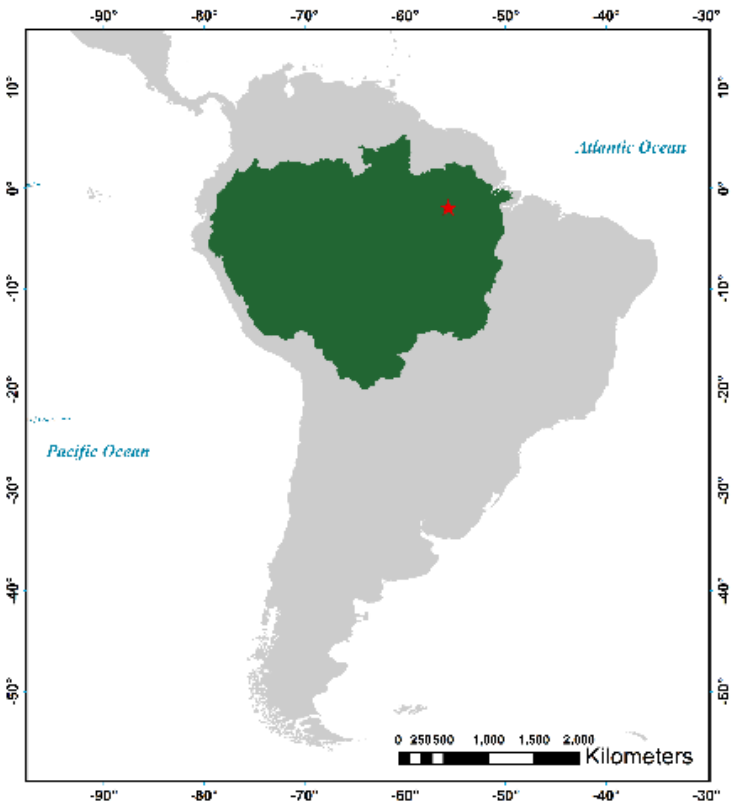

Fig.S1 Location of Amazon river basin, with river discharge station indicated by red star symbol.

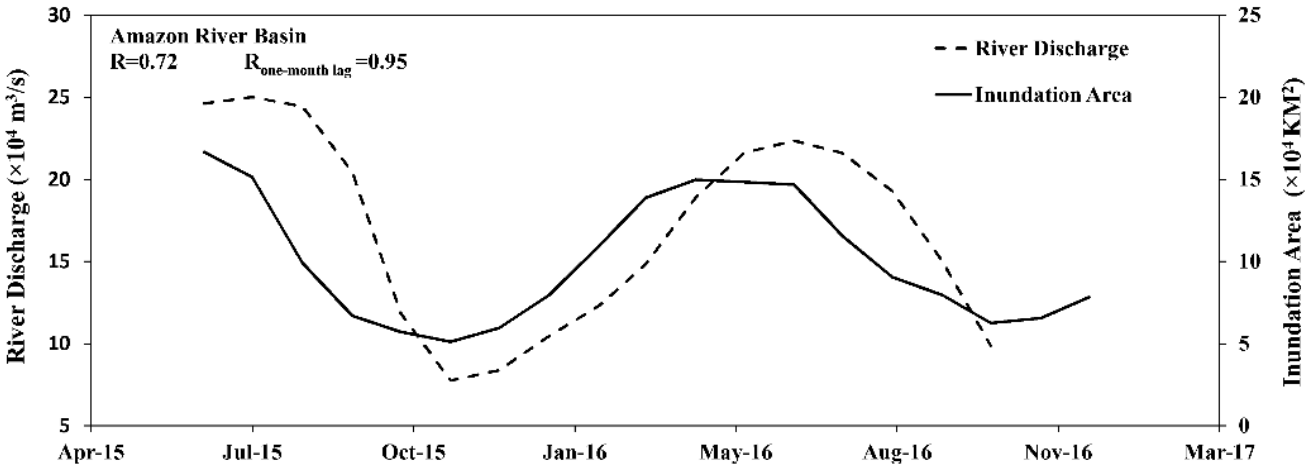

Fig.S2 Monthly mean river discharge (Q, m^3/s) and corresponding inundation areas (km^2) derived from SMAP 36 km fw_{LBand} monthly averages for the Amazon river basin.