



Supplement of

HydroSat: geometric quantities of the global water cycle from geodetic satellites

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Table S1. Satellite altimetry missions from 1985– and their characteristics. The use of satellite altimetry for inland water monitoring has beenfacilitated by the advent of two different developments: 1) Open-Loop Tracking Command (OLTC) (used in missions with gray background,2) Operation in Synthetic Aperture Radar (SAR) mode (implemented in missions with bolded text).

mission	operated by	life time	height [km]	inclination [°]	rev./day ¹	frequency [GHz]
Geosat	NOAA	03.1985-09.1989	785	108.0	244/17	13.5
ERS-1	ESA	07.1991-03.1996	785	98.5	501/35	13.5
TOPEX/Poseidon	CNES, NASA	09.1992-01.2006	1336	66.0	127/10	13.6 & 5.3
ERS-2	ESA	04.1995–09.2011	781	98.5	501/35	13.5
GFO	US-Navy	02.1998-11.2008	784	108.0	244/17	13.5
Jason-1	CNES, NASA	01.2002-06.2013	1336	66.0	127/10	13.6 & 5.3
ENVISAT	ESA	03.2002-04.2012	800	98.5	501/35	13.5 & 3.2
Jason-2	CNES, NASA, NOAA, EUMETSAT	06.2008-ongoing	1336	66.0	127/10	13.6 & 5.3
HY-2A	NSOAS	08.2011-ongoing	971	99.3	193/14	13.58 & 5.25
ICeSat	NASA	01.2003-10.2009	600	94.0	2723/183	Laser: 1064 & 532 nm
CryoSat-2	ESA	04.2010-ongoing	717	92.0	5344/369	13.575
SARAL/AltiKa	ISRO, CNES	02.2013-ongoing	800	98.5	501/35	35.75
Jason-3	CNES, NASA, NOAA, EUMETSAT	01.2016-ongoing	1336	66.0	127/10	13.6 & 5.3
Sentinel-3A	ESA, GMES	02.2016-ongoing	815	98.6	385/27	13.6 & 5.3
Sentinel-3B	ESA, GMES	04.2018-ongoing	815	98.6	385/27	13.6 & 5.3
ICeSat 2	NASA	09.2018-ongoing	480	92.0	1387/91	Laser: 1064 & 532 nm
HY-2B	NSOAS	10.2018-ongoing	971	99.3	193/14	13.58 & 5.25
Sentinel-6 Michael Freilich	EUMETSAT, NASA	11.2020- ongoing	1336	66.0	127/10	13.5
SWOT	NASA,CNES	02.2022-02.2025	890	77.6	292/21	35.75



Figure S1. Flowchart of obtaining SR altimetric water level time series for a single virtual station.



Figure S2. Flowchart of bias correction for obtaining SR and HR altimetric water level time series over lakes.



Figure S3. Flowchart of obtaining HR product over rivers through densification of individual altimetric water level time series along a river



Figure S4. Water level estimates from different satellite altimetry missions along the Weser River in Germany.



Figure S5. Flowchart of the proposed method for generating time series of surface water extent from MODIS images (top pannel). Flowchart of the proposed algorithm for generating time series of surface water extent from Landsat-based GSWD product (bottom panel)



Figure S6. Flowchart of obtaining Total Water Storage Anomaly (TWSA) in HydroSat



Figure S7. Flowchart of obtaining water volume anomaly using surface water area from satellite imagery and water level time series from satellite altimetry



Figure S8. Adopted from ?: Flowchart of discharge estimation algorithm for generating the quantile mapping function



Figure S9. Flowchart of estimation of High-Rate river discharge using a Kalman filter approach