

Supplementary Materials

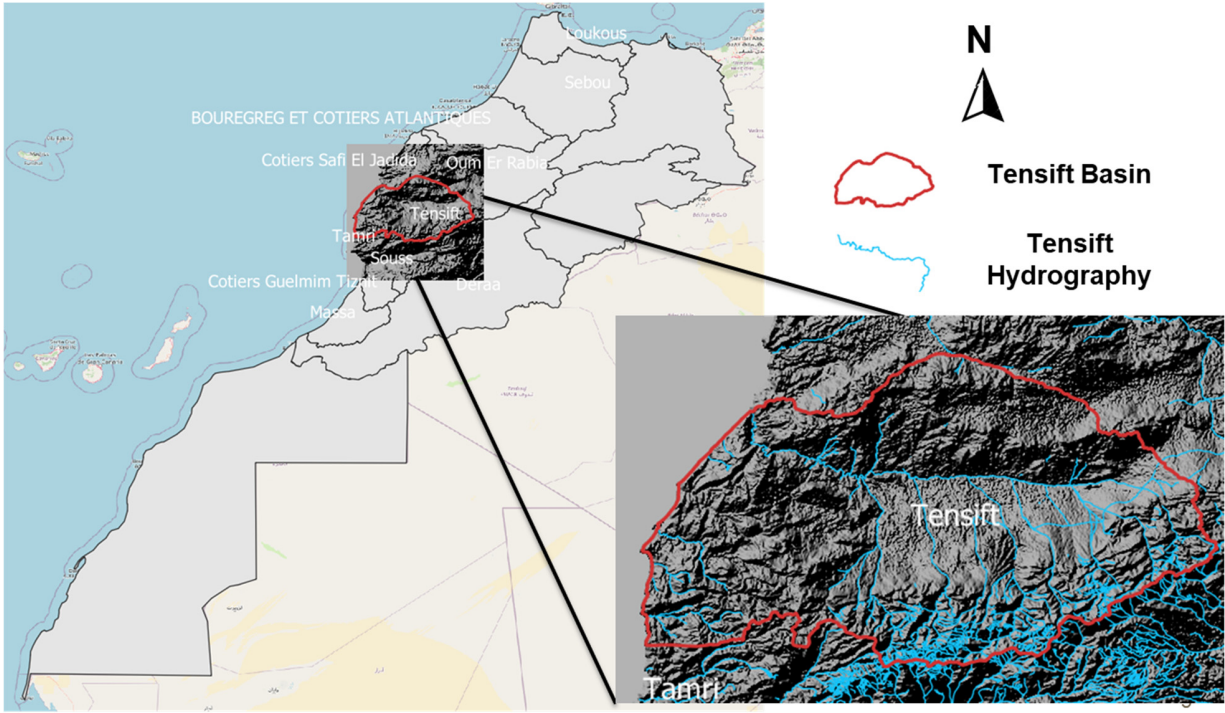


Figure S1: Location of the Tensift Basin of Morocco. Source: Adapted from [36].

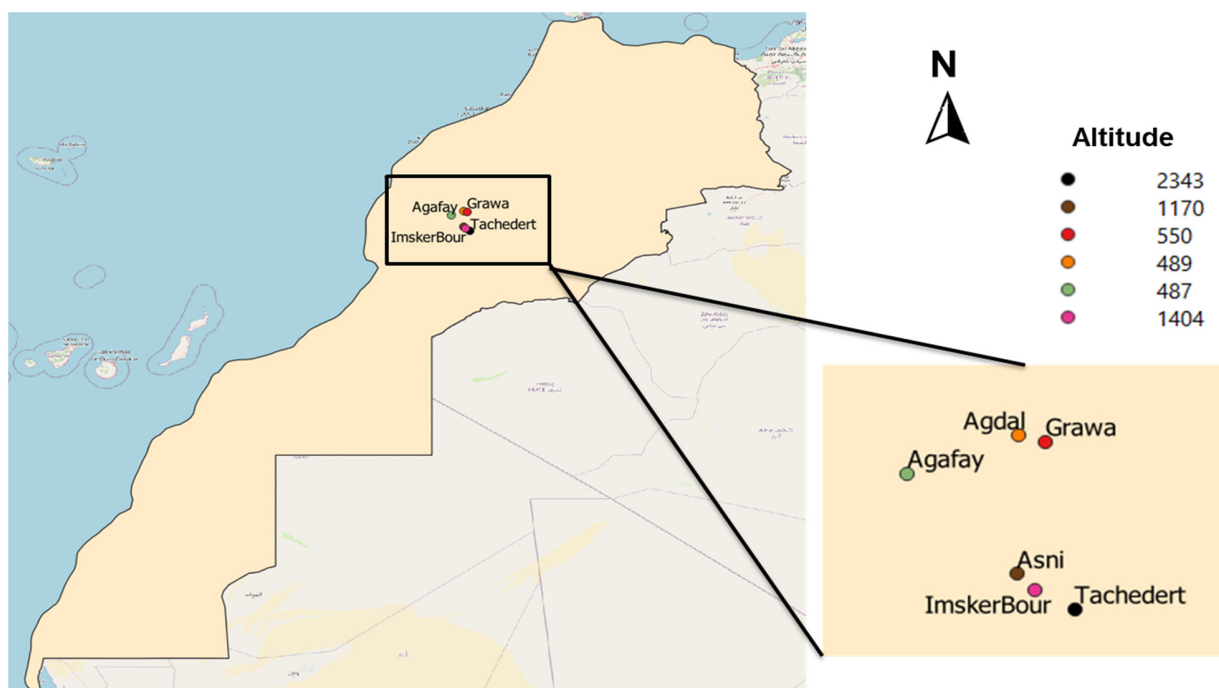


Figure S2: Location of weather stations in the Tensift region.

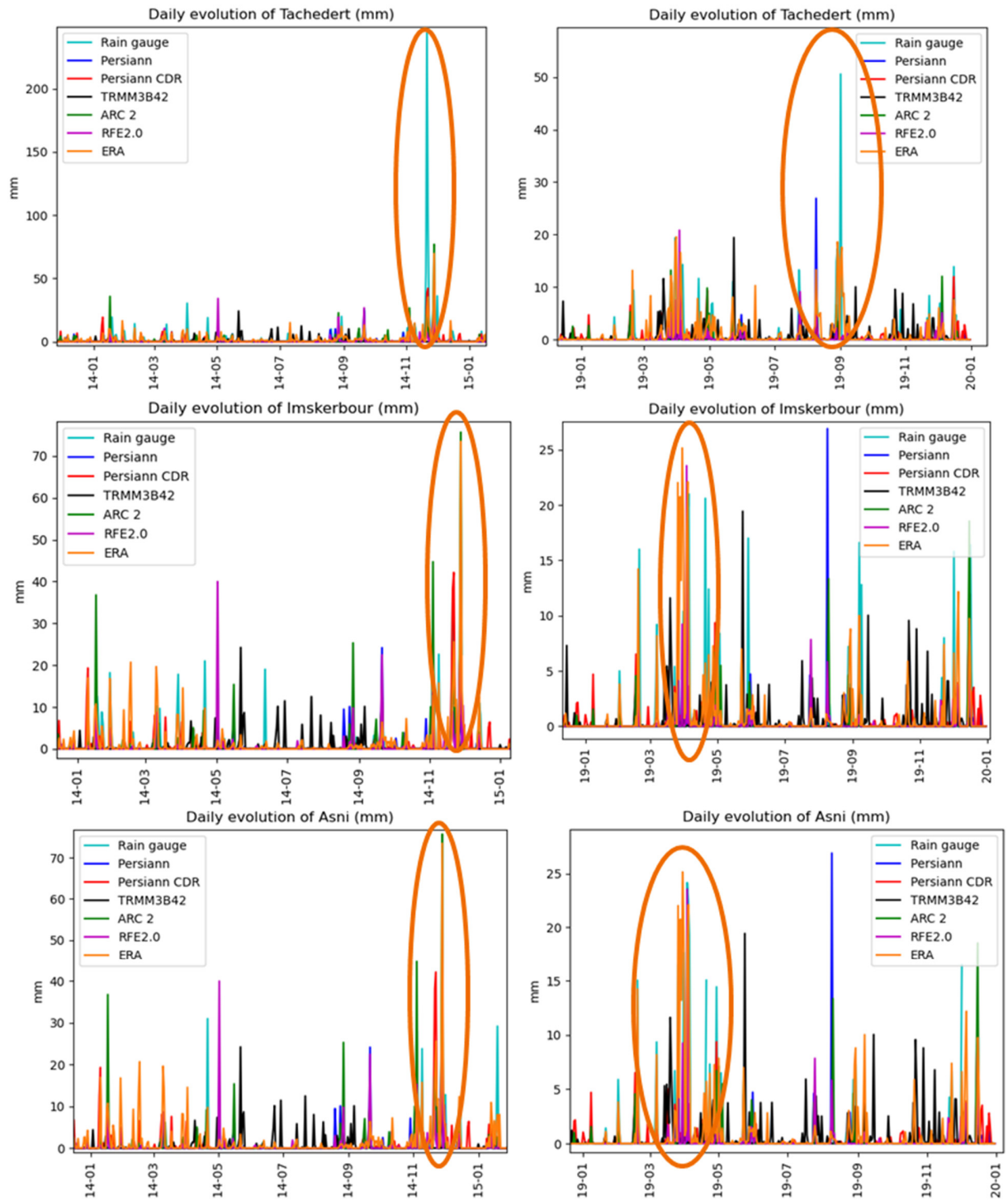


Figure S3-1: Zooming on one of the wettest years (2014) and the driest year (2019) (Daily).

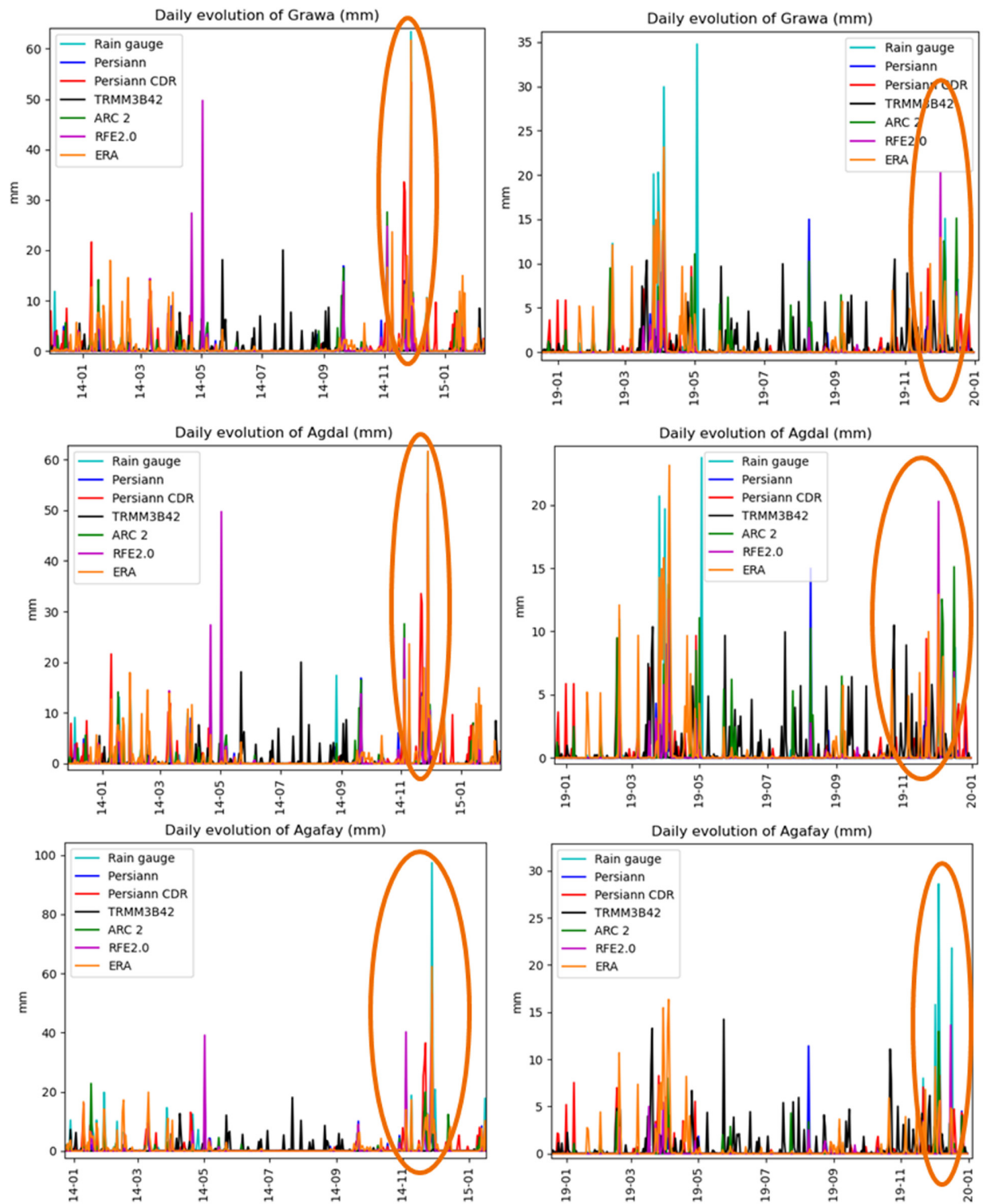


Figure S3-2: Zooming on one of the wettest years (2014) and the driest year (2019) (Daily).

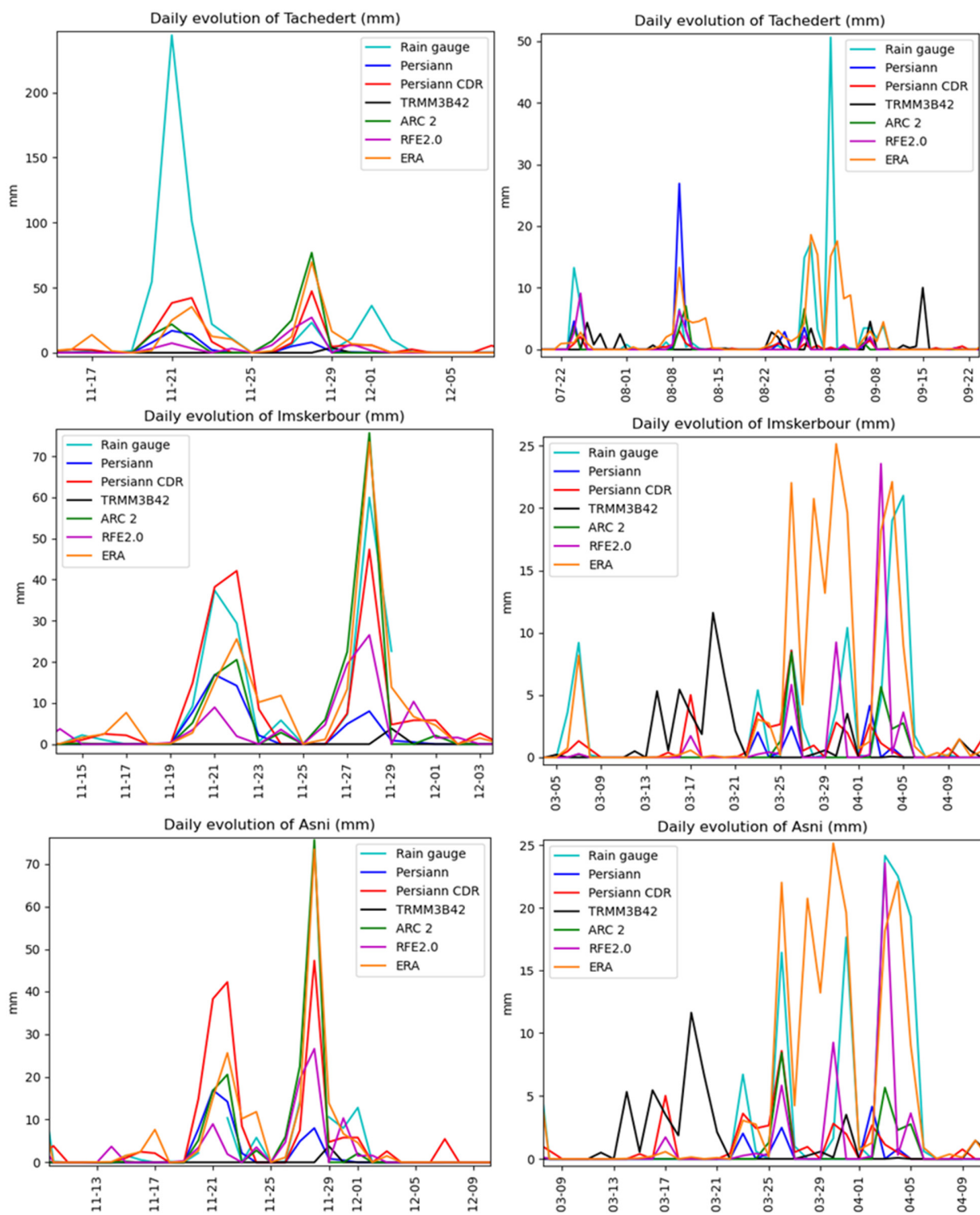


Figure S4-1: Zoom on the spikes of the two study years (Daily).

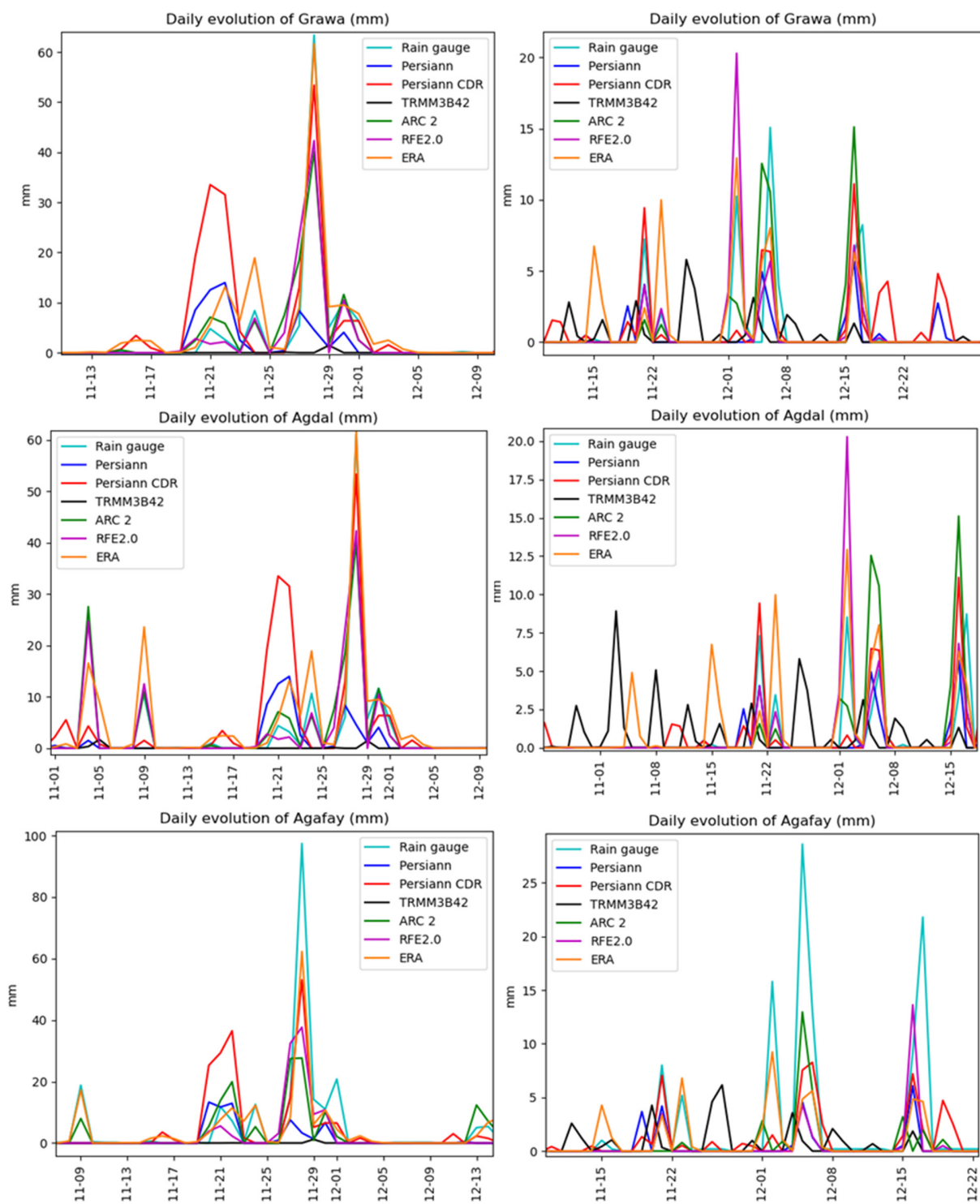


Figure S4-2: Zoom on the spikes of the two study years (Daily).

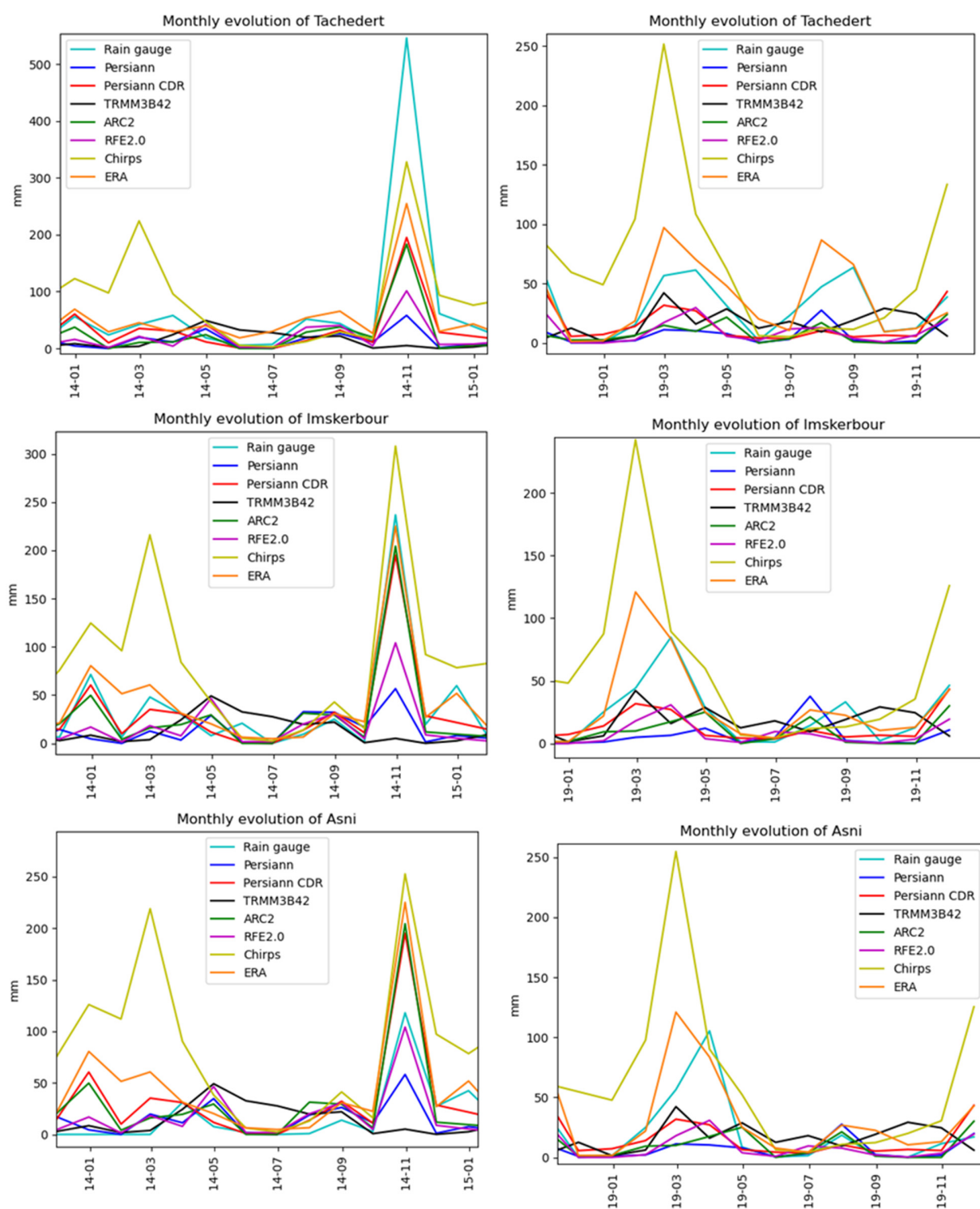


Figure S5-1: Zooming on one of the wettest years (2014) and the driest year (2019) (Monthly).

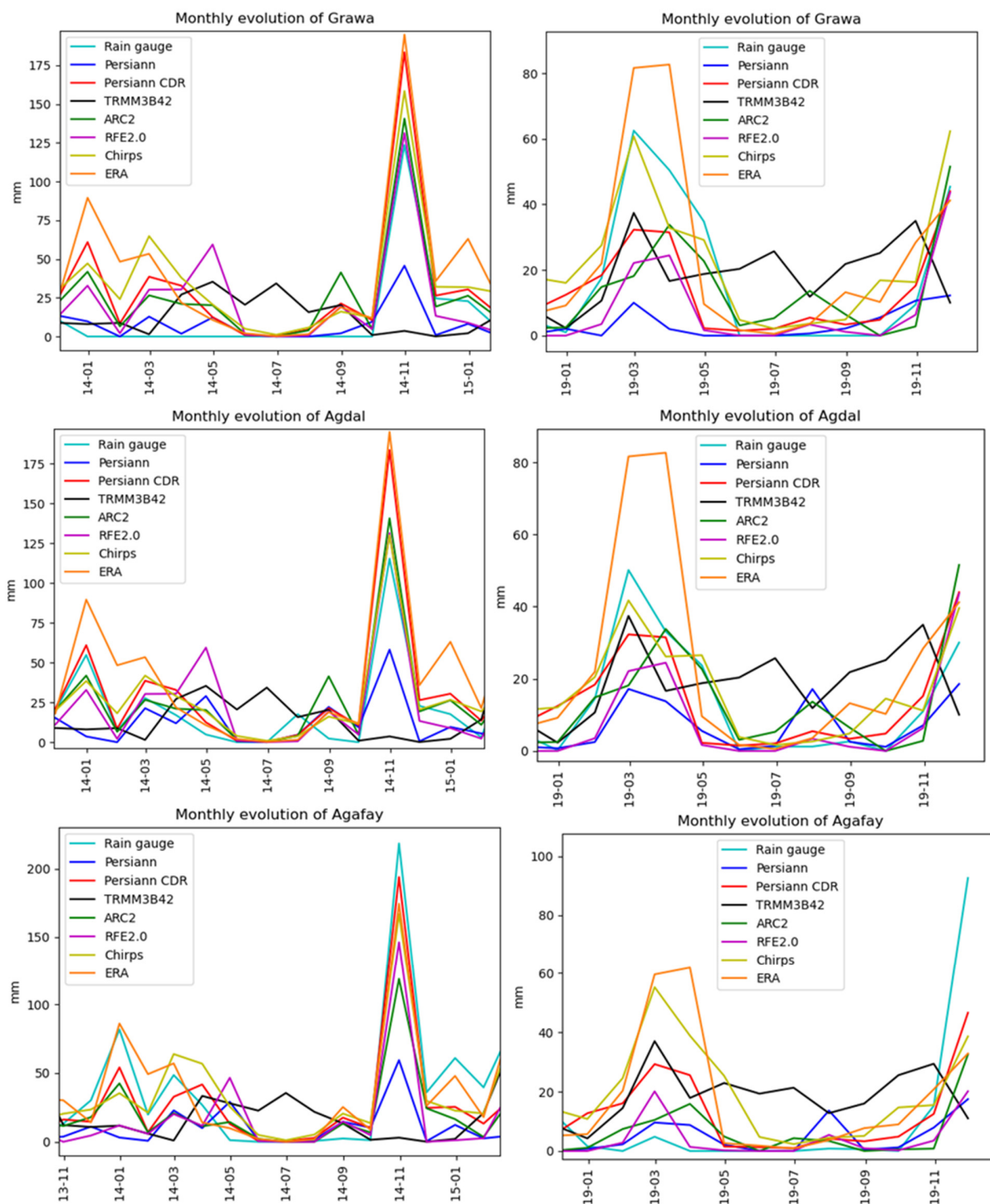


Figure S5-2: Zooming on one of the wettest years (2014) and the driest year (2019) (Monthly).

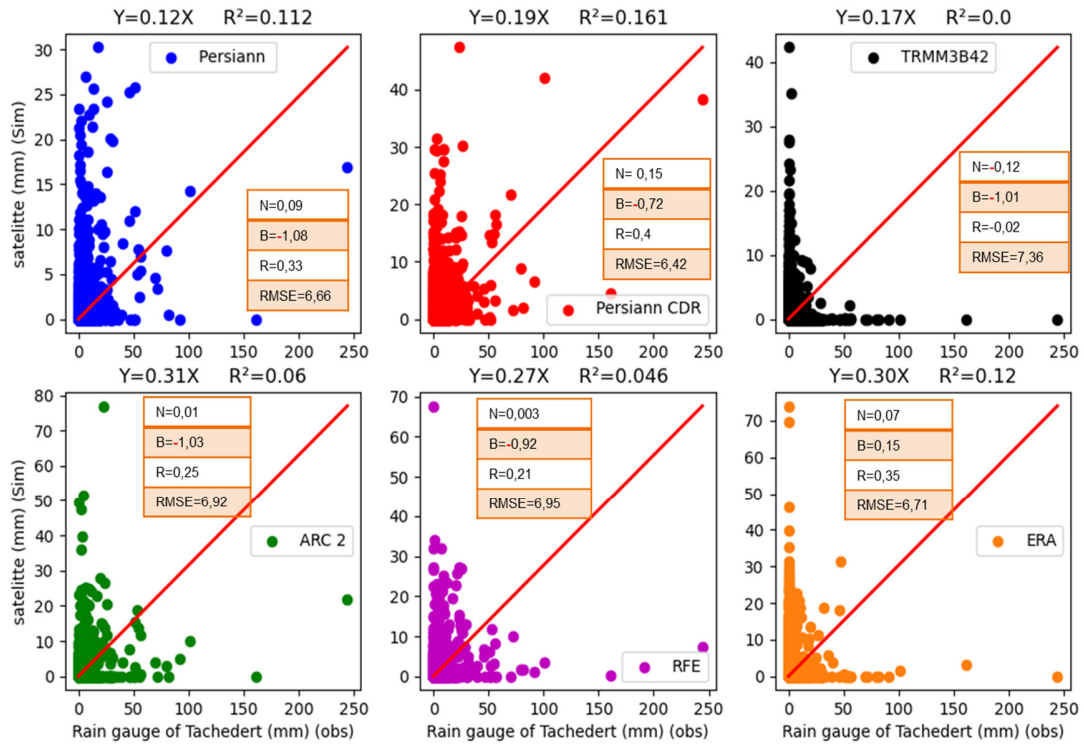


Figure S6: Scatterplot of the daily satellite products and the Tachedert weather station data.

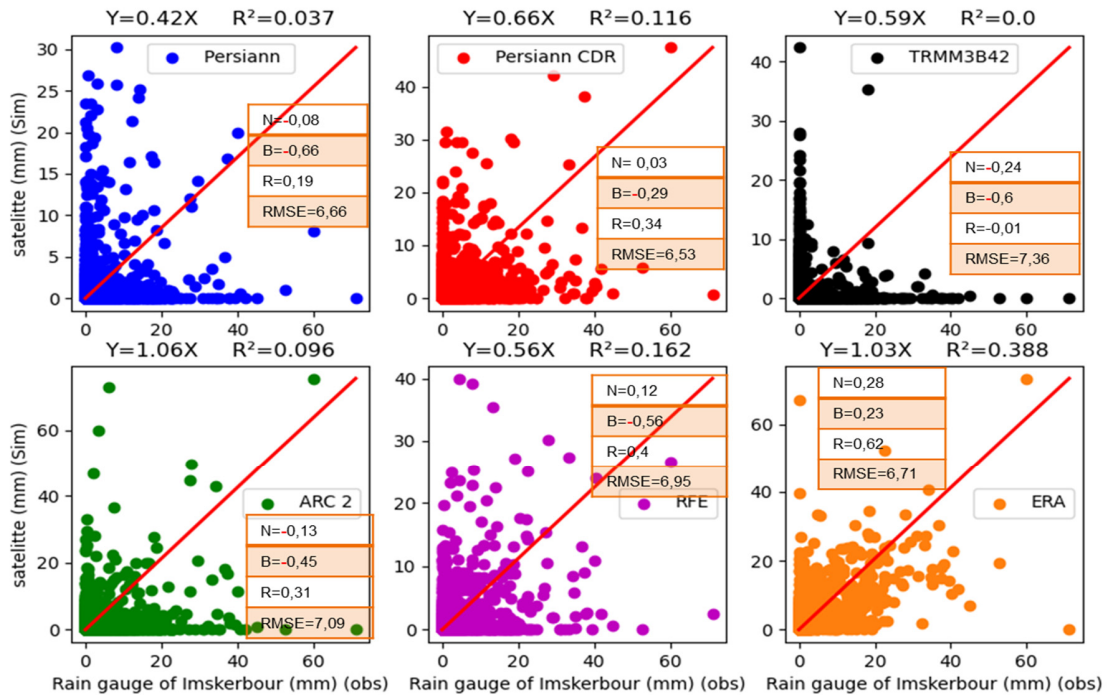


Figure S7: Scatterplot of the daily satellite products and the Imskerbour weather station data.

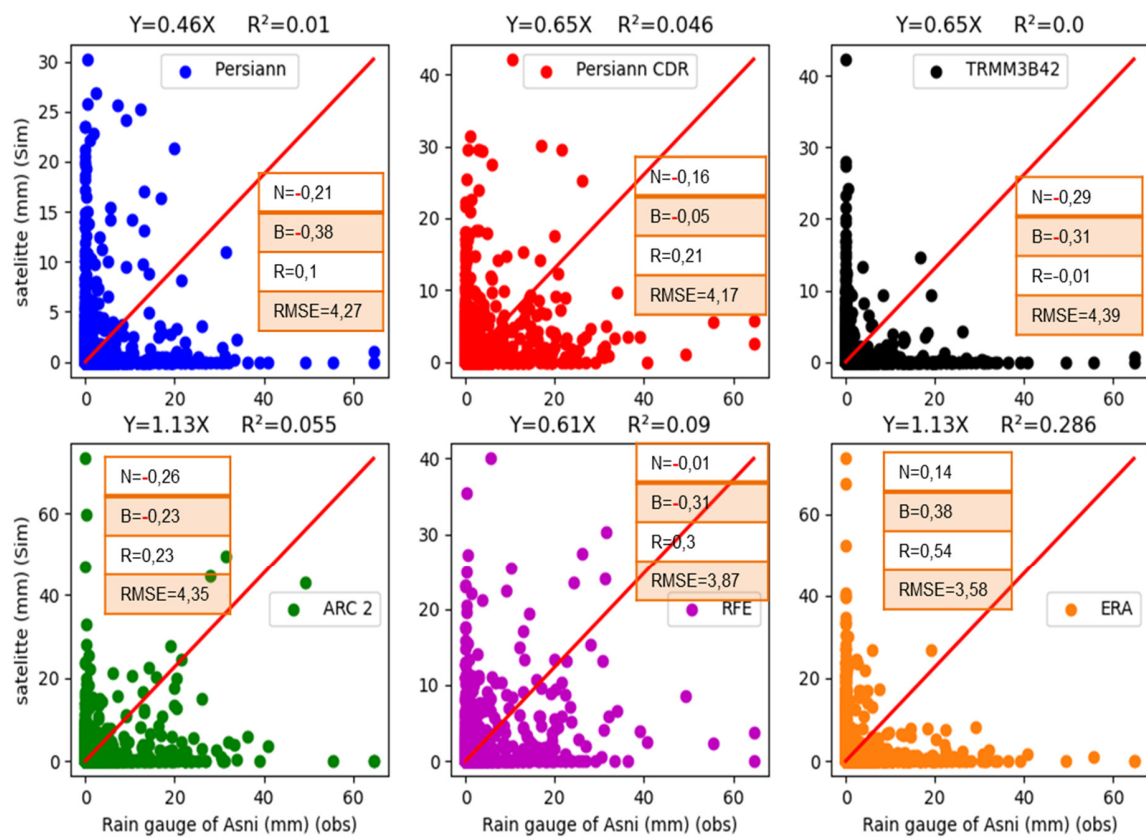


Figure S8: Scatterplots of the daily satellite products and Asni weather station.

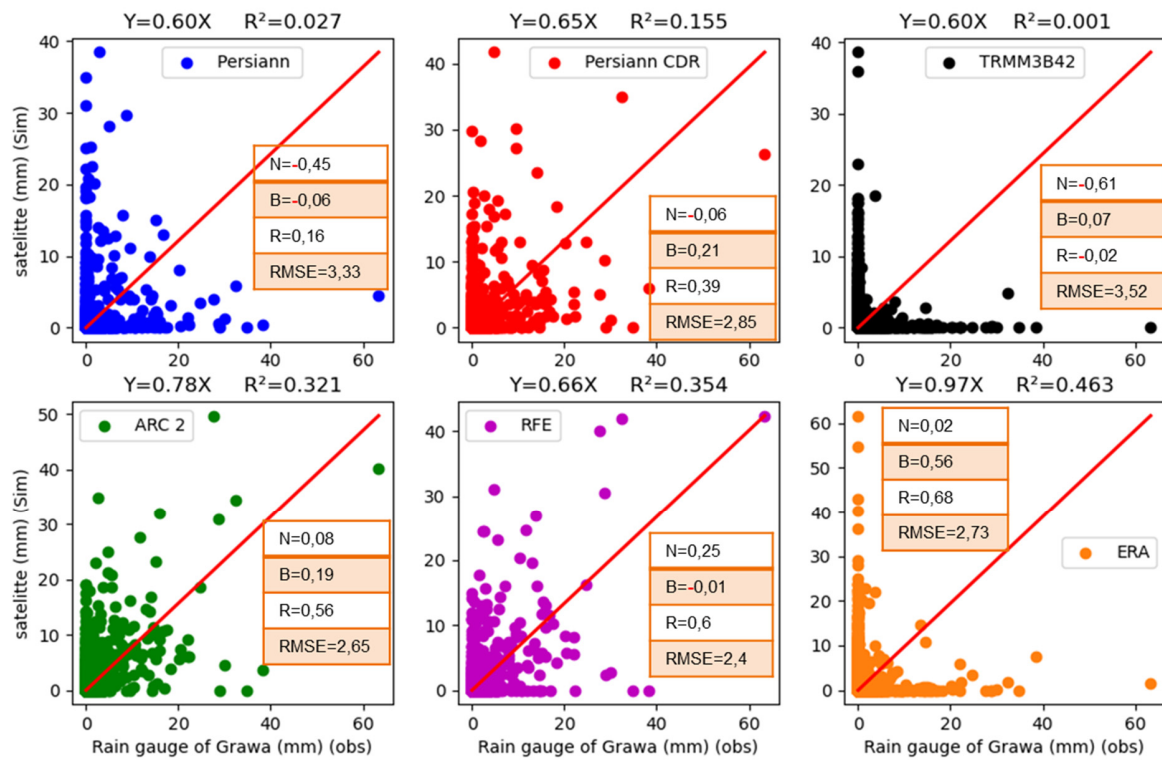


Figure S9: Scatterplots of the daily satellite products and Grawa weather station data.

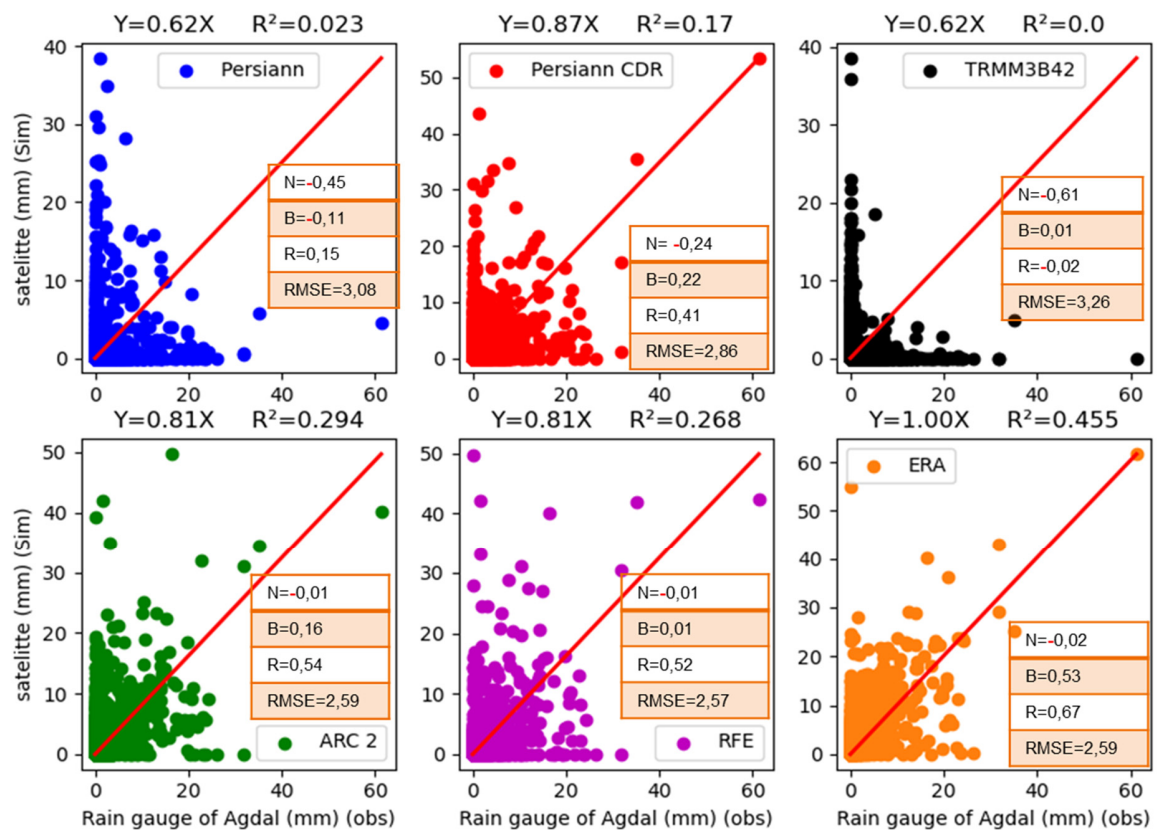


Figure S10: Scatterplots of the daily satellite products and Agdal weather station data.

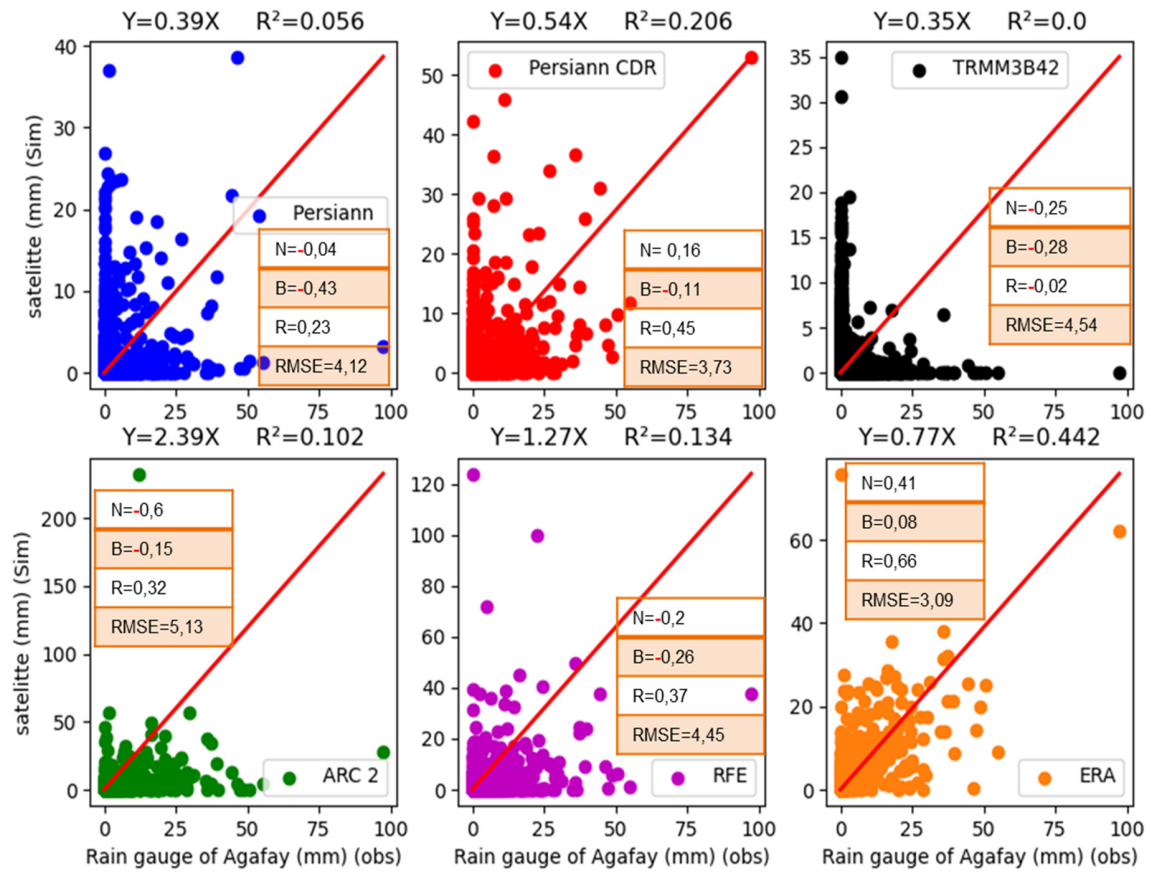


Figure S11: Scatterplots of the daily satellite products and Agafay weather station data.

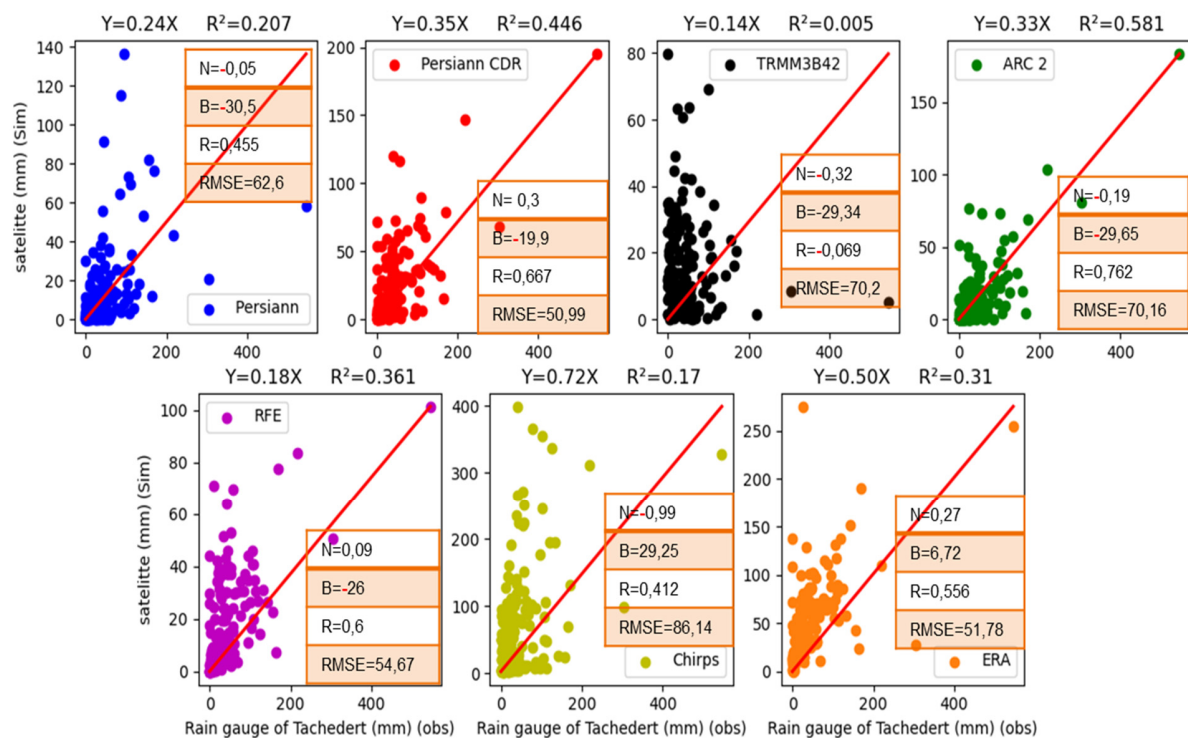


Figure S12: Scatterplots of the monthly satellite products and the Tachedert weather station data.

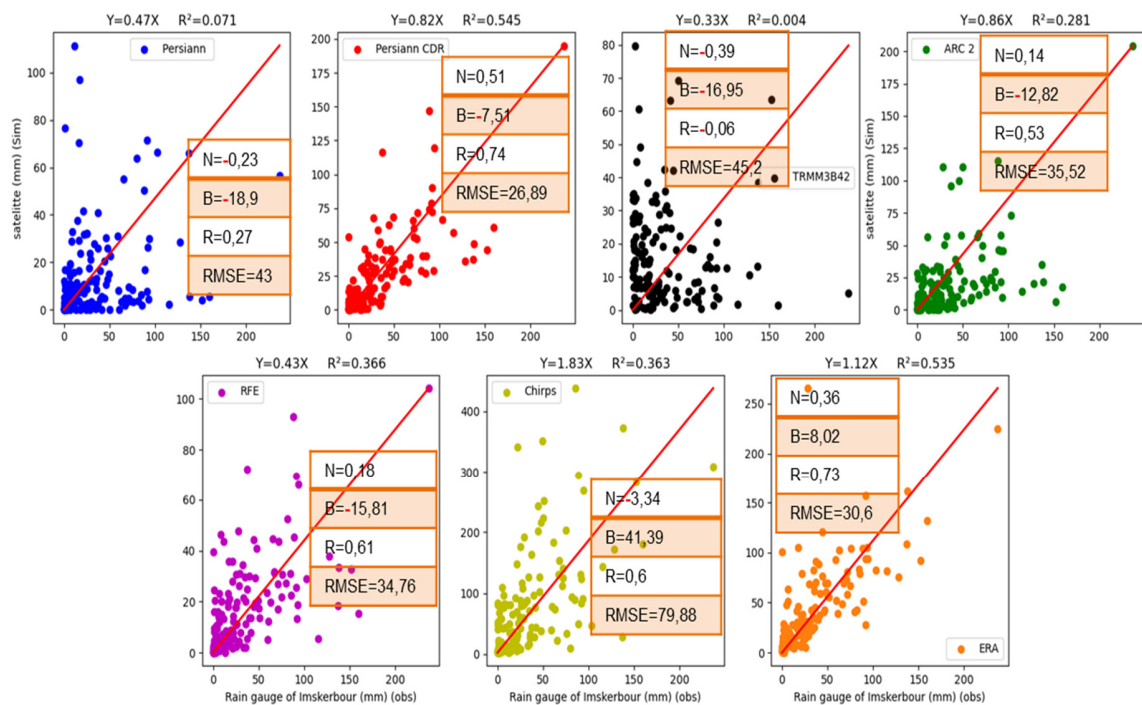


Figure S13: Scatterplots of the monthly satellite products and the Imskerbour weather station data.

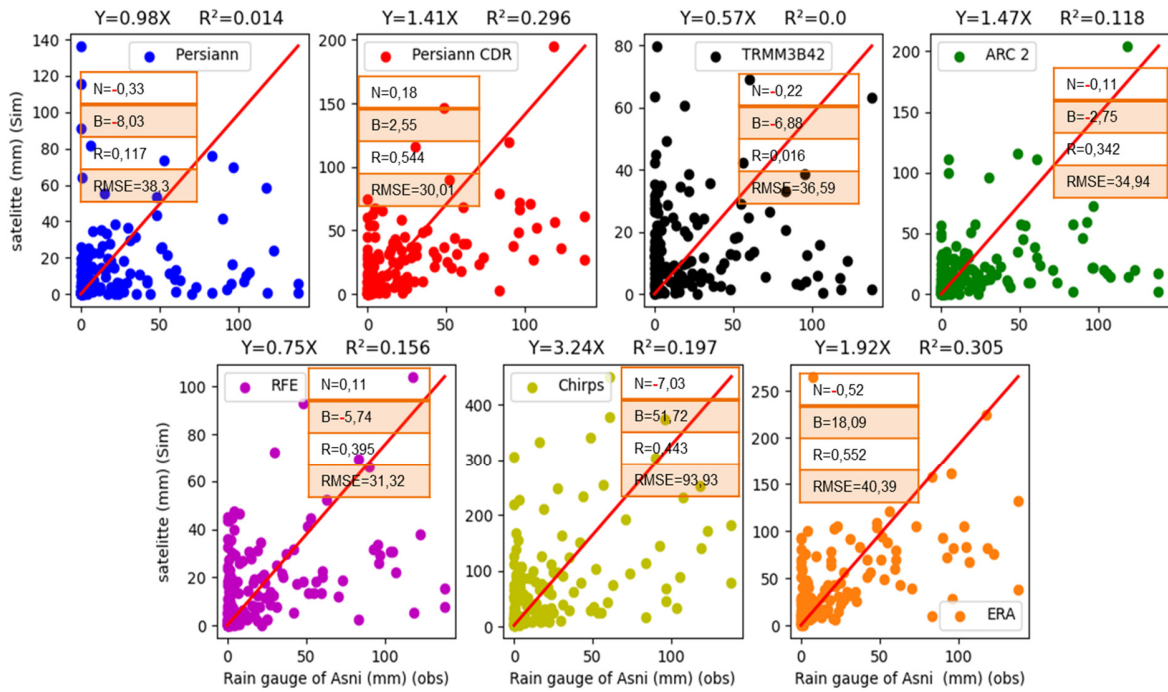


Figure S14: Scatterplots of the monthly satellite products and the Asni weather station data.

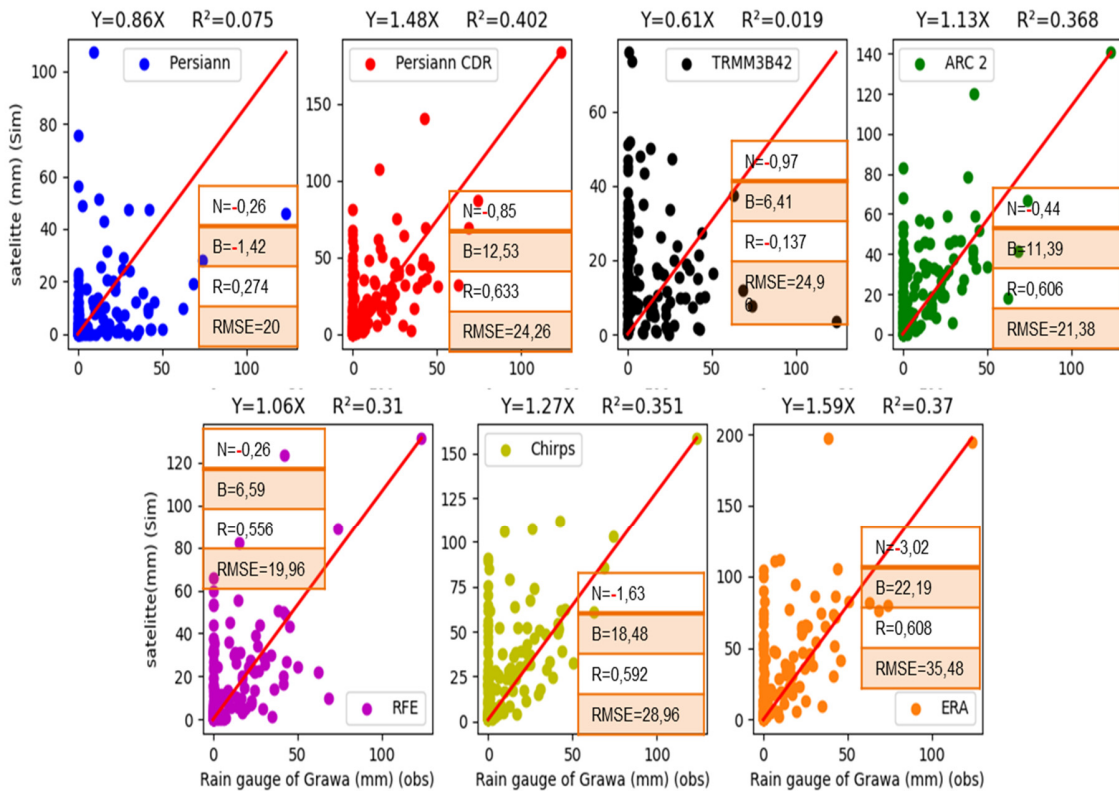


Figure S15: Scatterplots of the monthly satellite products and the Grawa weather station data.

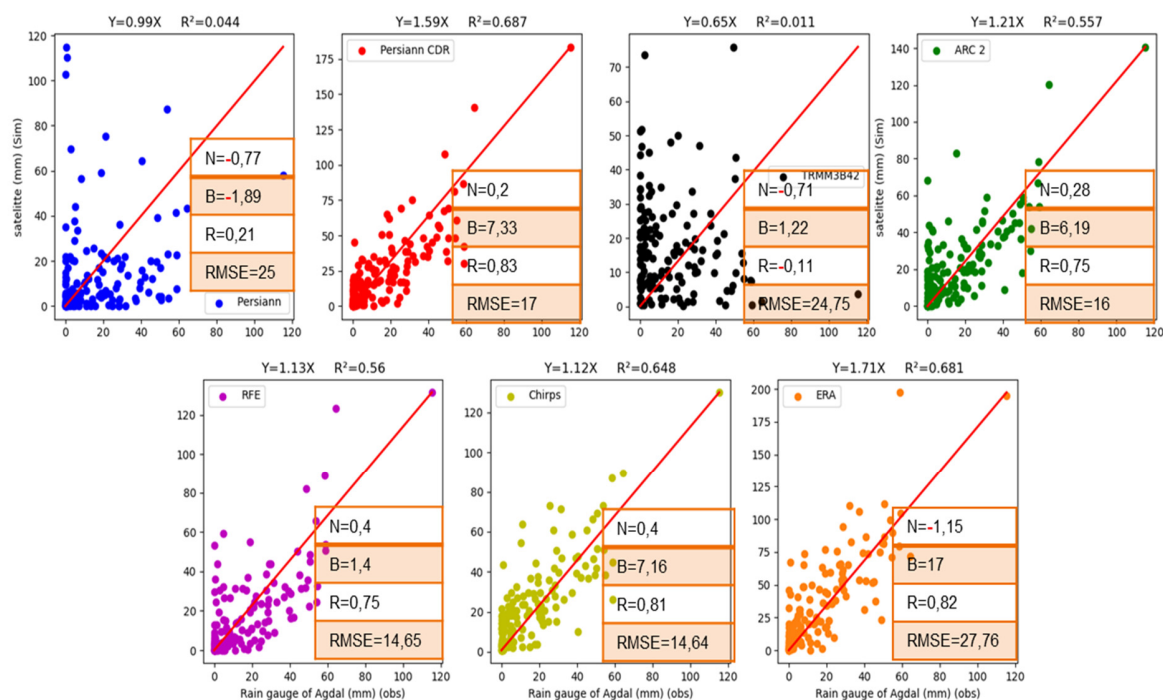


Figure S16: Scatterplots of the monthly satellite products and the Agdal weather station data.

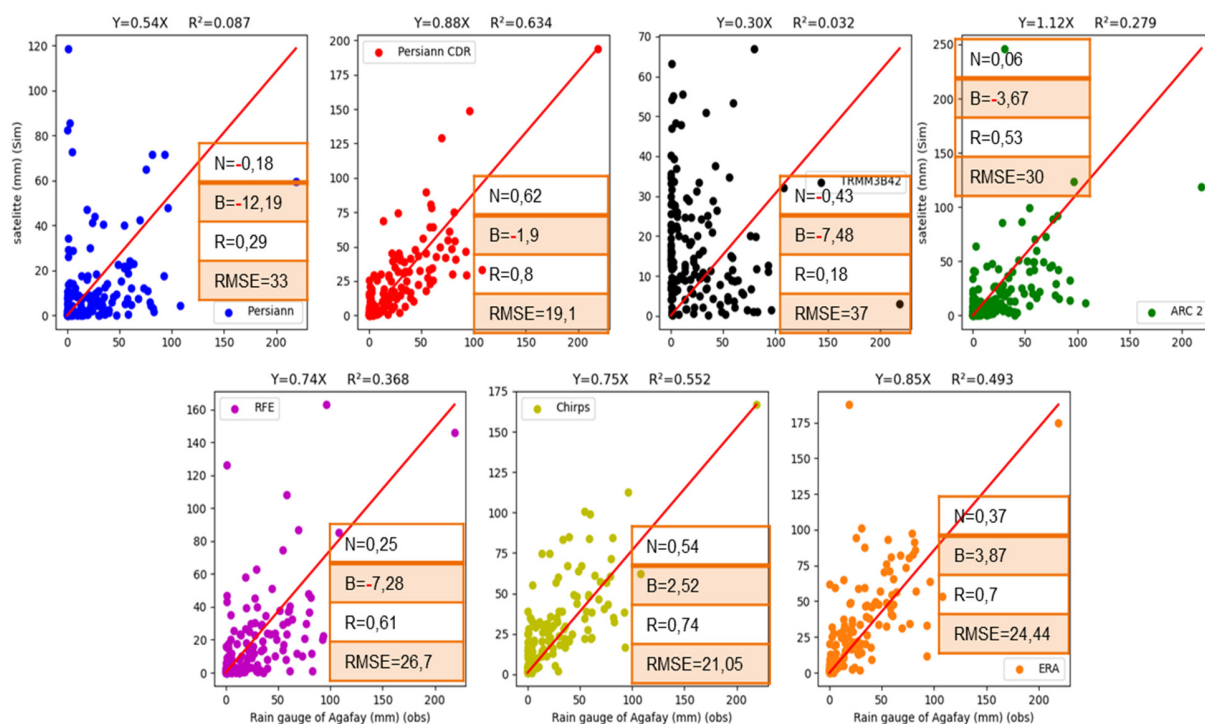


Figure S17: Scatterplots of the monthly satellite products and the Agafay weather station data.

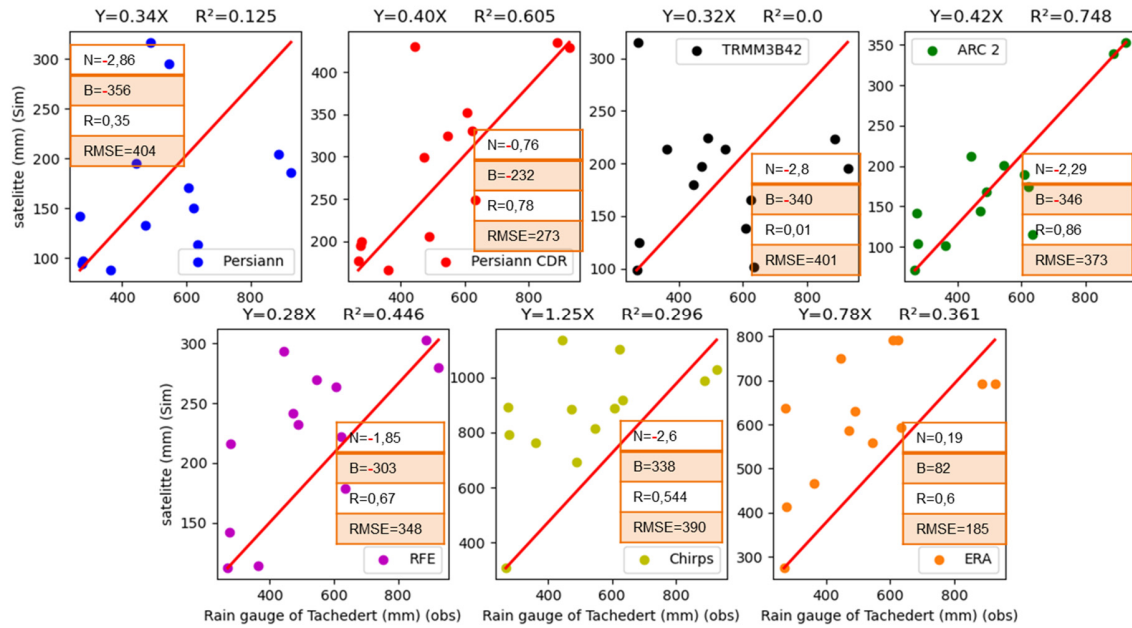


Figure S18: Scatterplots of the annual satellite products and the Tachedert weather station data.

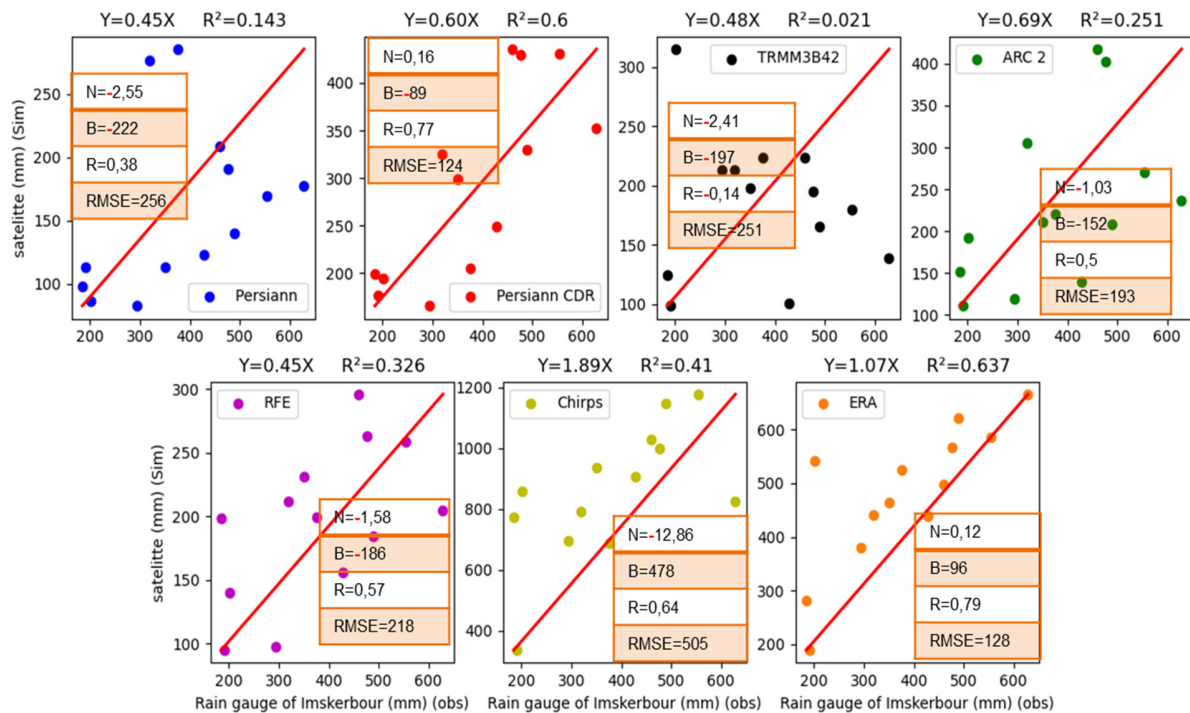


Figure S19: Scatterplots of the annual satellite products and the Imskerbour weather station data.

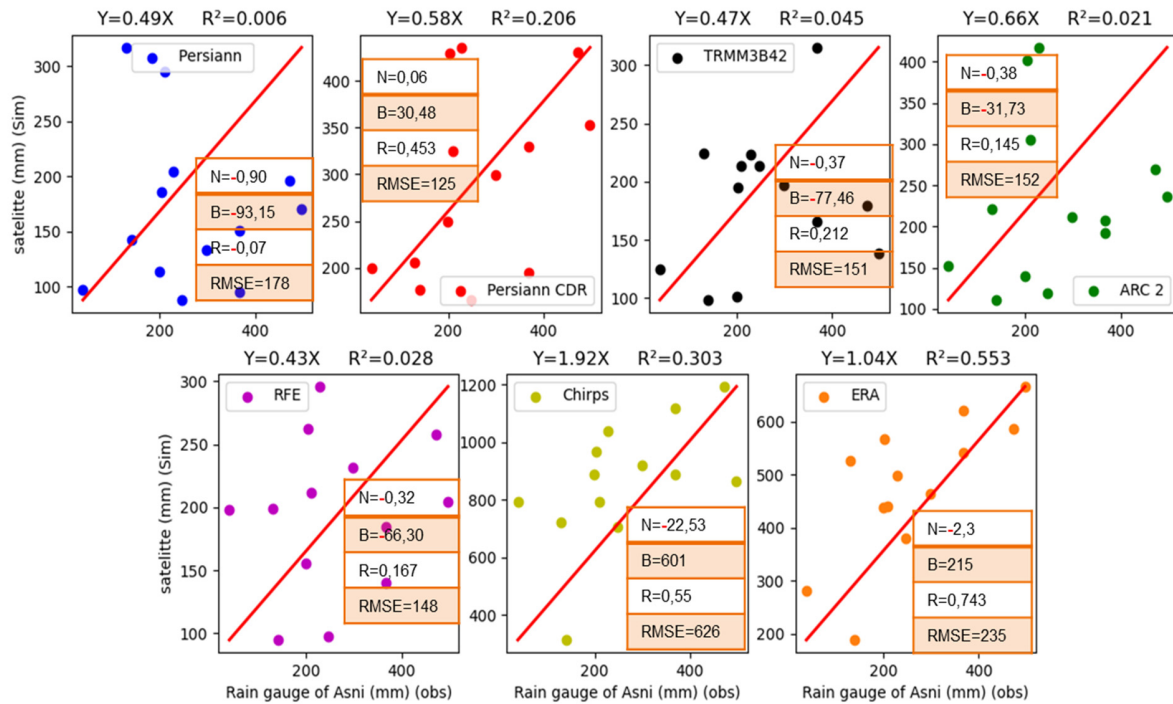


Figure S20: Scatterplots of the annual satellite products with the Asni weather station data.

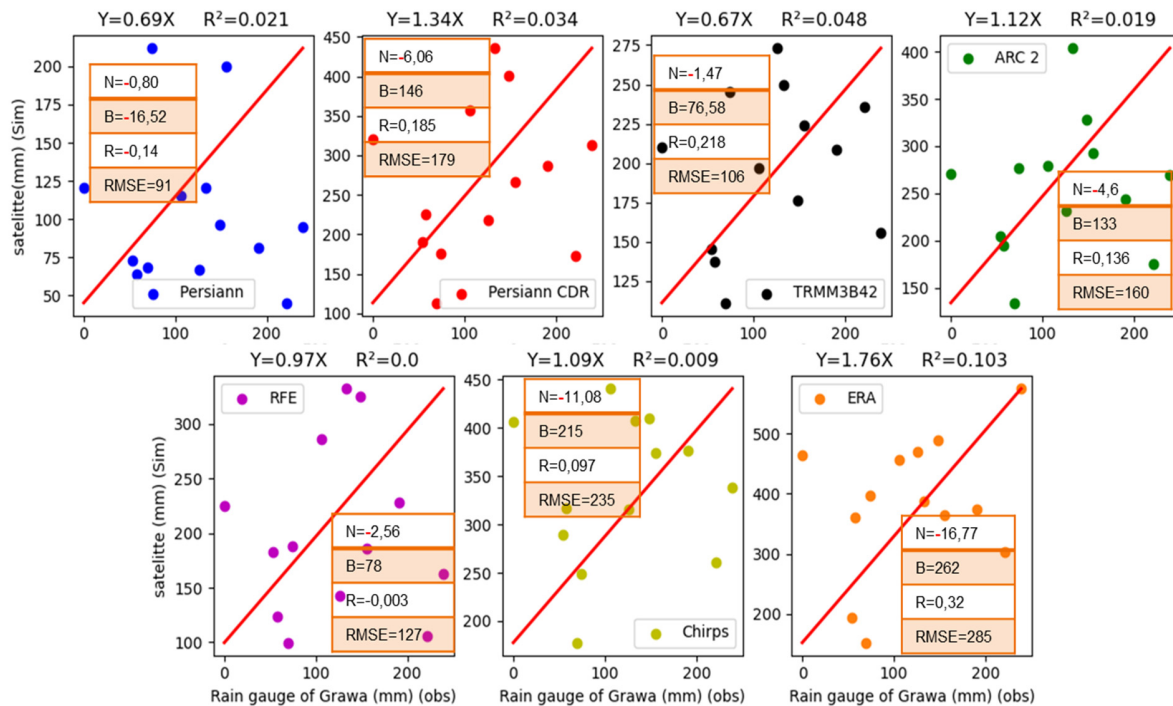


Figure S21: Scatterplots of the annual satellite products and the Grawa weather station

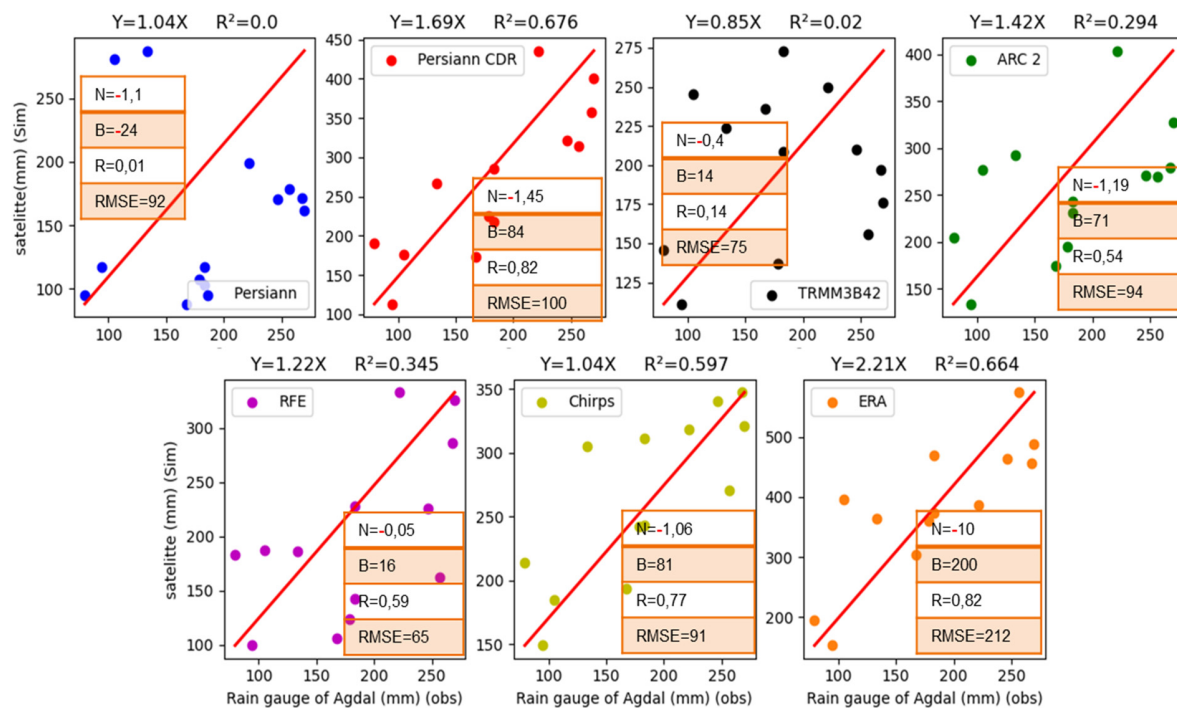


Figure S22: Scatterplots of the annual satellite products and the Agdal weather station

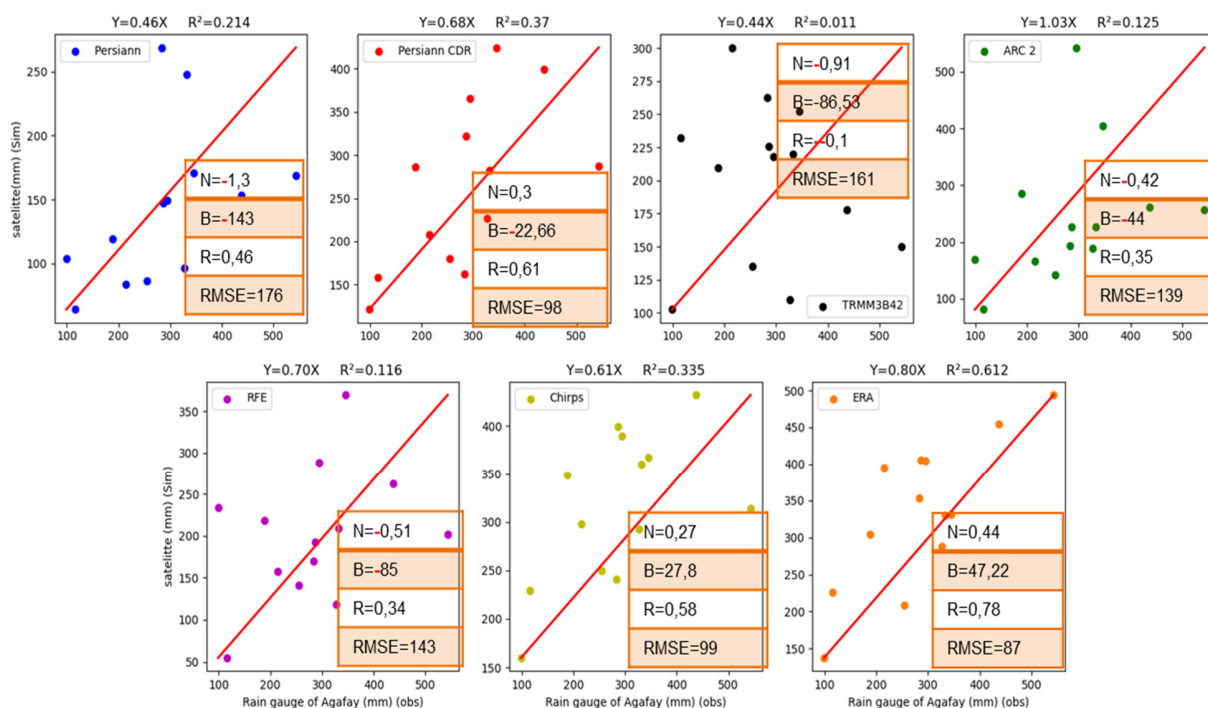


Figure S23: Scatterplots of the annual satellite products and the Agafay weather station

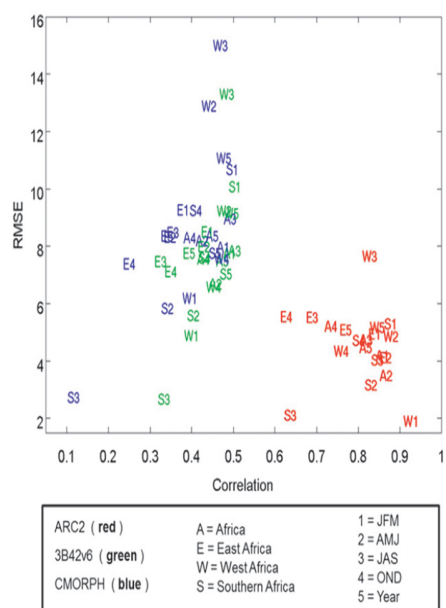


Figure S24: Scatterplot of the correlation (x-axis) and RMSE (y-axis) between rain gauge measurements and ARC2 (red), TRMM (green) and CMORPH (blue). [27]

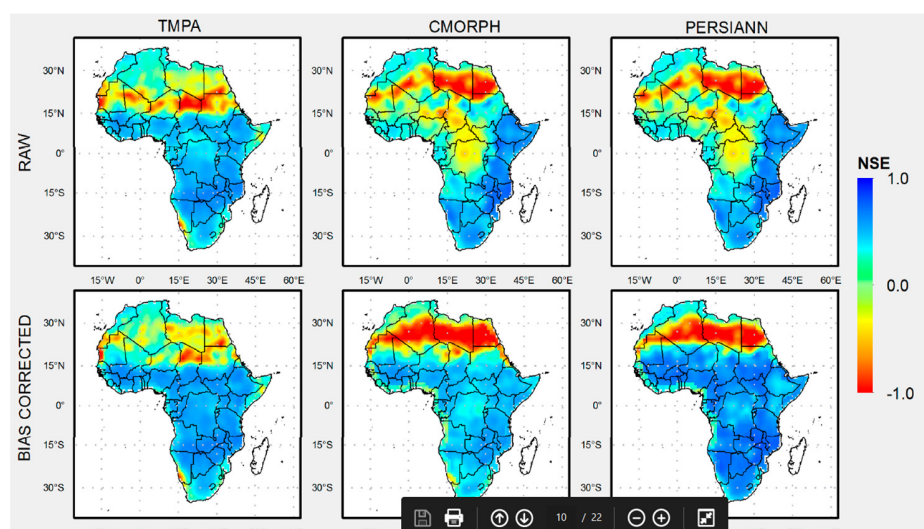


Figure S25: Nash efficiency (NSE) of the three satellite precipitation products compared to the GPCP baseline before bias correction (top line), and after (bottom line). [30]

TableS1: Availability of rainfall data

Data	Start date	End date
Tachedert (2343)	13/05/2007	24/06/2020
Imeskerbour (1404)	10/05/2007	21/07/2020
Asni (1170)	07/01/2004	21/07/2020
Grawa (550)	10/09/2003	13/08/2020
Agdal (489)	09/11/2004	13/08/2020
Agafay (487)	05/02/2003	19/08/2020

Table S2: Availability of satellite and reanalysis data

Data	Start date	End date
Persiann (CHRS/ NASA/NOAA) [12] (24h) (0.25°) IR (GEO: GOES GMS-5, METEOSAT)+ MOP (LEO)	01/03/2000	Today
Persiann CDR [14] (24h) (0.25°) : IR+NCEP+GPCP	01/01/1983	Today
TRMM3B42 (NASA) [20] (3h) (0.25°) : MOP+ IR +GPCP	31/12/1997	31/12/2019
ARC2 (CPC) [22] (24h) (0.1°) : IR+ GTS	01/01/1983	Today
CHIRPS (FEWS NET) [24] (1M) (0,05°) : IR+ TMPA+ GTS+ GPCC	01/01/1981	Today
RFE2 (NOAA) [23] (24h) (0,1°) : MO+ IR+ satellite SSM+ GTS	01/01/2002	Today
ERA5 (ECMWF) [28] (1h) (0,25°)	01/01/1980	01/06/2020

Table S3: Classification of SPI values

SPI classification	SPI values
Extremely dry	< -2
Severely dry	-1.99 to -1.50
Moderately dry	-1.49 to -1.0
Near normal	-1.0 to 1.0
Moderately wet	1.0 to 1.49
Severely wet	1.50 to 1.99
Extremely wet	>2

Table S4: Drought Periods at Tachedert weather station.

Tachedert Start date	Drought Duration (DD)	Drought Intensity (DI)	Drought severity (DS)
September 2008	3 M	-1.6	4.4
Auguste 2013	3 M	-1.2	1.8
May 2016	4 M	-2.25	6.2
April 2017	3 M	-1.4	1.5
July 2018	3 M	-1.4	1.8
January 2019	3M	-1.4	3.1

Table S5: Drought Periods at Imskerbour weather station.

Imskerbour Start date	Drought Duration (DD)	Drought Intensity (DI)	Drought severity (DS)
January 2008	2 M	-1.2	1,3
November 2009	2 M	-2.1	2,2
January 2012	4 M	-1,2	3,4
June 2013	4 M	-1.2	2.1
November 2013	3 M	-1.1	2.3
December 2015	3 M	-1.4	3.3
May 2016	3 M	-1.5	3.9
August 2017	5 M	-1.5	4.5
December 2018	5 M	-2.66	5.4
November 2019	2 M	-1.05	1.7

Table S6: Drought Periods at Asni weather station.

Asni Start date	Drought Duration (DD)	Drought Intensity (DI)	Drought severity (DS)
September 2010	3 M	-1.02	2.4
December 2013	5 M	-1.38	4.8
March 2015	7 M	-1.4	5.5
December 2015	3 M	-1.66	2.3
December 2017	3 M	-1.62	3.9

Table S7: Drought Periods at Agdal weather station.

Agdal Start date	Drought Duration (DD)	Drought Intensity (DI)	Drought severity (DS)
Marsh 2008	3 M	-2.39	3
May 2010	2 M	-1.01	1.8
January 2012	4 M	-2.1	4
October 2014	2 M	-1.01	1.3
September 2015	2 M	-1.1	1.7
December 2015	4 M	-2.38	4.2
April 2017	3 M	-1.01	2.5
August 2017	7 M	-1.62	6.5
January 2019	2 M	-2.18	2.9
September 2019	4 M	-1.02	2

Table S8: Drought Periods at Agafay weather station.

Agafay Start date	Drought Duration (DD)	Drought Intensity (DI)	Drought severity (DS)
April 2008	4 M	-2.48	3.5
February 2011	2 M	-1.36	1.6
December 2011	2 M	-1.75	3
Marsh 2012	2 M	-1.35	1.9
November 2013	2 M	-1.18	2
September 2014	3 M	-1.22	1.9
December 2015	3 M	-2.02	2.8
September 2016	3 M	-1.02	2.1
January 2019	7 M	-2.18	8.2
September 2019	4 M	-1.42	3

Table S9: Drought Periods over Tensift Basin

Drought Periods	DD	DS	DI
January 2008 to November 2008	11	12,2	-2,48
November 2009 to December 2009	2	2,2	-2,1
May 2010 to November 2010	6	4,2	-1,02
February 2011 to Mars 2011	2	1,6	-1,36
December 2011 to April 2012	5	12,3	-1,75
June 2013 to April 2014	11	10,7	-1,8
September 2014 to November 2014	3	3,2	-1,2
Marsh 2015 to February 2016	12	19,4	-2,38
May 2016 to November 2016	7	12,2	-2,25
April 2017 to February 2018	11	16,4	-1,62
July 2018 to September 2018	3	1,5	-1,4
December 2018 to July 2019	8	19,6	-2,66
September 2019 to December 2019	3	5	-1,42