IASI L2 temperature and humidity monitoring against in situ sonde measurements

Monthly report for April 2023,
Platform: M03,
GroundSegment: GS1

EUMETSAT
Eumetsat-Allee 1, D–64295 Darmstadt, Germany
Tel: +49 6151 807-7
Fax: +49 6151 807 555
www.eumetsat.int

Issue : V1
Date : 03/05/2023

CONTENTS

1 INTRODUCTION

1.1 Purpose and scope

This report compiles Monthly statistics from the routine monitoring of the IASI L2 temperature and humidity [RD 1] products with *in situ* sonde measurements.
The IASI L2 products come from the operational ground segment GS1. The reference measurements are retrieved from the NOAA Integrated Global Radiosonde Archive (IGRA) [RD 3]. The collocation and statistics are computed with the MONALiSA monitoring facility [RD 4].

This document is intended for internal monitoring purposes, to characterise and detect possible changes or trends in performances. It is also a public report to Users interested in IASI L2 temperature and humidity products uncertainties. In this respect, it is important to note that differences with sondes also include uncertainties of the sonde measurements themselves as well as collocation uncertainties. These come from the representativeness of a point measurements (sonde) *vs* the 12-40 km footprint of IASI and from the spatial and temporal lags between sonde and satellite acquisitions.

1.2 Collocation criteria and data selection

All IASI pixel within 3 h and 50 km from the sonde sites are collocated to the radiosonde measurement and stored in a match-up database.

The statistics are then computed globally and for Europe separately with clear-sky pixel (FLG_CLDNES = 1 or 2 [RD 2]) successfully processed with the statistical (in blue) and optimal estimation (in red) retrieval methods. The quality control on the IASI L2 products retains profiles with quality indicators (uncertainty estimates) better than 1.5 K for tropospheric temperature and 3.5 K in dew point for tropospheric humidity. This selection usually represent more than 95% of the pixel flagged free of clouds (20% of the overall measurements).

1.3 Reference Documents

ID	Title	Reference
[RD 1]	"IASI Level 2 Product Generation Specifications"	EPS.SYS.SPE.990013
[RD 2]	"IASI Level 2 Product Guide"	EUM/OPS-EPS/MAN/04/0033
[RD 3]	"Integrated Global Radiosonde Archive (IGRA)"	https://www.ncdc.noaa.gov/data-access/weather-balloon/integrated-global-radiosonde-archive
[RD 4]	"MONALiSA Software Release Note"	EUM/RSP/TEN/17/930189

1.4 Terminology

- M01 : Metop B
- M02 : Metop A
- M03 : Metop C
- Ground Segment 1 (GS1) : operational
- Ground Segment 2 (GS2) : validation
- Ground Segment 3 (GS3) : experiment

1.5 MONALiSA

- Version : v3.6-28-g1f6b6d2
- GitHash : 1f6b6d2a6df1a80b6800c8b111201a724479b7f8

2 GLOBAL MONTHLY STATISTICS IN CLEAR-SKY PIXEL

2.1 Matchups

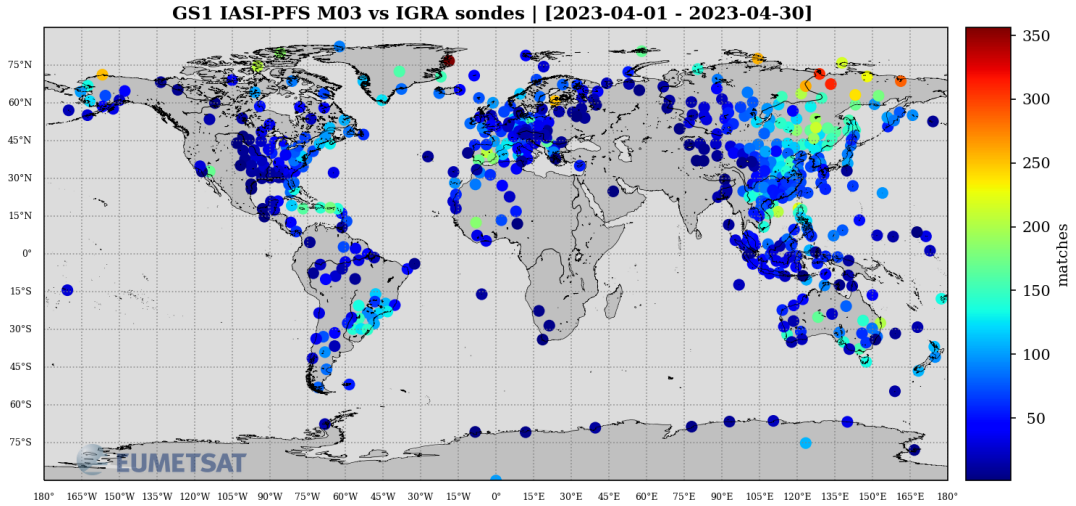

Figure 2.1: Number of match-ups per station with M03 IASI L2 from GS1 for 01-30/04/2023

2.2 Vertical profile statistics

2.2.1 Temperature

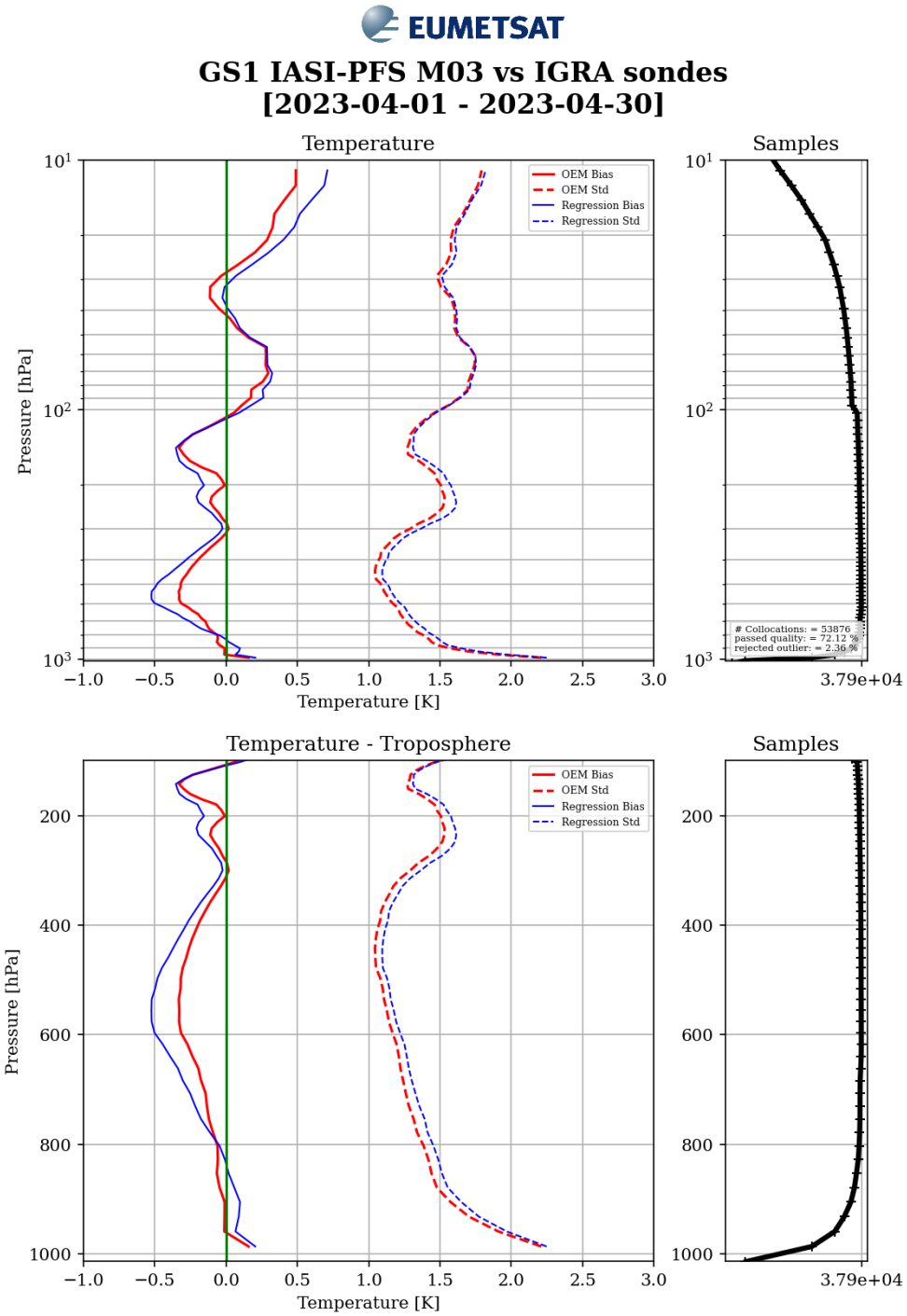

Figure 2.2: IASI *vs* sonde mean (solid line) difference and standard deviation (dash line) in temperature with the statistical (blue) and optimal estimation (red) retrieval methods (top: pressure log scale, bottom: linear scale). Global statistics with M03 IASI L2 from GS1 for 01-30/04/2023

2.2.2 Specific Humidity

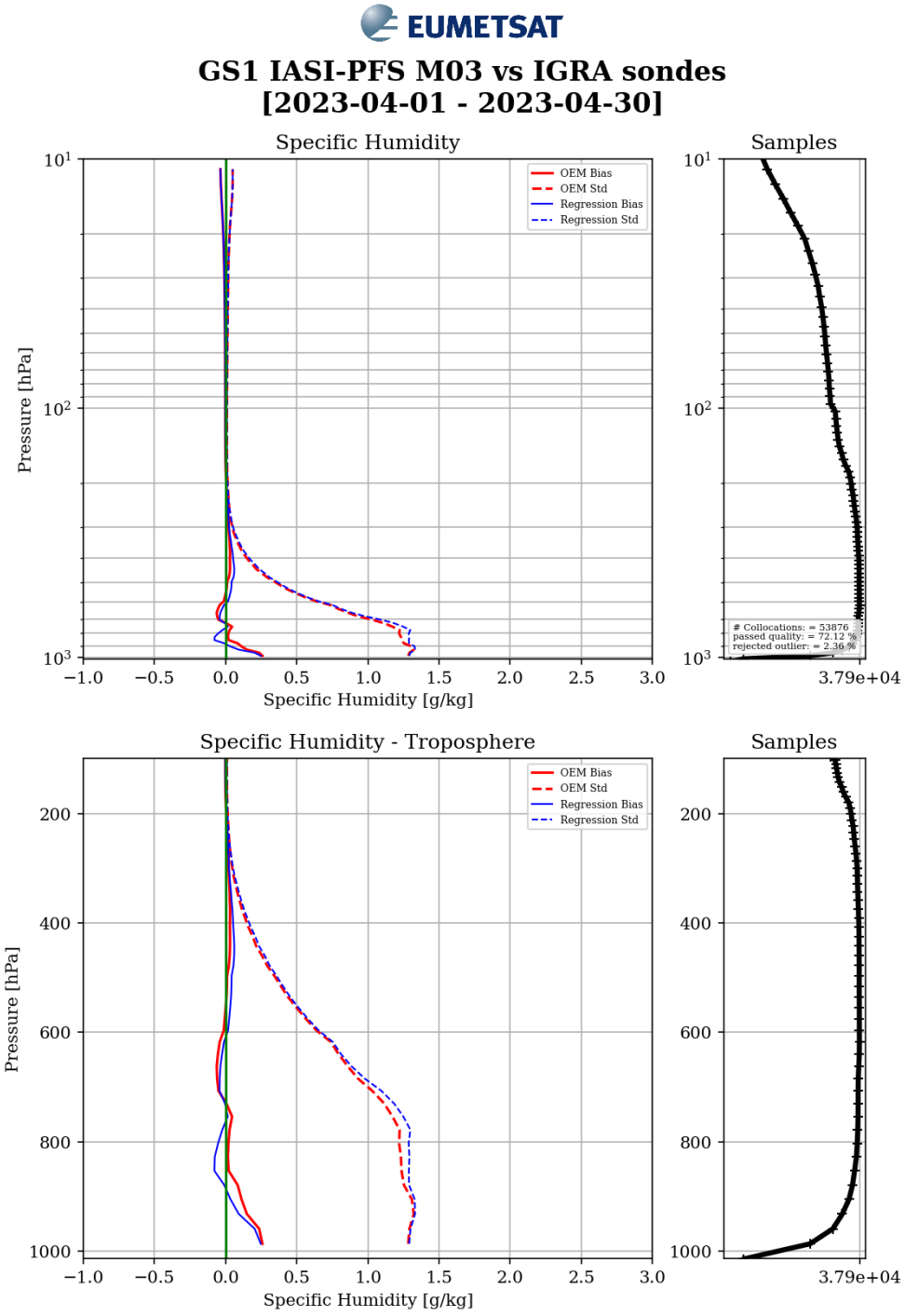

Figure 2.3: IASI *vs* sonde mean (solid line) difference and standard deviation (dash line) in specific humidity with the statistical (blue) and optimal estimation (red) retrieval methods (top: pressure log scale, bottom: linear scale). Global statistics with M03 IASI L2 from GS1 for for 01-30/04/2023

2.2.3 Relative Humidity

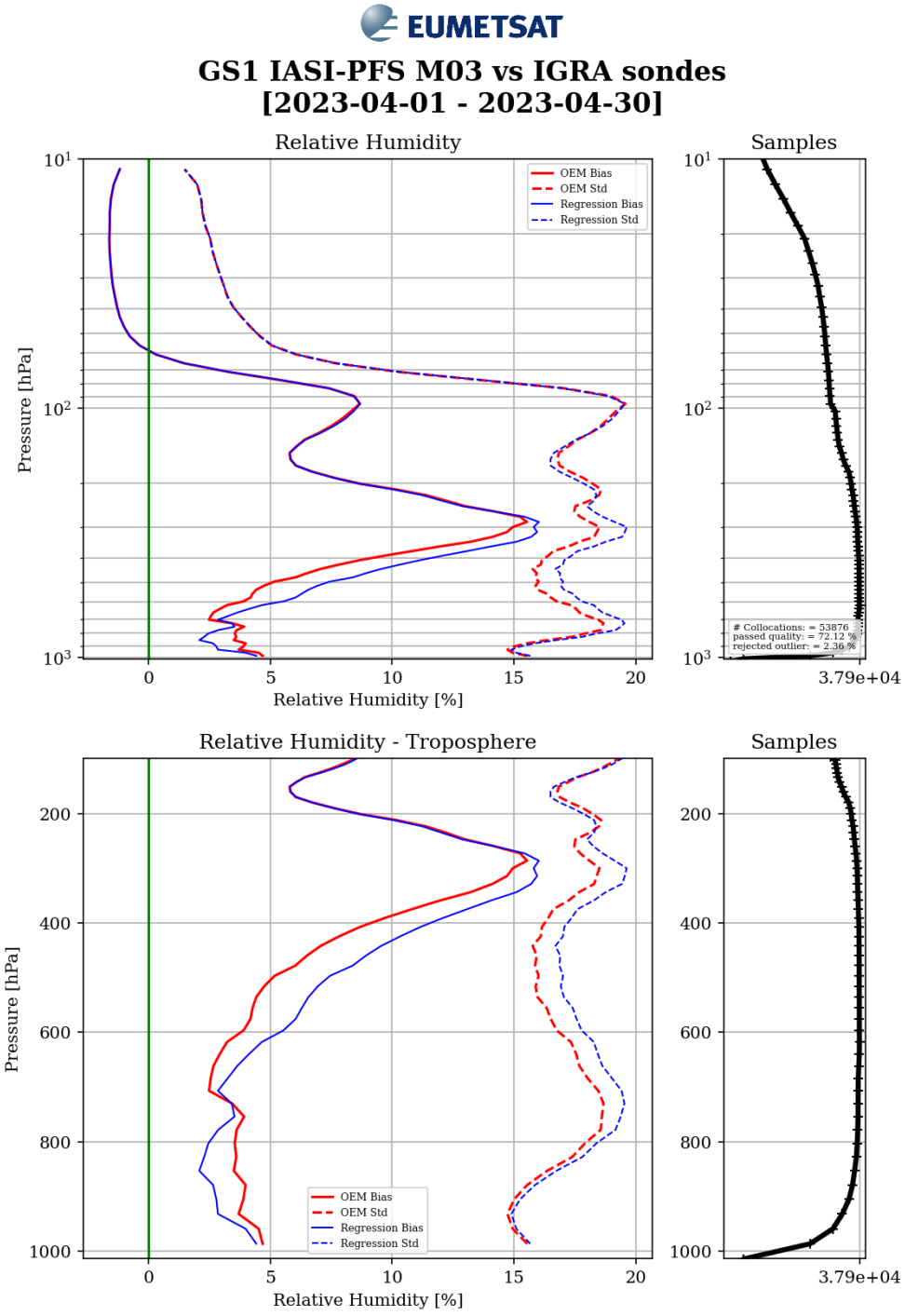

Figure 2.4: IASI *vs* sonde mean (solid line) difference and standard deviation (dash line) in relative humidity with the statistical (blue) and optimal estimation (red) retrieval methods (top: pressure log scale, bottom: linear scale). Global statistics with M03 IASI L2 from GS1 for for 01-30/04/2023

2.3 Quality Indicator profile statistics

2.3.1 Temperature

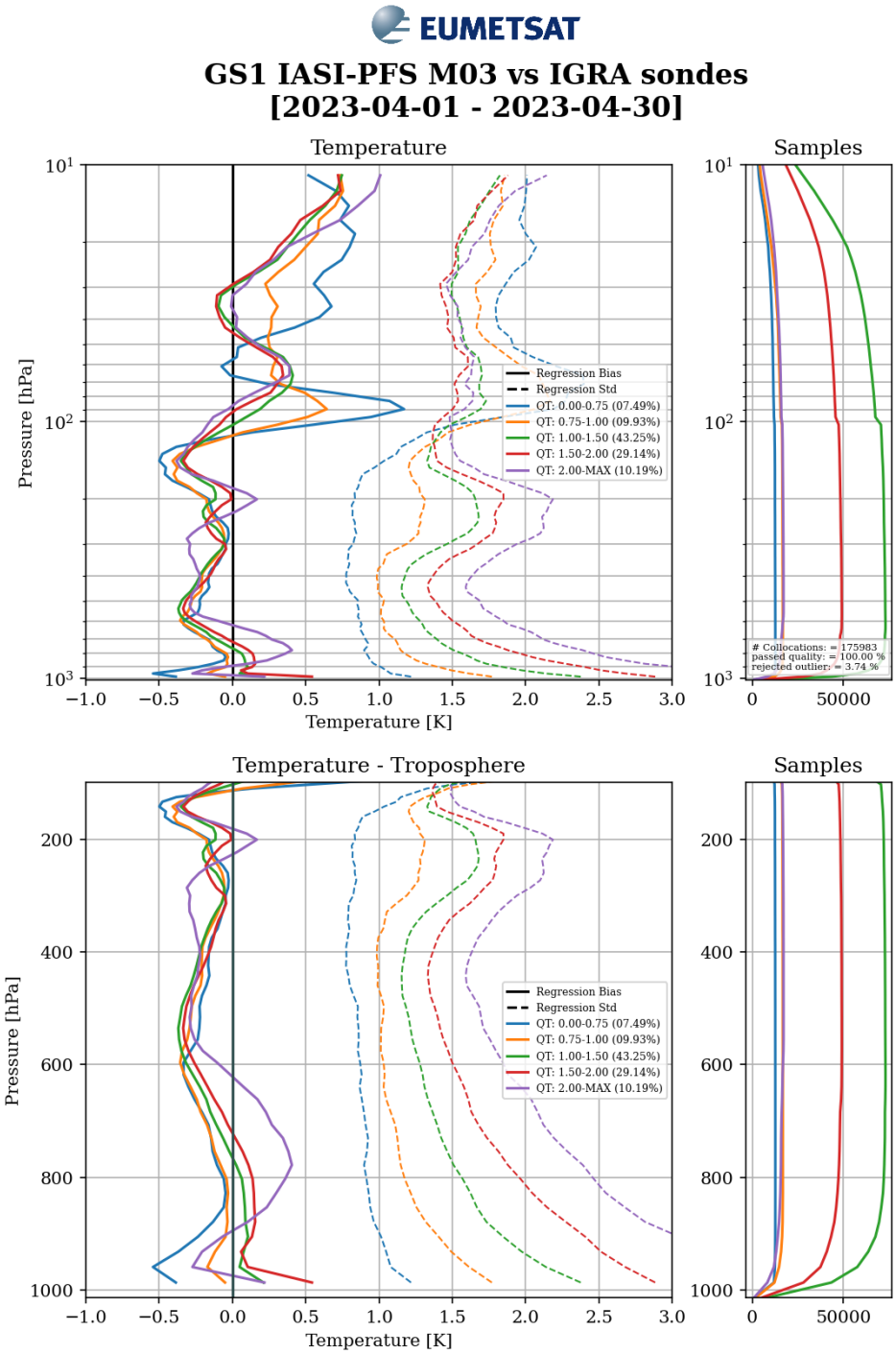

Figure 2.5: IASI *vs* sonde mean (solid line) difference and standard deviation (dash line) in temperature for different quality indicator ranges (top: pressure log scale, bottom: linear scale). Global statistics with M03 IASI L2 from GS1 for 01-30/04/2023

2.3.2 Specific Humidity

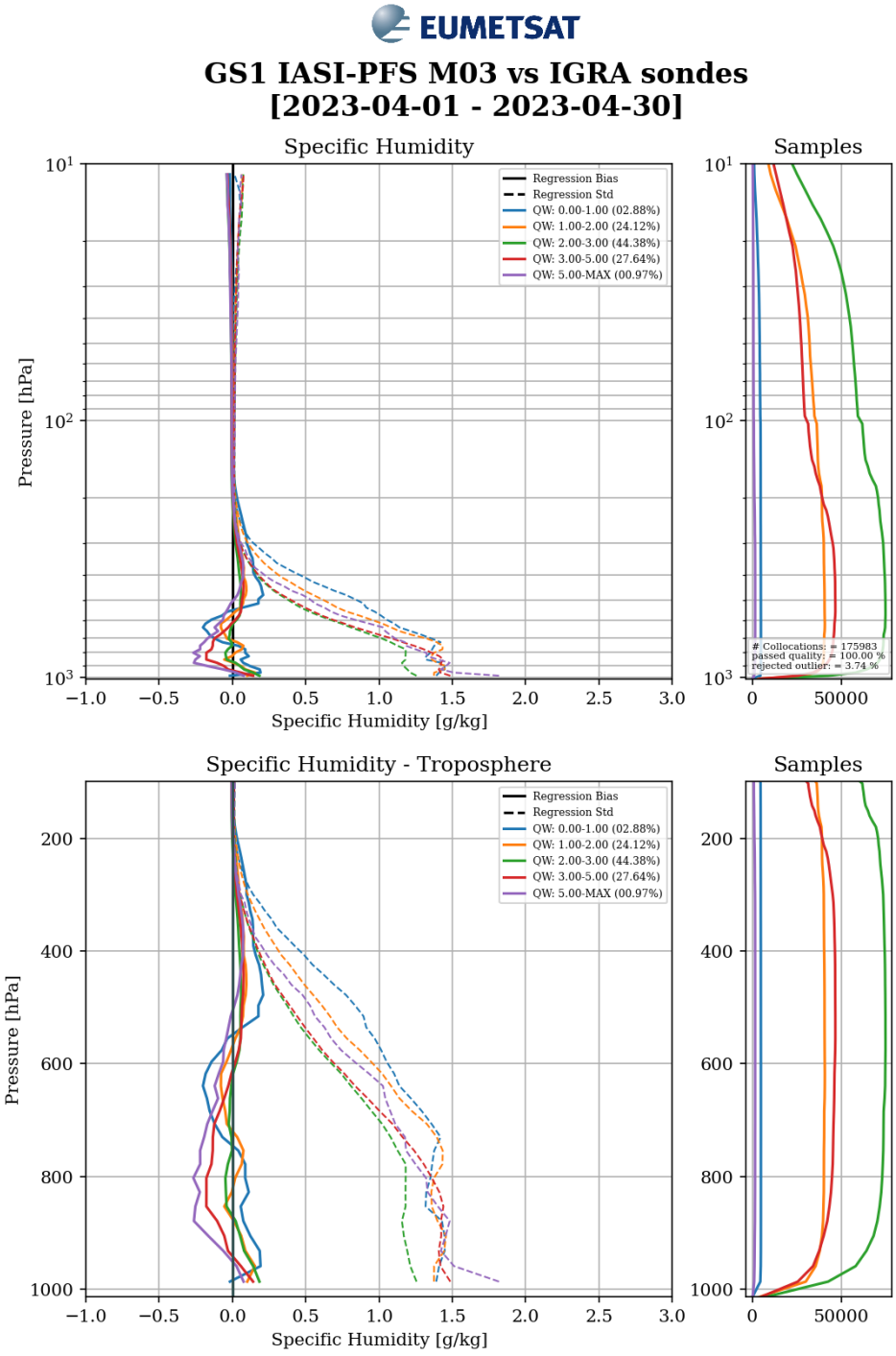

Figure 2.6: IASI *vs* sonde mean (solid line) difference and standard deviation (dash line) in specific humidity for different quality indicator ranges (top: pressure log scale, bottom: linear scale). Global statistics with M03 IASI L2 from GS1 for for 01-30/04/2023

2.3.3 Relative Humidity

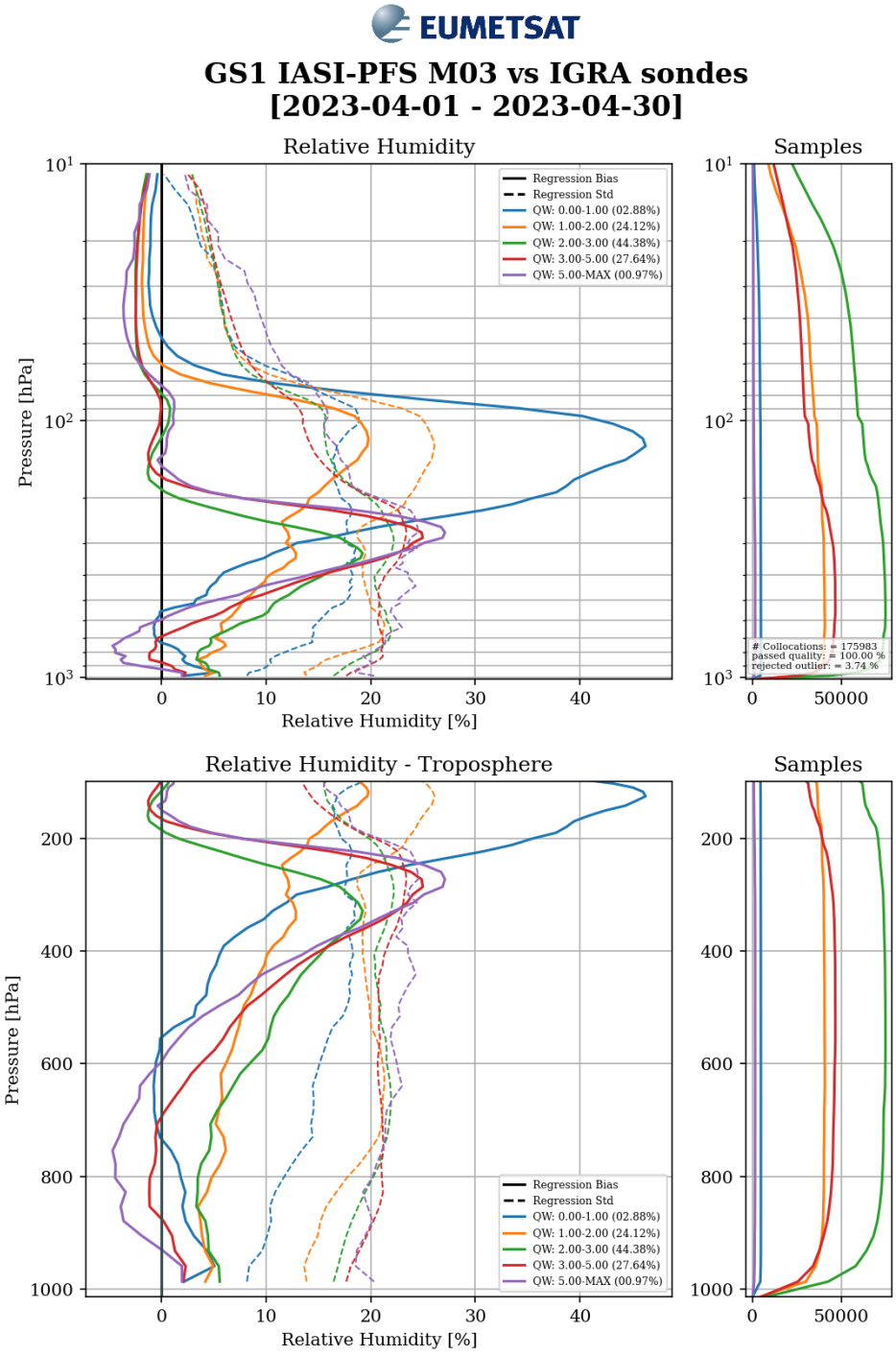

Figure 2.7: IASI *vs* sonde mean (solid line) difference and standard deviation (dash line) in relative humidity for different quality indicator ranges (top: pressure log scale, bottom: linear scale). Global statistics with M03 IASI L2 from GS1 for for 01-30/04/2023

2.4 Monthly time series

2.4.1 Temperature / Humidity

2.4.1.1 Level: 10 hPa

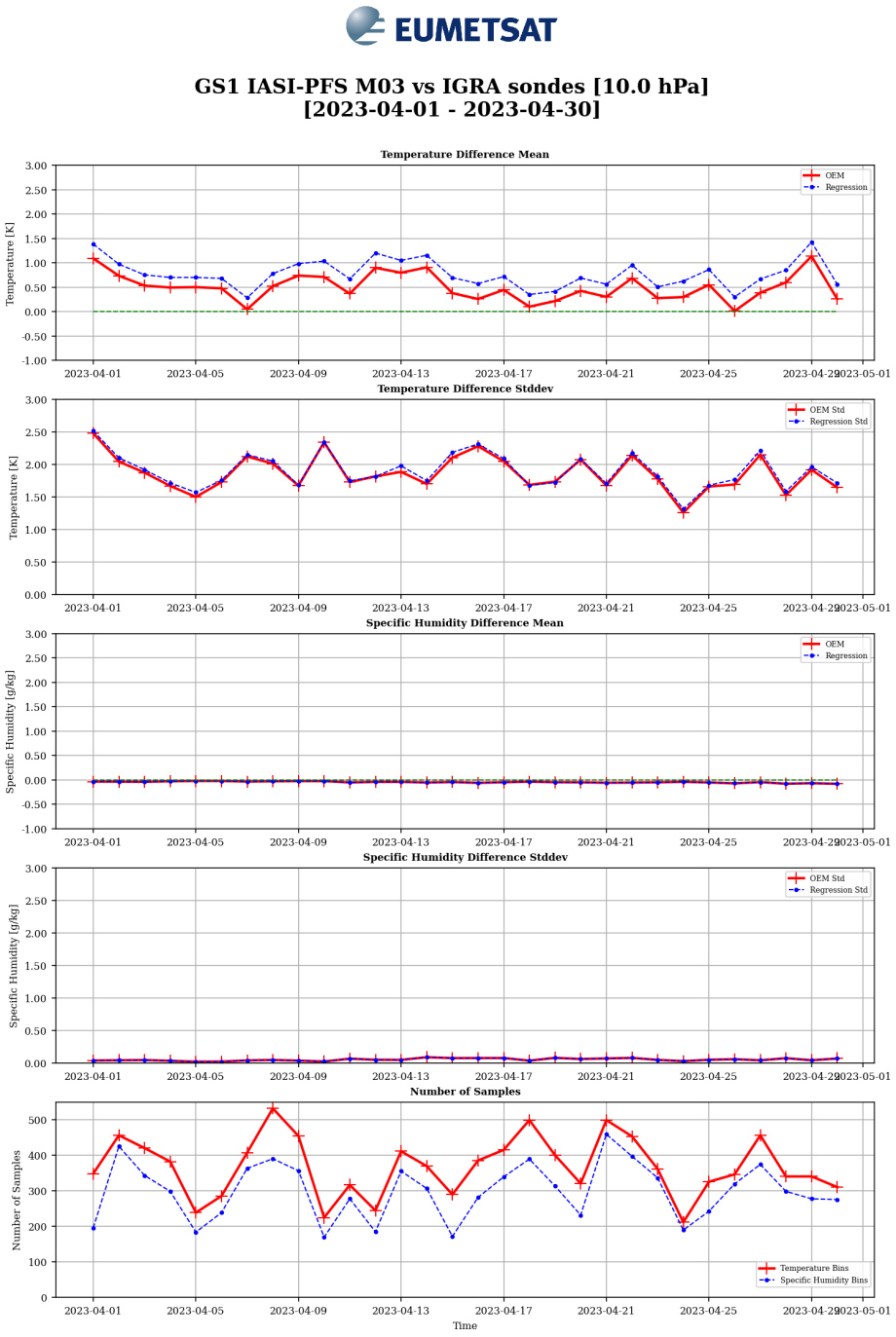

Figure 2.8: Monthly time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 10 hPa. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 for 01-30/04/2023

2.4.1.2 Level: 100 hPa

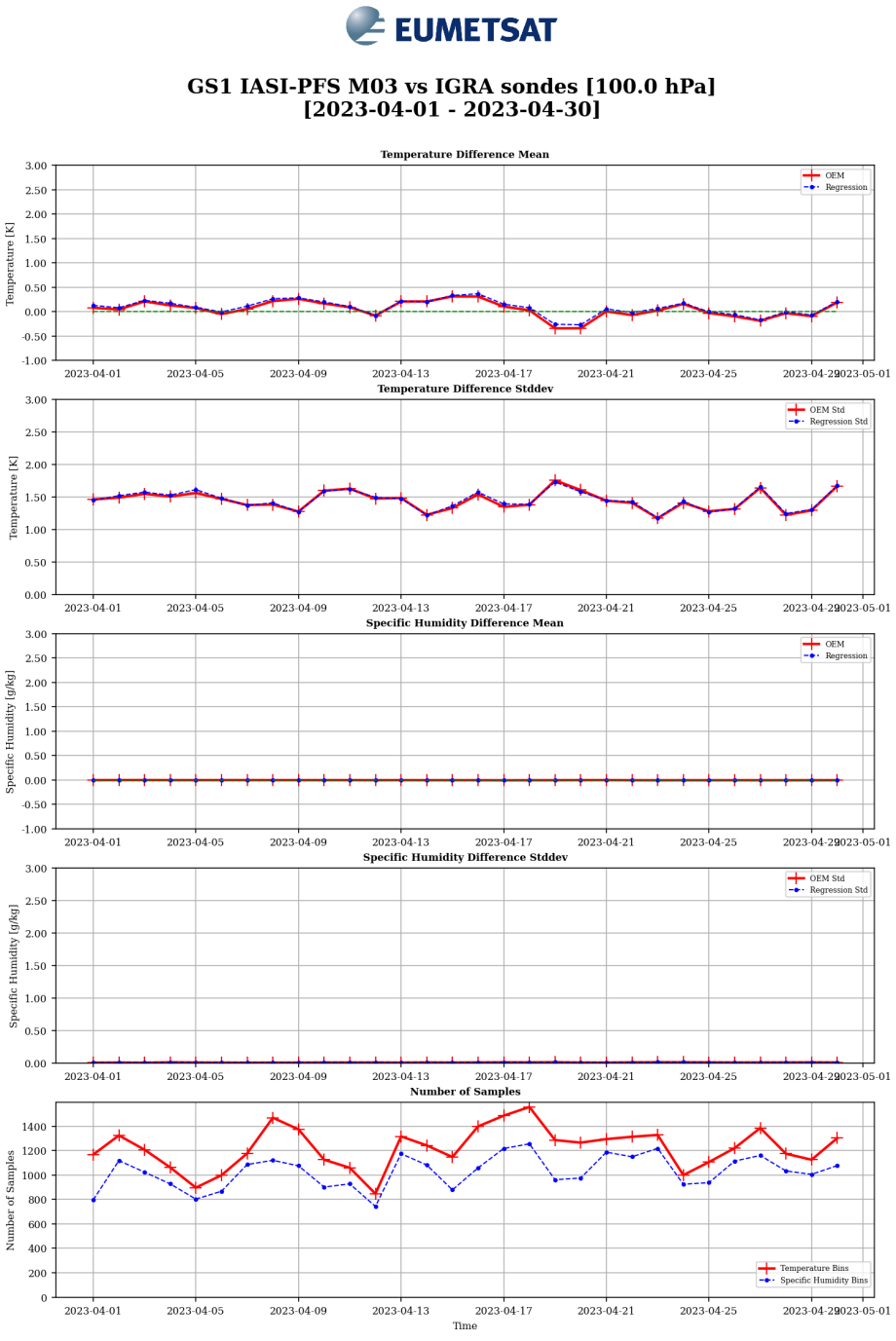

Figure 2.9: Monthly time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 100 hPa. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 for 01-30/04/2023

2.4.1.3 Level: 200 hPa

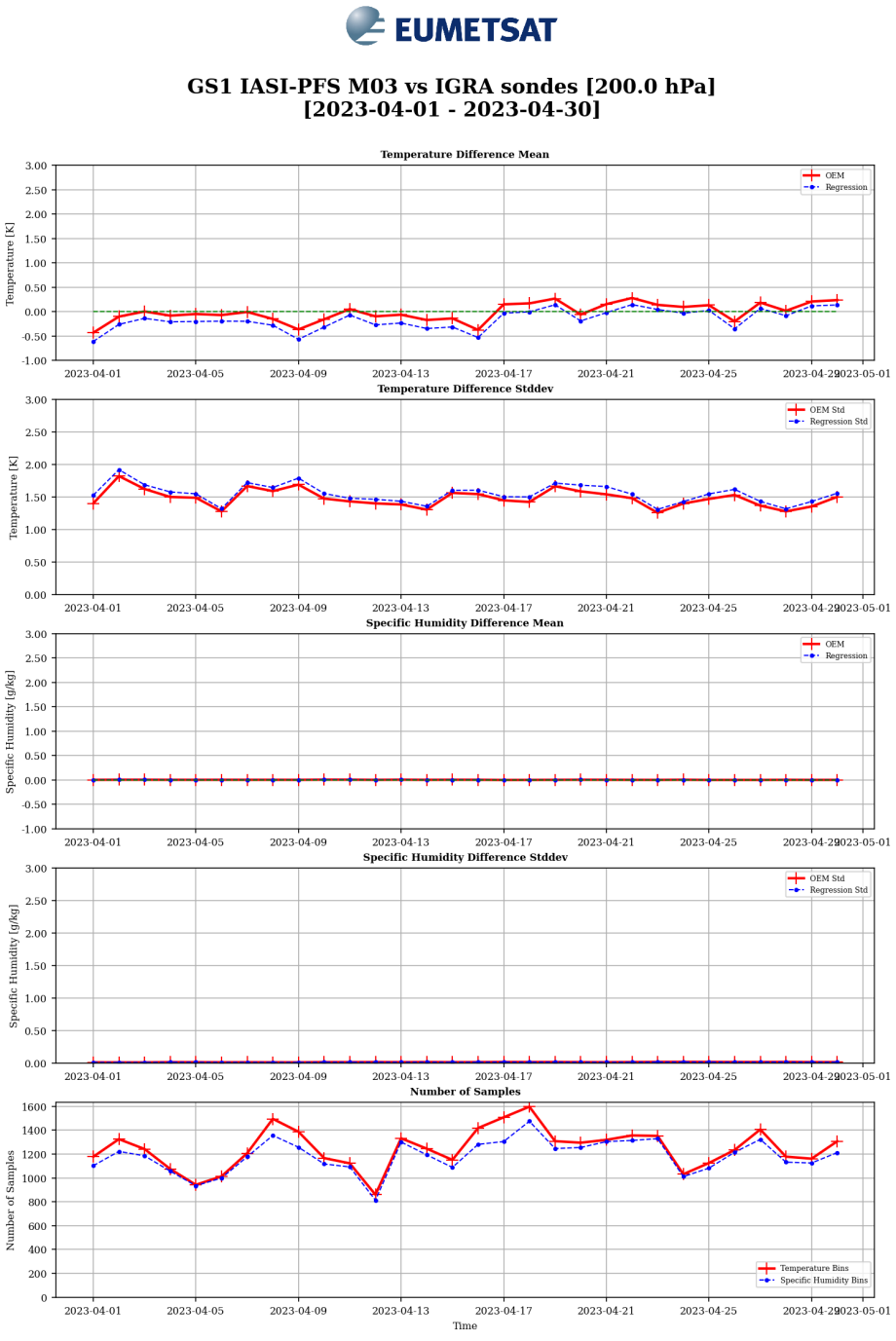

Figure 2.10: Monthly time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 200 hPa. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 for 01-30/04/2023

2.4.1.4 Level: 300 hPa

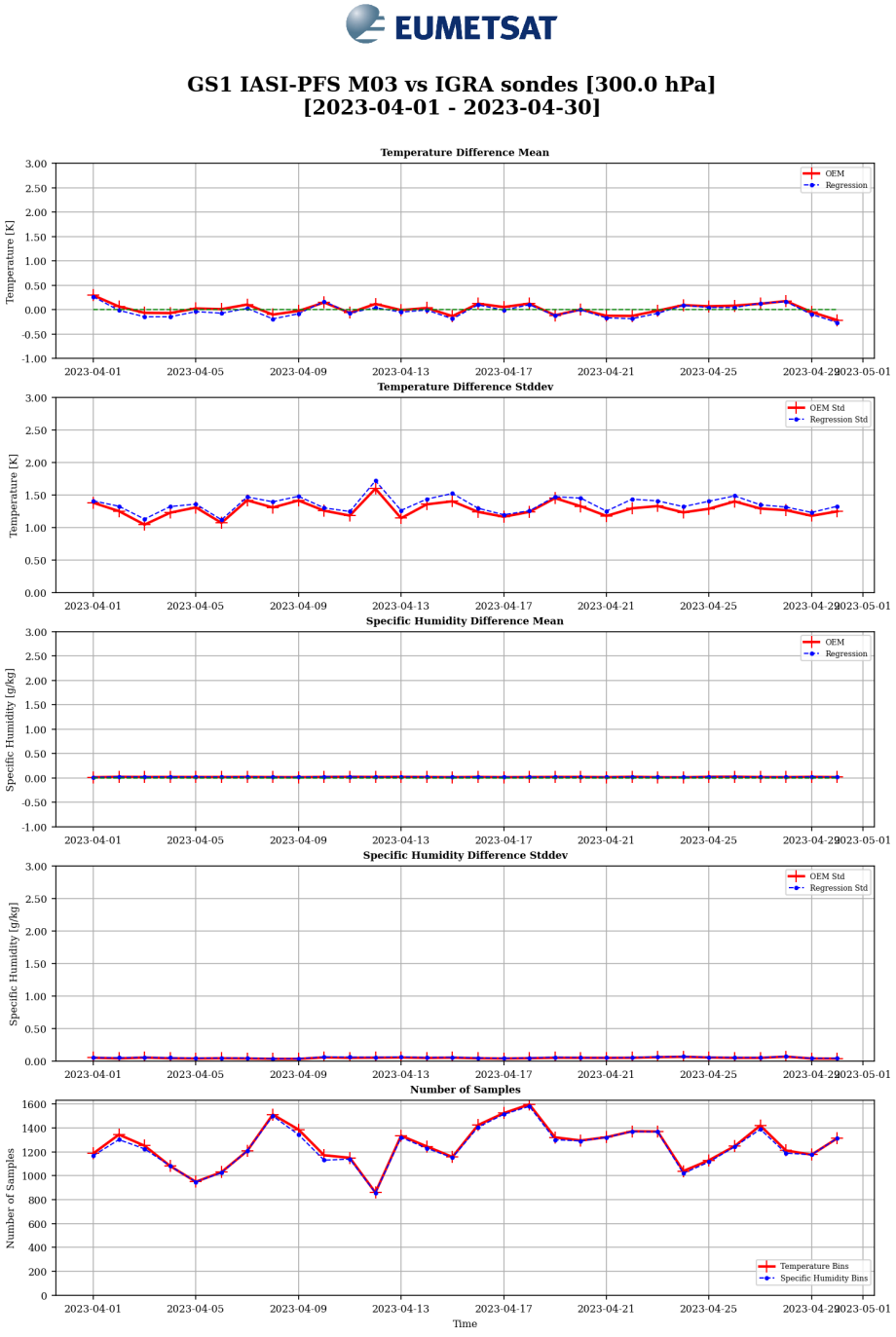

Figure 2.11: Monthly time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 300 hPa. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 for 01-30/04/2023

2.4.1.5 Level: 500 hPa

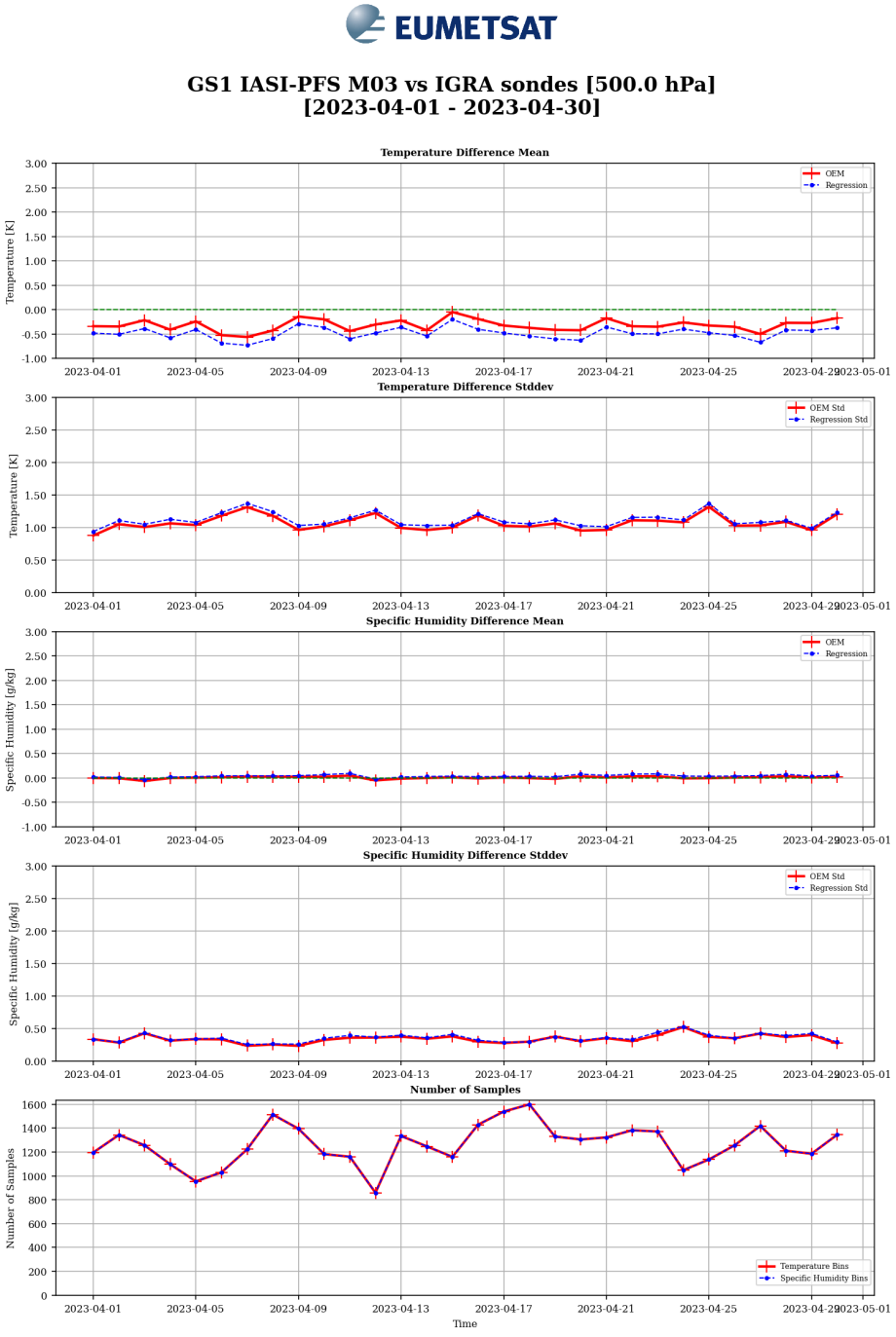

Figure 2.12: Monthly time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 500 hPa. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 for 01-30/04/2023

2.4.1.6 Level: 600 hPa

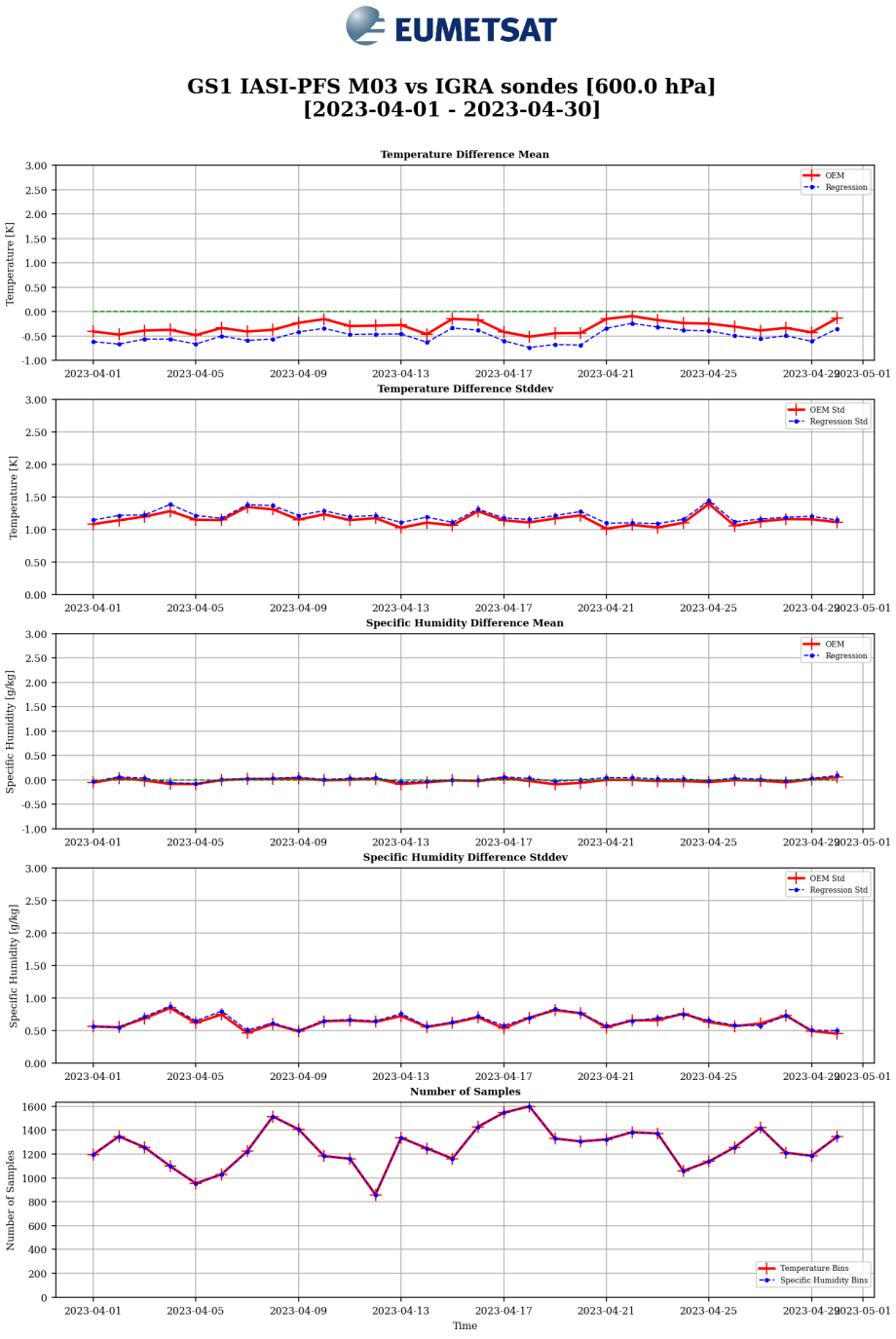

Figure 2.13: Monthly time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 600 hPa. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 for 01-30/04/2023

2.4.1.7 Level: 800 hPa

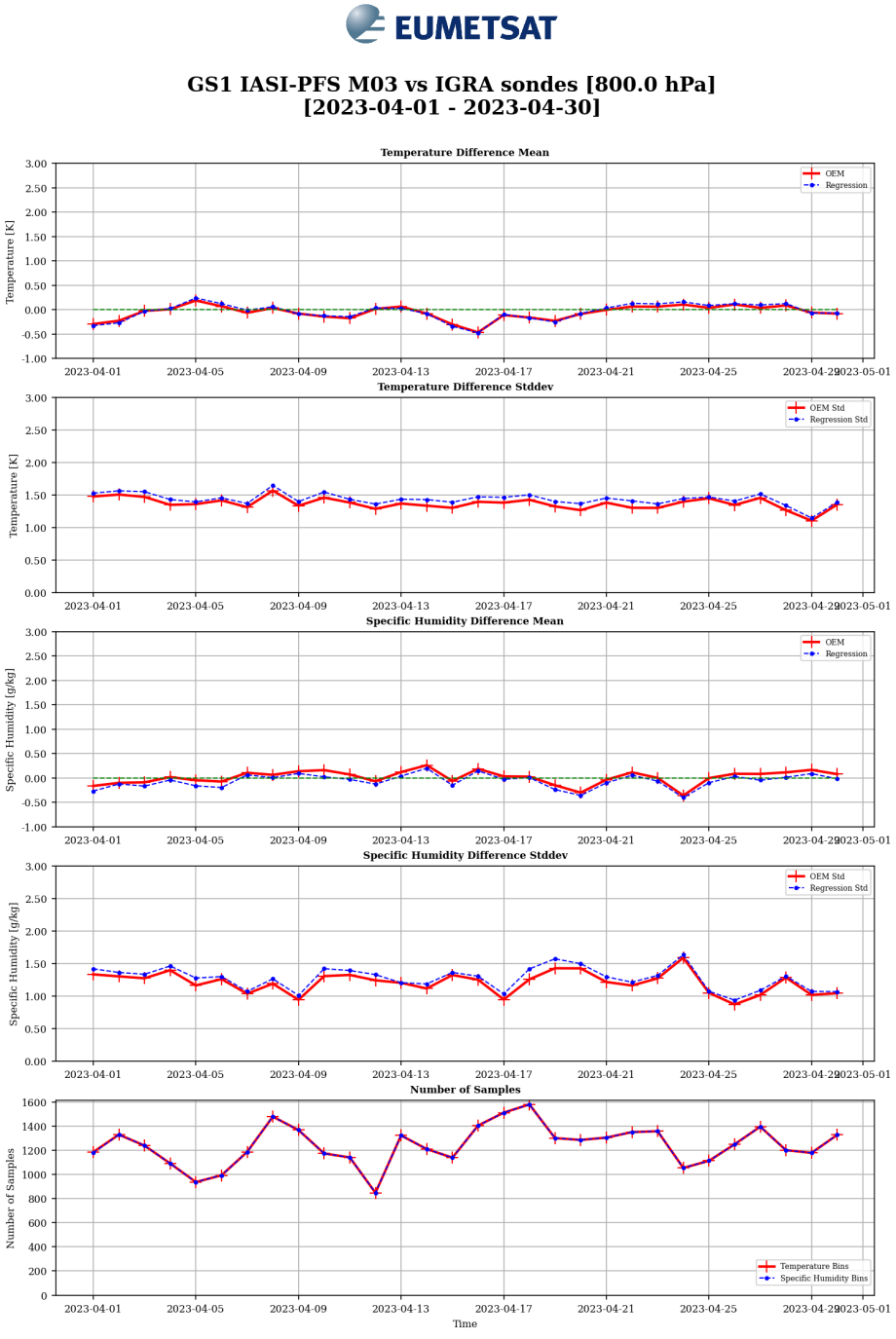

Figure 2.14: Monthly time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 800 hPa. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 for 01-30/04/2023

2.4.1.8 Level: 1000 hPa

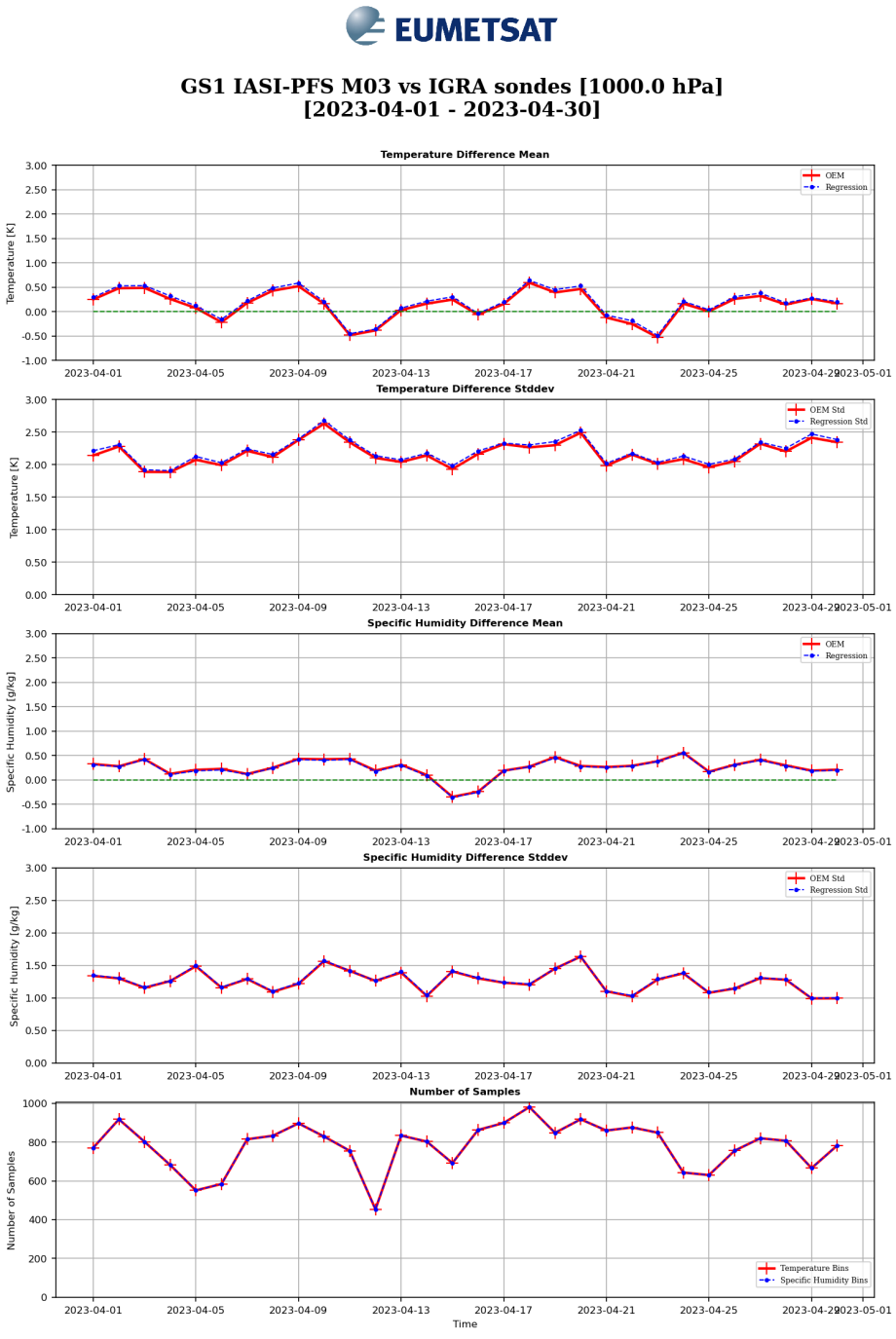

Figure 2.15: Monthly time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 1000 hPa. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 for 01-30/04/2023

2.4.2 Precipitable Water

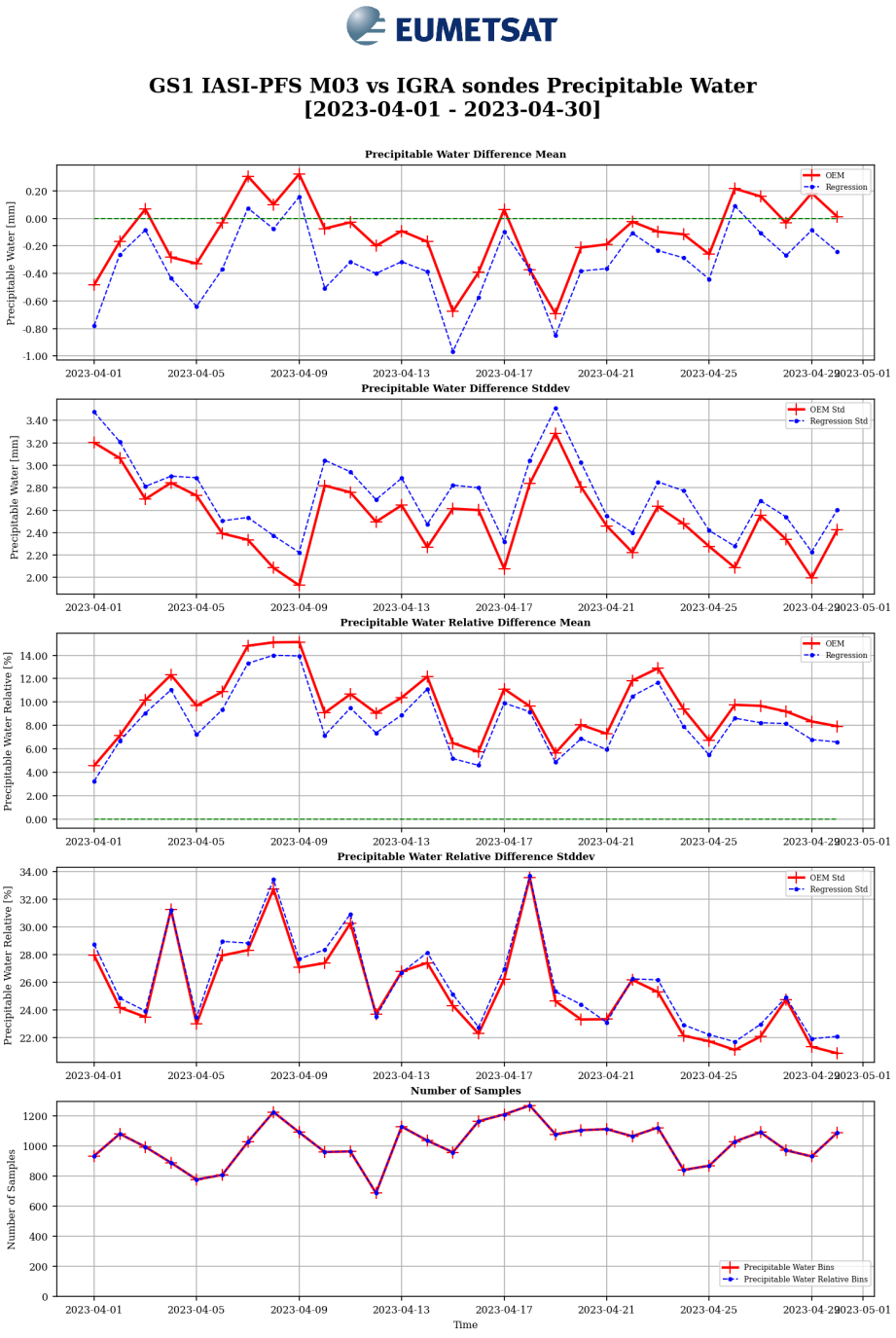

Figure 2.16: Monthly time series of Precipitable Watermean difference and standard deviation in absolute (top 2 panels) and relative Difference (middle 2 panels) between IASI L2 and IGRA. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 for 01-30/04/2023

2.5 Long-term time series

2.5.1 Temperature / Humidity

2.5.1.1 Level: 10 hPa

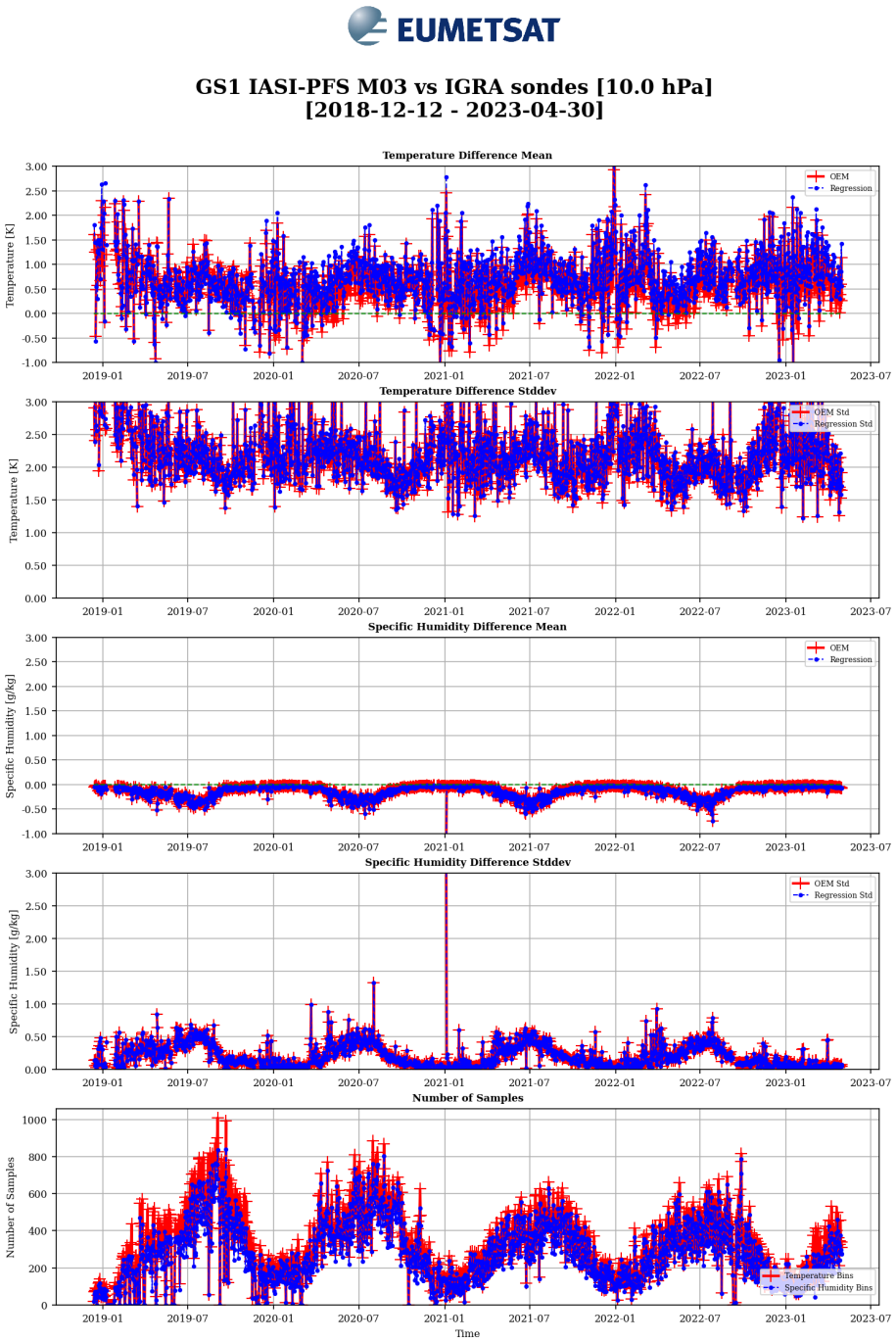

Figure 2.17: Long-term time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 10 hPa. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 updated on 30/04/2023

2.5.1.2 Level: 100 hPa

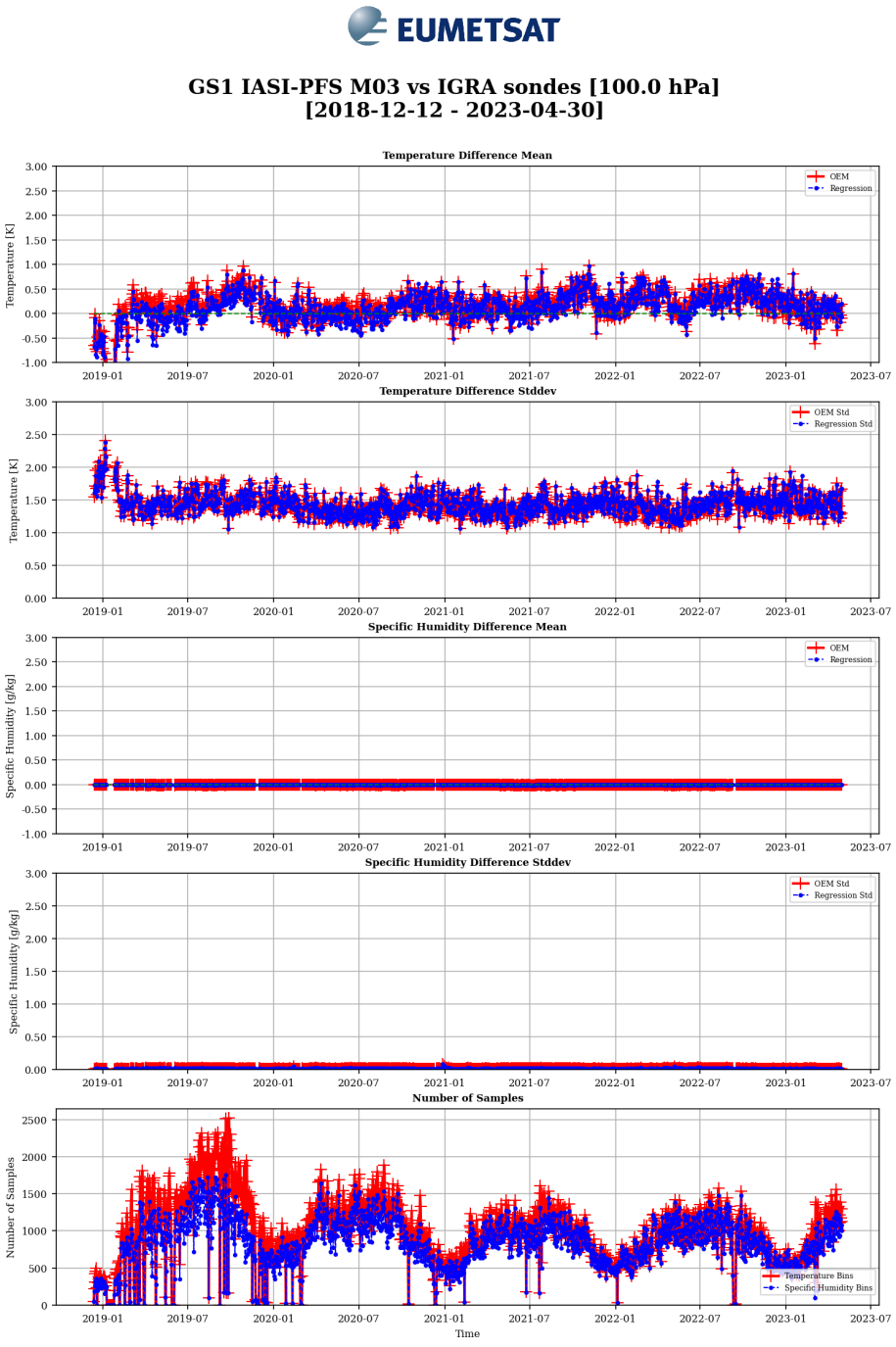

Figure 2.18: Long-term time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 100 hPa. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 updated on 30/04/2023

2.5.1.3 Level: 200 hPa

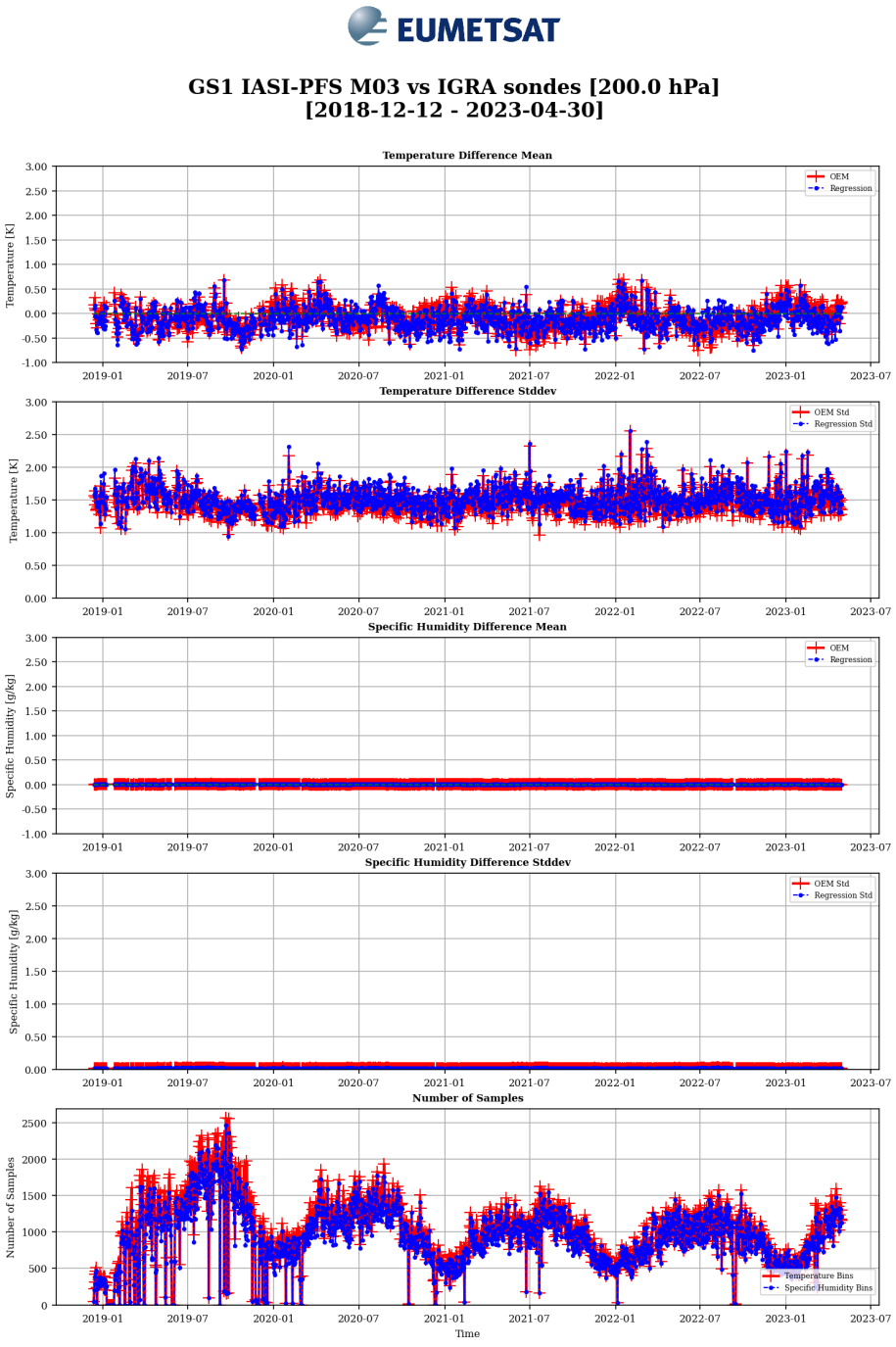

Figure 2.19: Long-term time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 200 hPa. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 updated on 30/04/2023

2.5.1.4 Level: 300 hPa

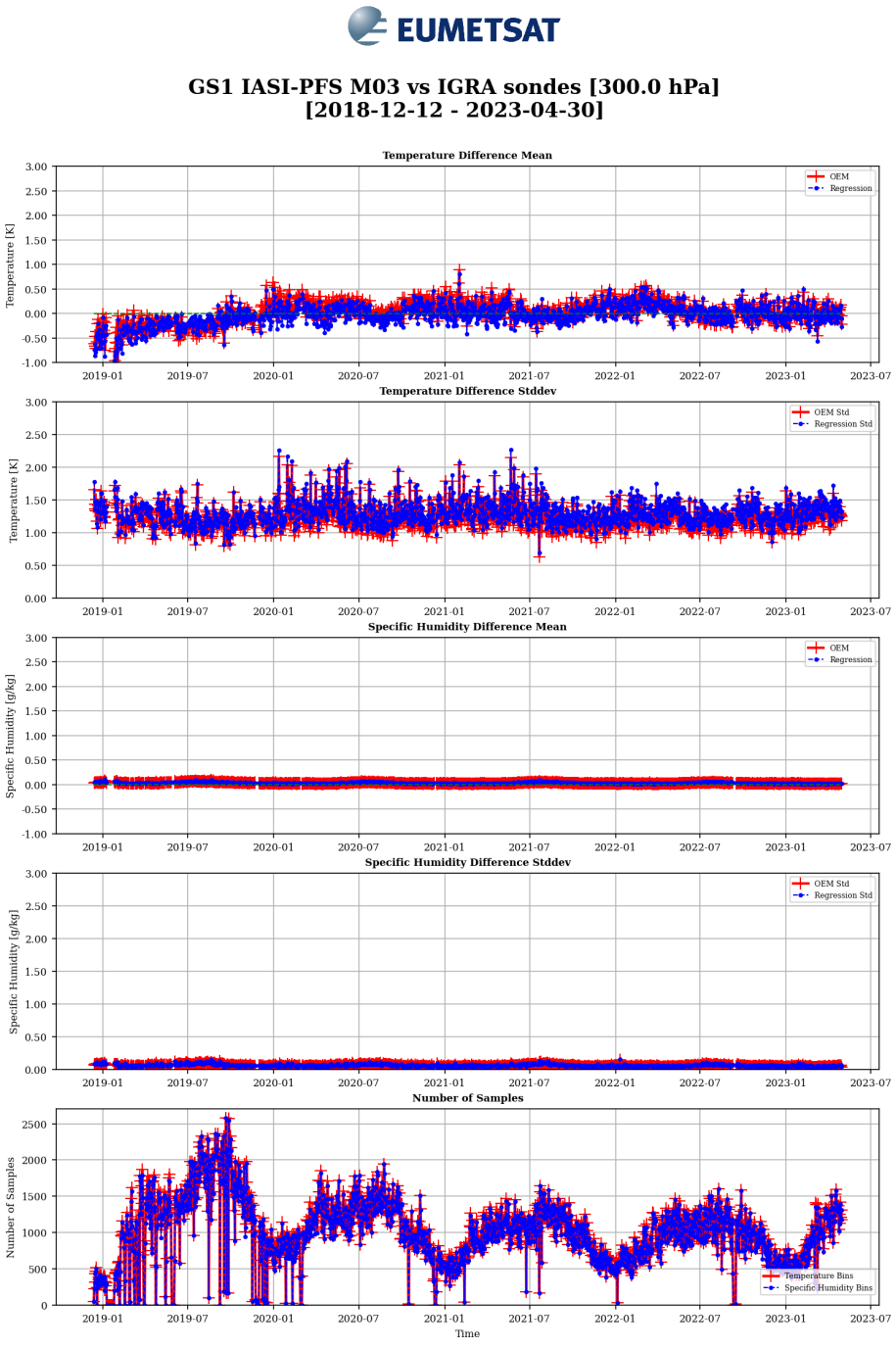

Figure 2.20: Long-term time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 300 hPa. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 updated on 30/04/2023

2.5.1.5 Level: 500 hPa

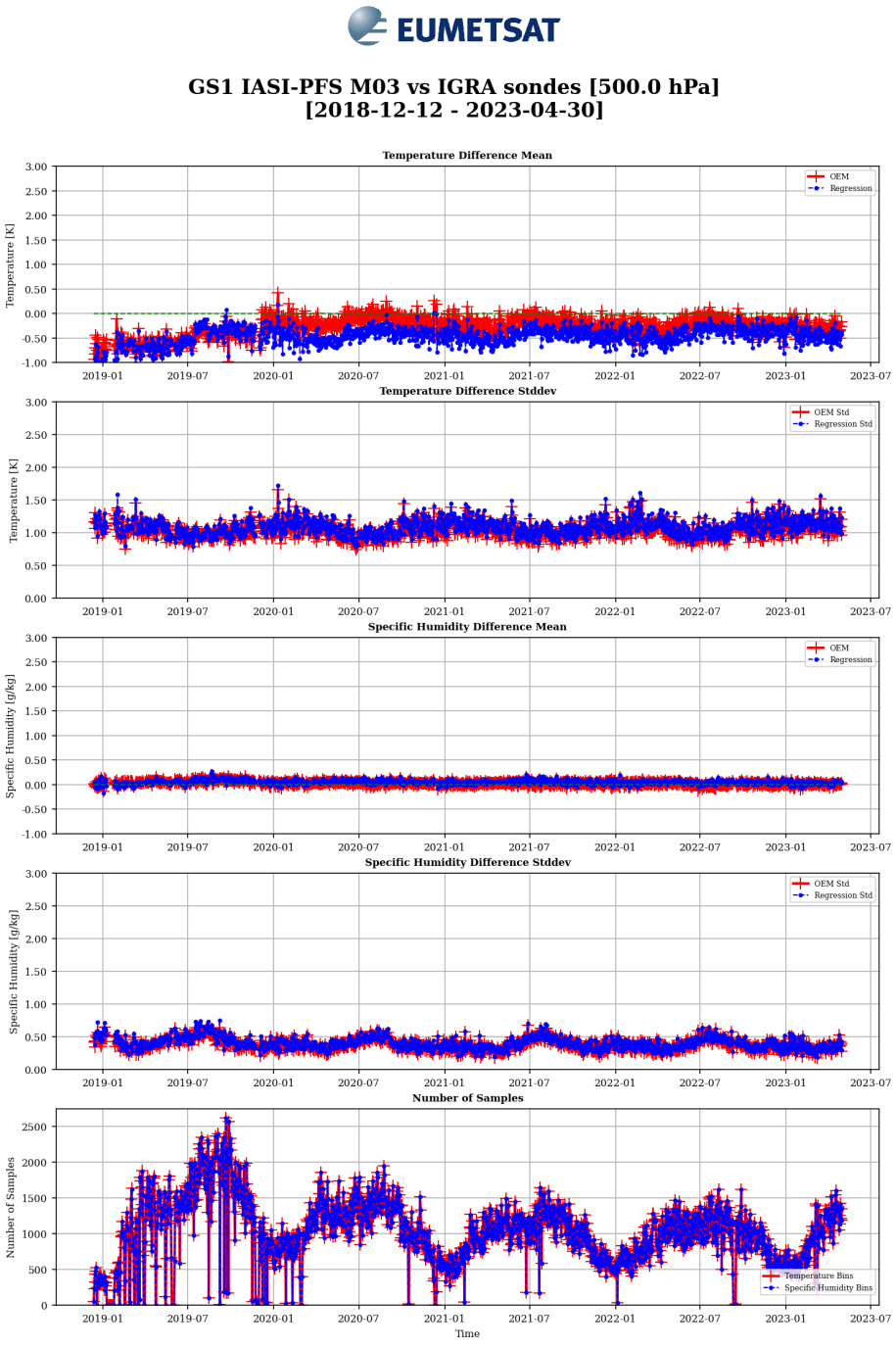

Figure 2.21: Long-term time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 500 hPa. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 updated on 30/04/2023

2.5.1.6 Level: 600 hPa

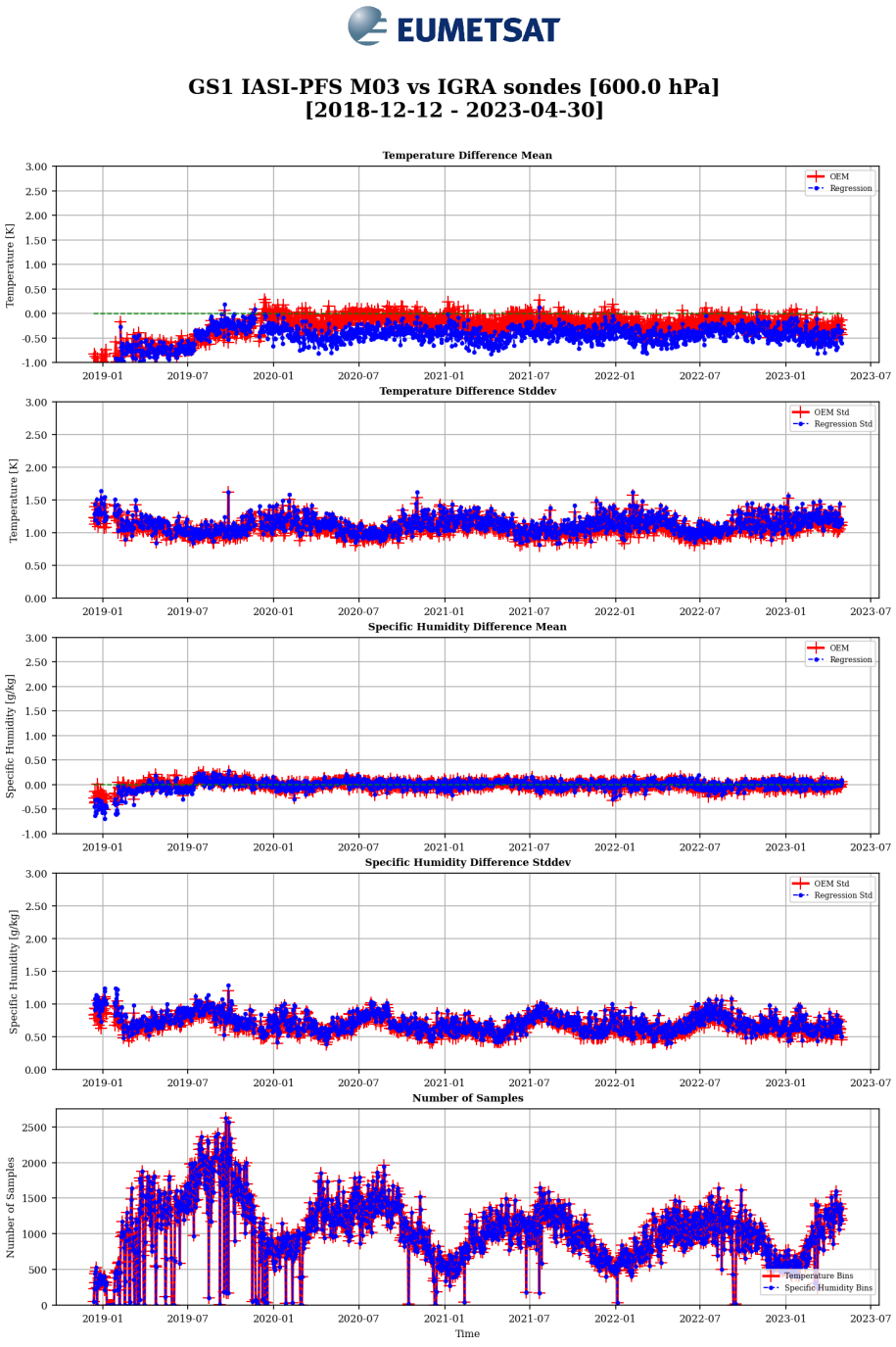

Figure 2.22: Long-term time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 600 hPa. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 updated on 30/04/2023

2.5.1.7 Level: 800 hPa

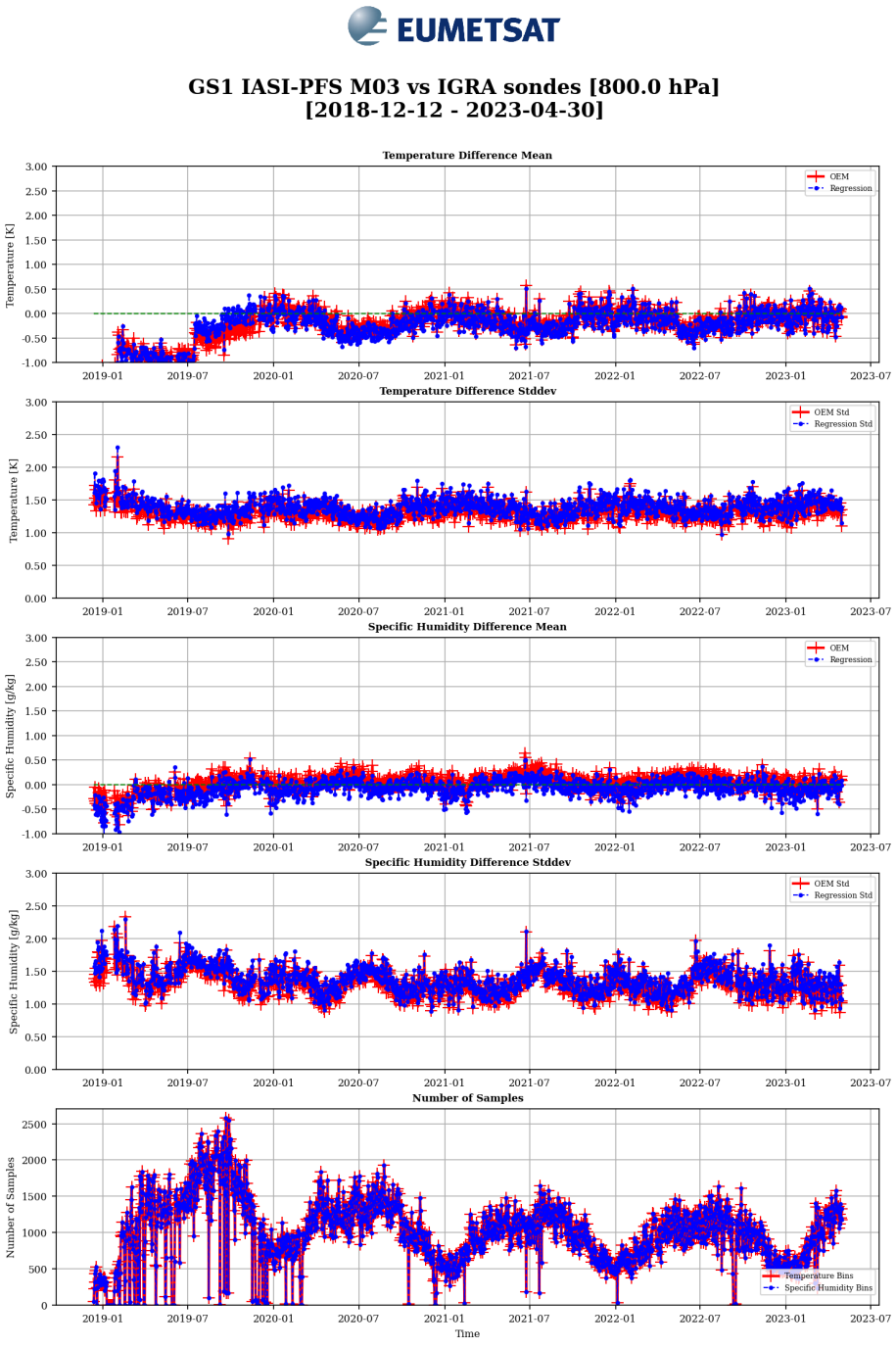

Figure 2.23: Long-term time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 800 hPa. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 updated on 30/04/2023

2.5.1.8 Level: 1000 hPa

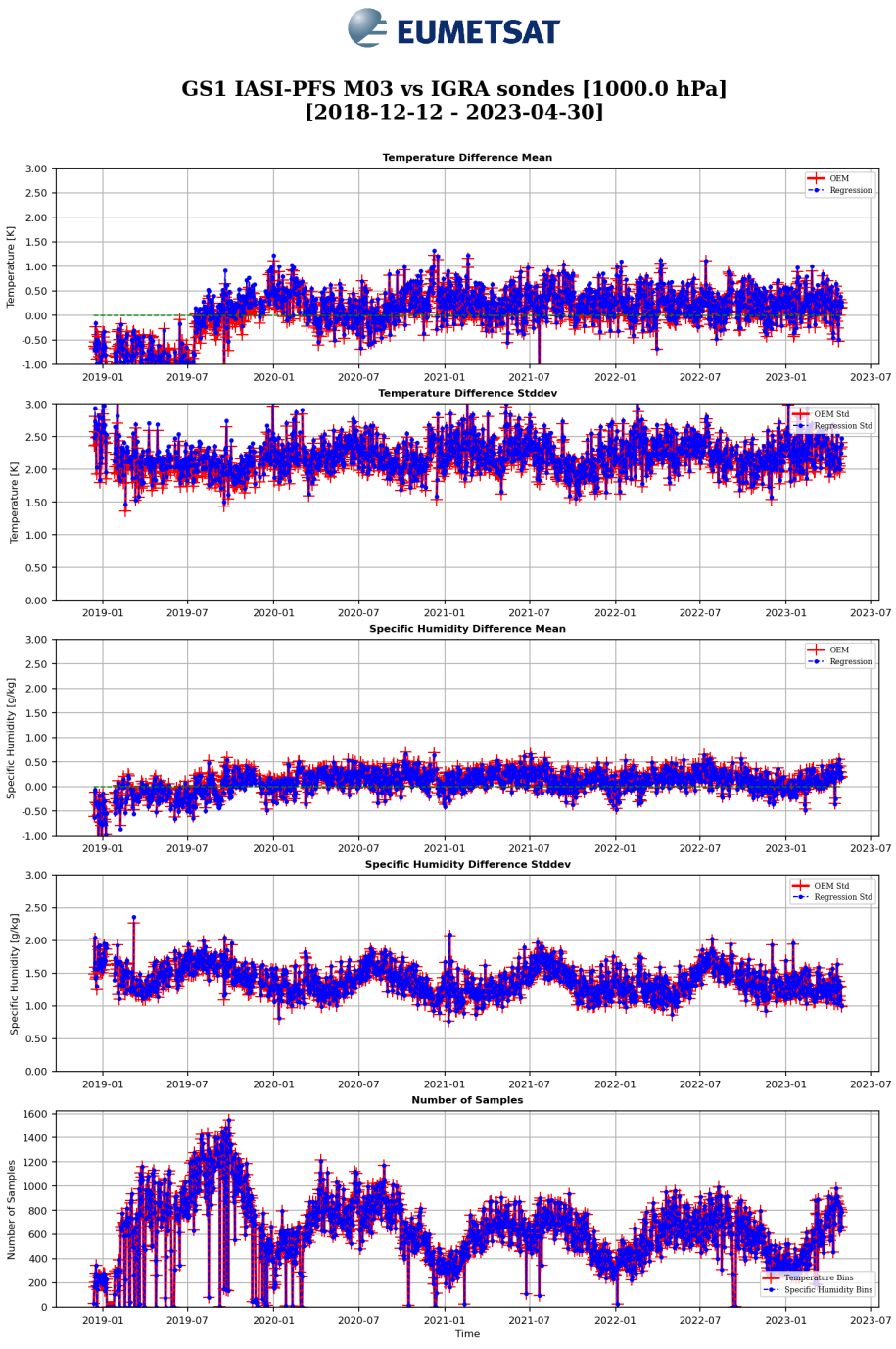

Figure 2.24: Long-term time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 1000 hPa. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 updated on 30/04/2023

2.5.2 Precipitable Water

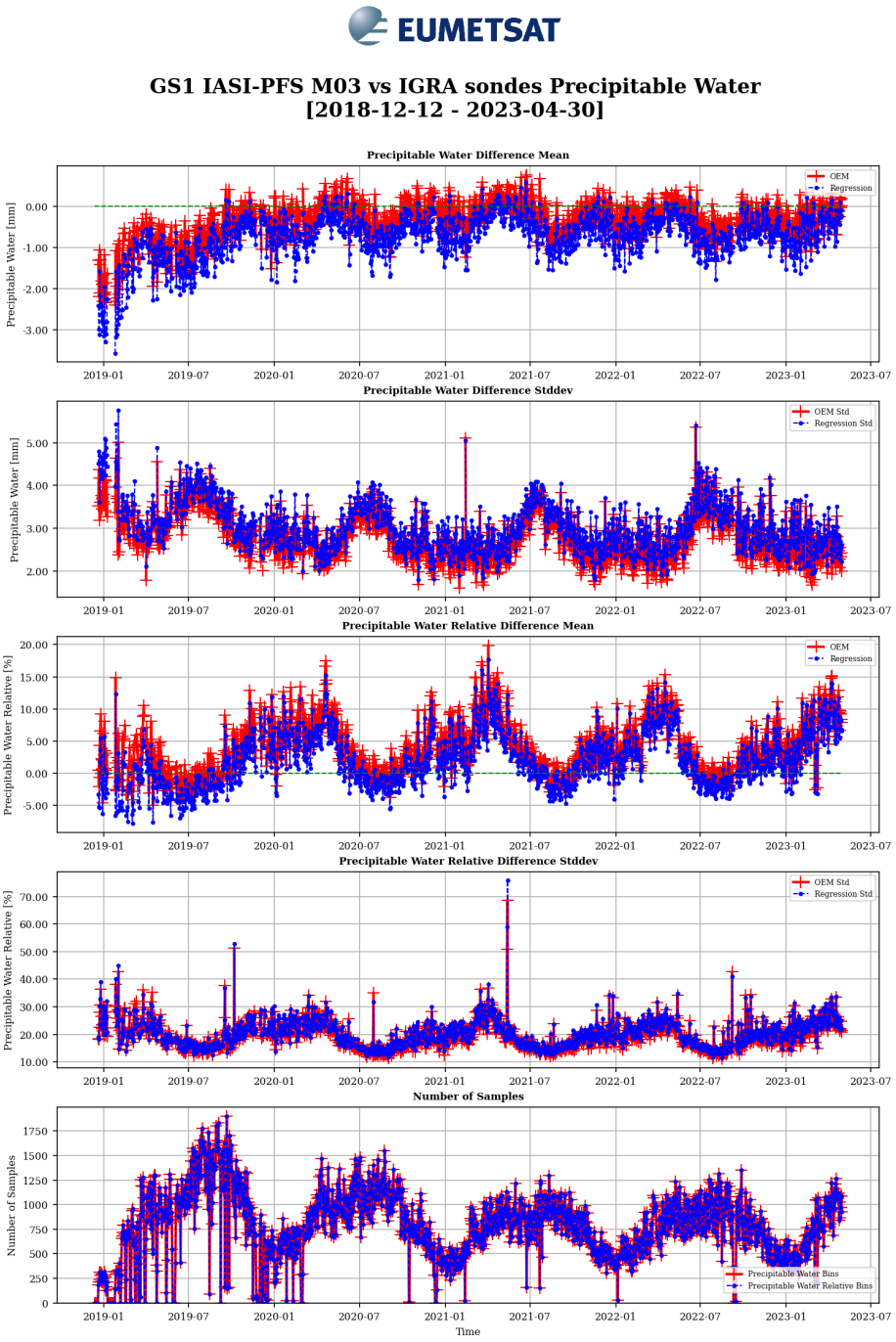

Figure 2.25: Long-term time series of Precipitable Water mean difference and standard deviation in absolute (top 2 panels) and relative Difference (middle 2 panels) between IASI L2 and IGRA. The bottom panel shows the number of Monthly match-ups. Global statistics with M03 IASI L2 from GS1 for 01-30/04/2023

2.6 Histograms

2.6.1 Moist adiabatic lapse rate

2.6.1.1 Layer: 1500m above Surface

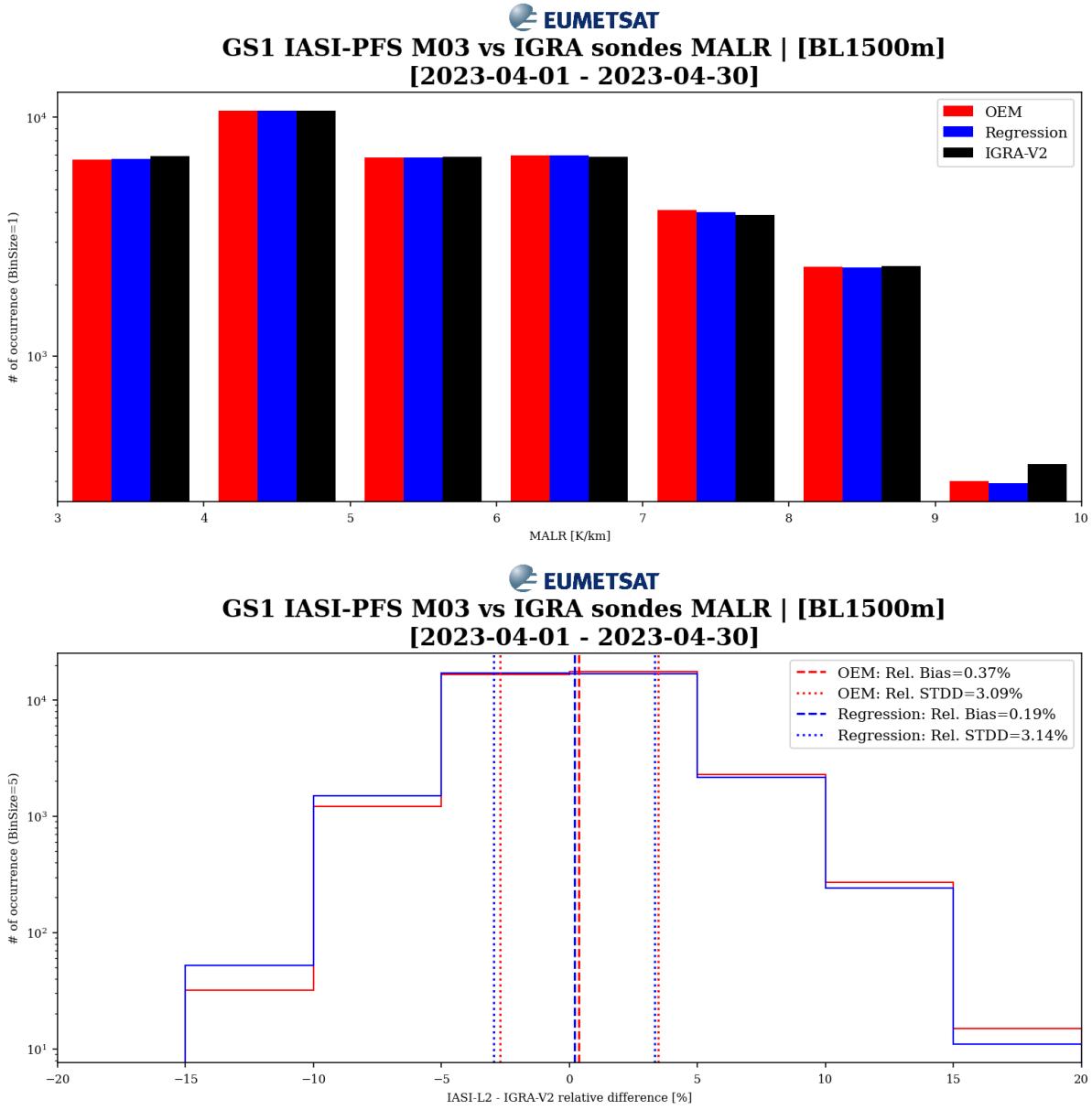

Figure 2.26: Mean Moist Adiabatic Lapse Rate (MA-Lapse Rate) Histograms as barcharts in absolute units (top) and relative differences (bottom) between IASI L2 and IGRA (ylog). Global statistics with M03 IASI L2 from GS1 for 01-30/04/2023 for the layer 1.5 km above the surface.

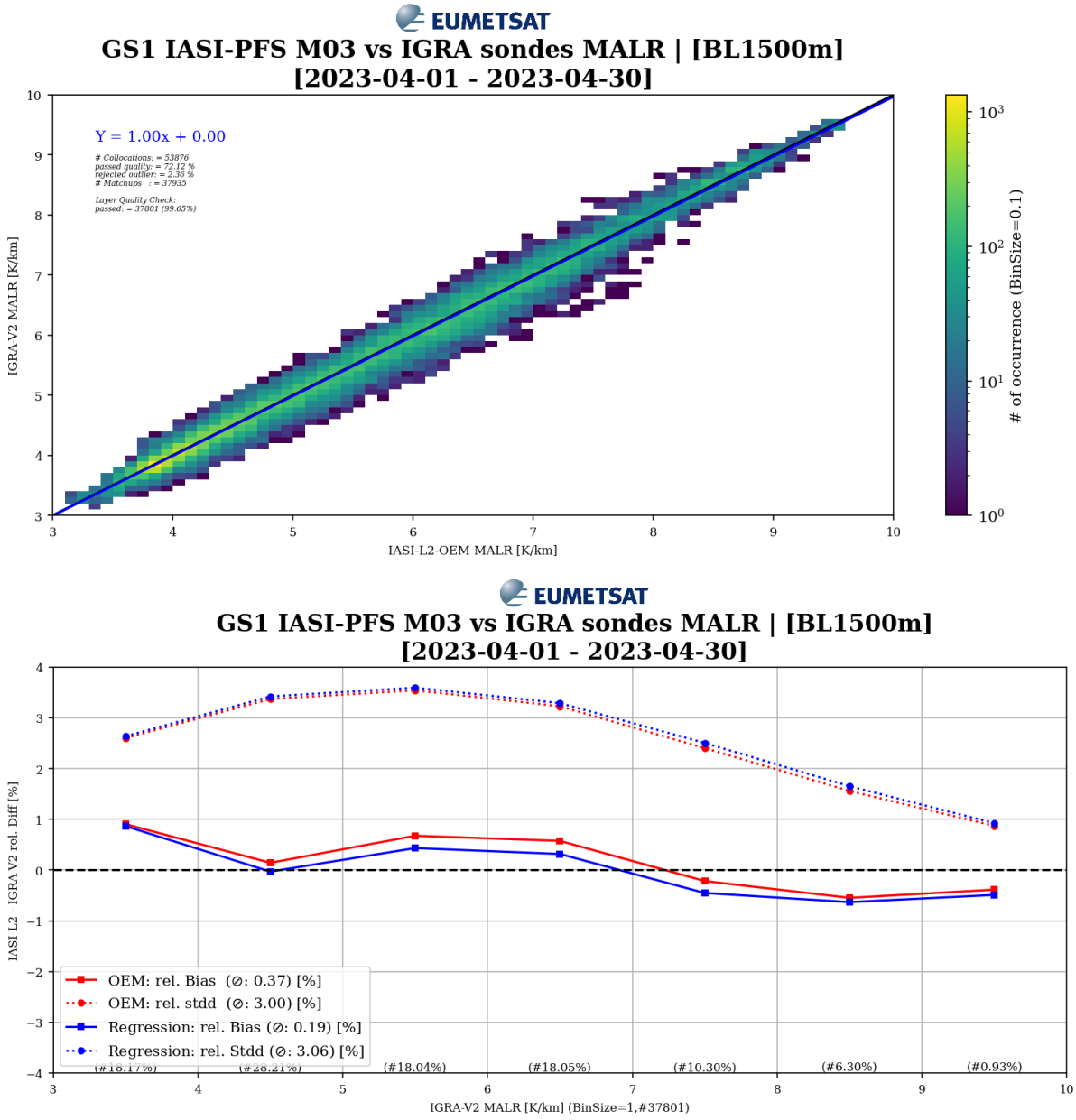

Figure 2.27: Mean Moist Adiabatic Lapse Rate (MA-Lapse Rate) 2D-Histogram (top) and bias and standard deviation as per pre-defined bins of the IGRA reference (bottom) between IASI L2 and IGRA measurements. Global statistics with M03 IASI L2 from GS1 for 01-30/04/2023 for the layer 1.5 km above the surface.

2.6.1.2 Layer: 850 - 500 hPa

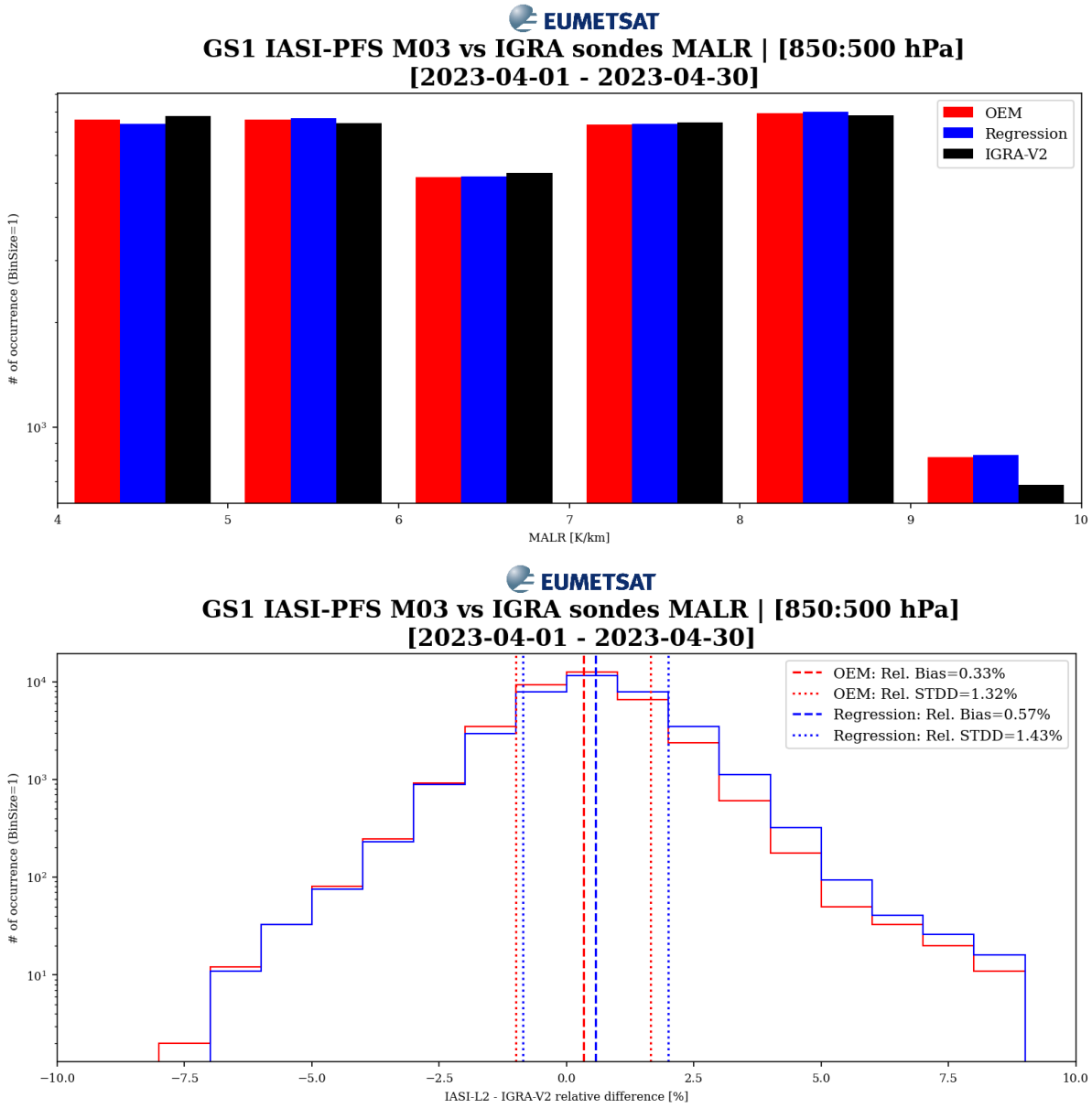

Figure 2.28: Mean Moist Adiabatic Lapse Rate (MA-Lapse Rate) Histograms as barcharts in absolute units (top) and relative differences (bottom) between IASI L2 and IGRA (ylog). Global statistics with M03 IASI L2 from GS1 for 01-30/04/2023 for the layer from 850 to 500 hPa.

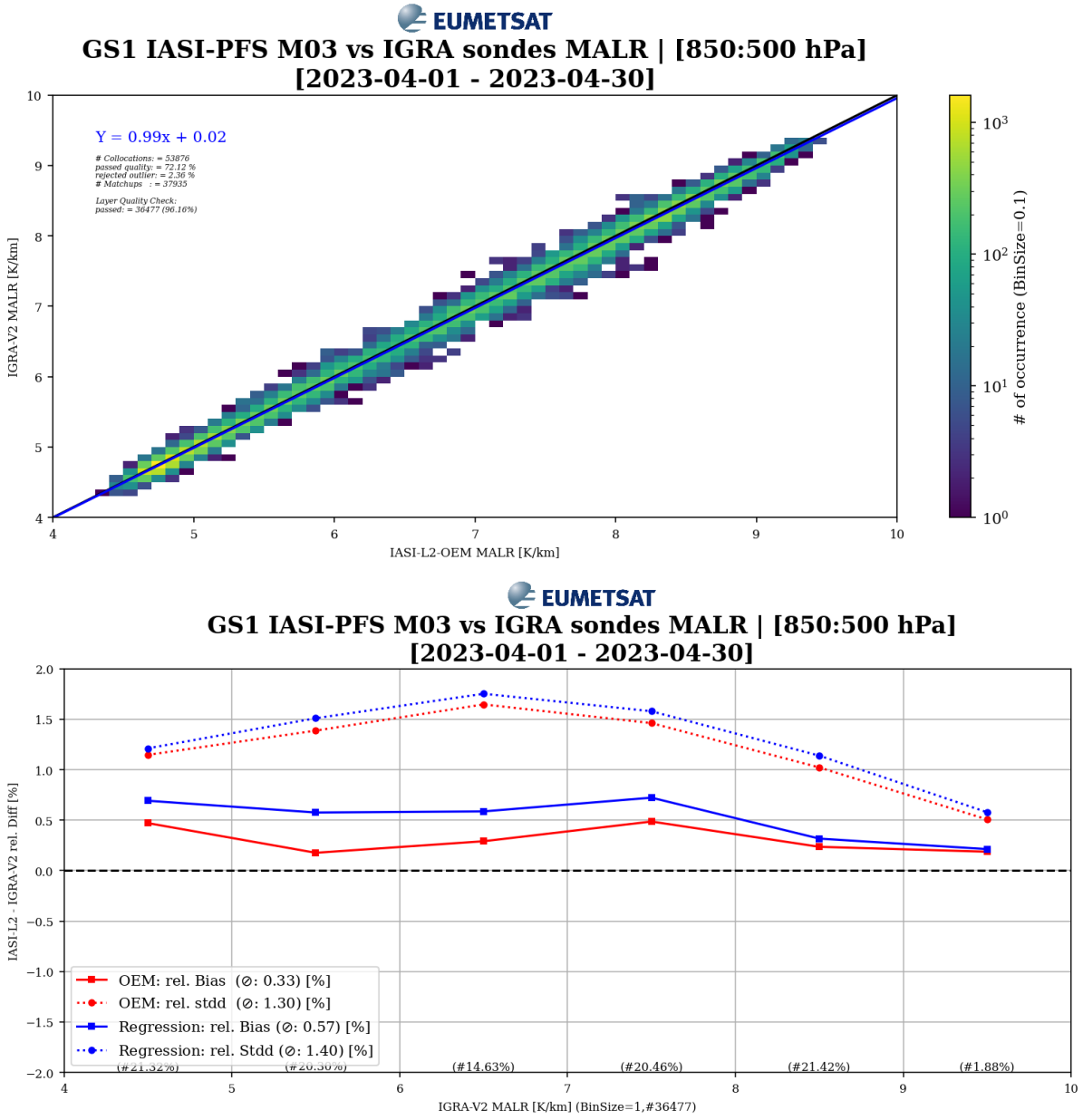

Figure 2.29: Mean Moist Adiabatic Lapse Rate (MA-Lapse Rate) 2D-Histogram (top) and bias and standard deviation as per pre-defined bins of the IGRA reference (bottom) between IASI L2 and IGRA measurements. Global statistics with M03 IASI L2 from GS1 for 01-30/04/2023 for the layer from 850 to 500 hPa.

2.6.2 Precipitable Water

2.6.2.1 Total Column

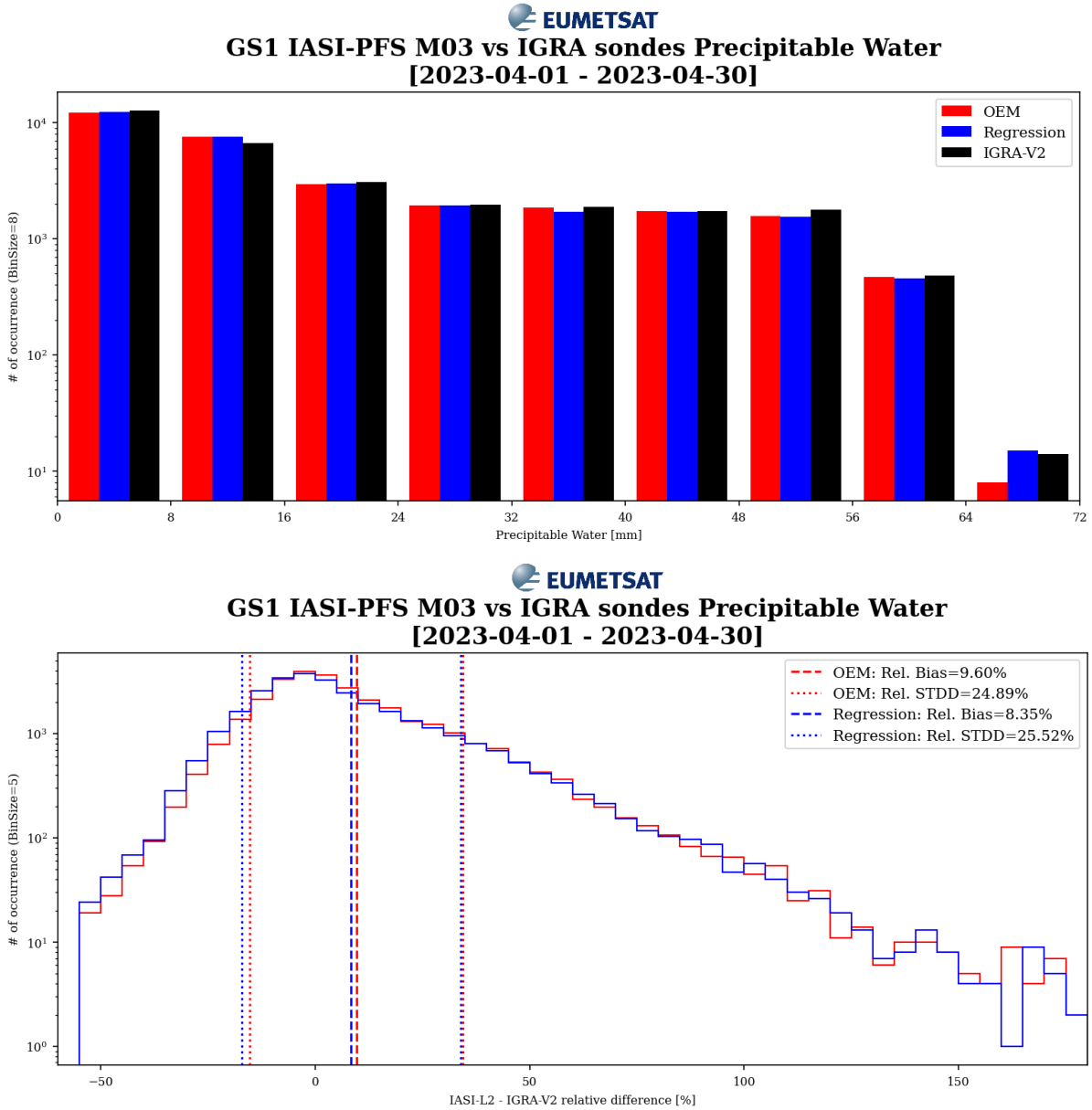

Figure 2.30: Histograms as barcharts in mm (top) and relative differences (bottom) between IASI L2 Precipitable Water and IGRA (ylog), with M03 IASI L2 from GS1 for 01-30/04/2023

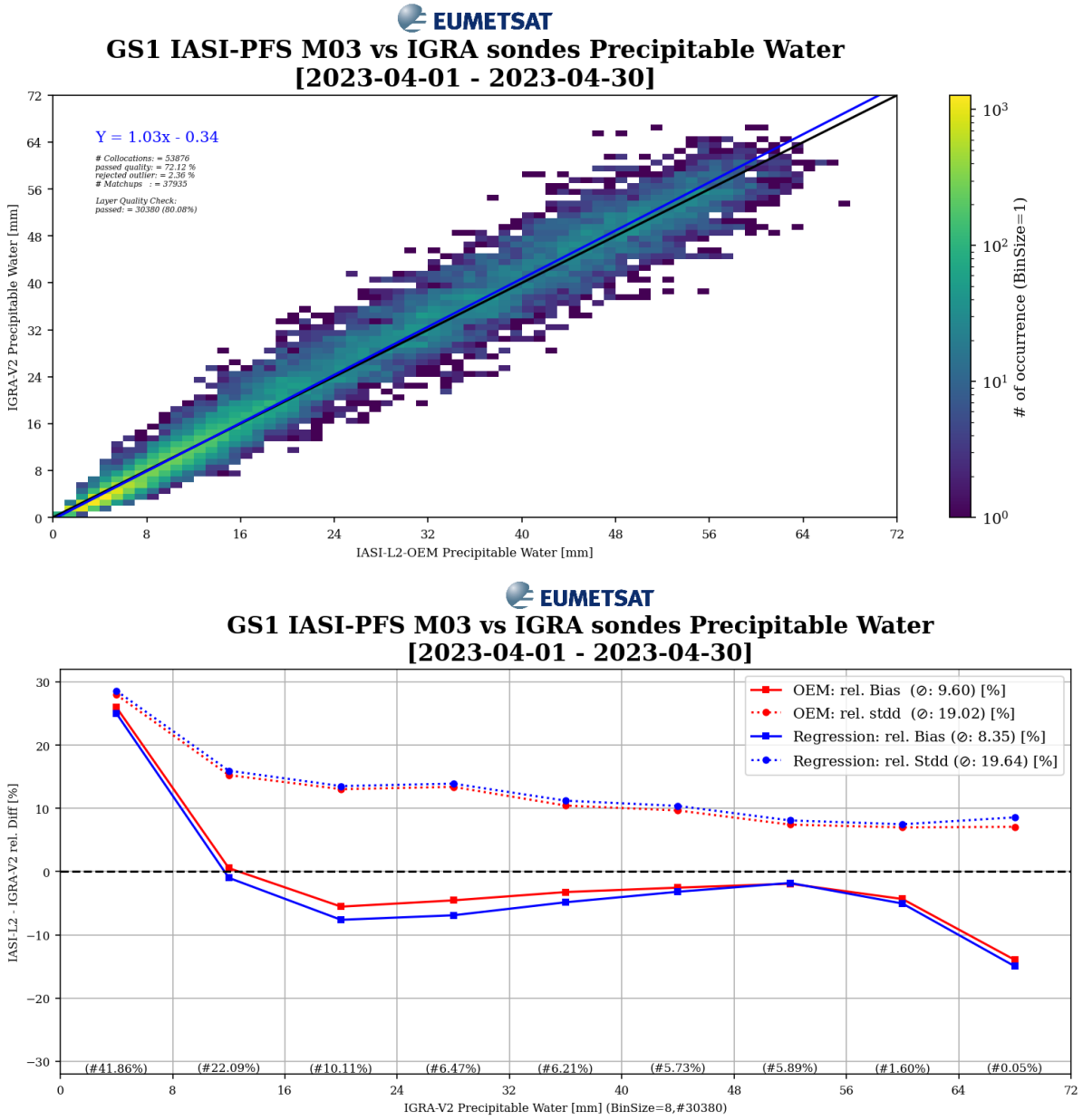

Figure 2.31: 2D Histogram (top) and bias and standard deviation as per 5-mm-sized-bin of the IGRA reference (bottom) between IASI L2 Precipitable Water and IGRA measurements, with M03 IASI L2 from GS1 for 01-30/04/2023

2.6.2.2 Layer: 1500m above Surface

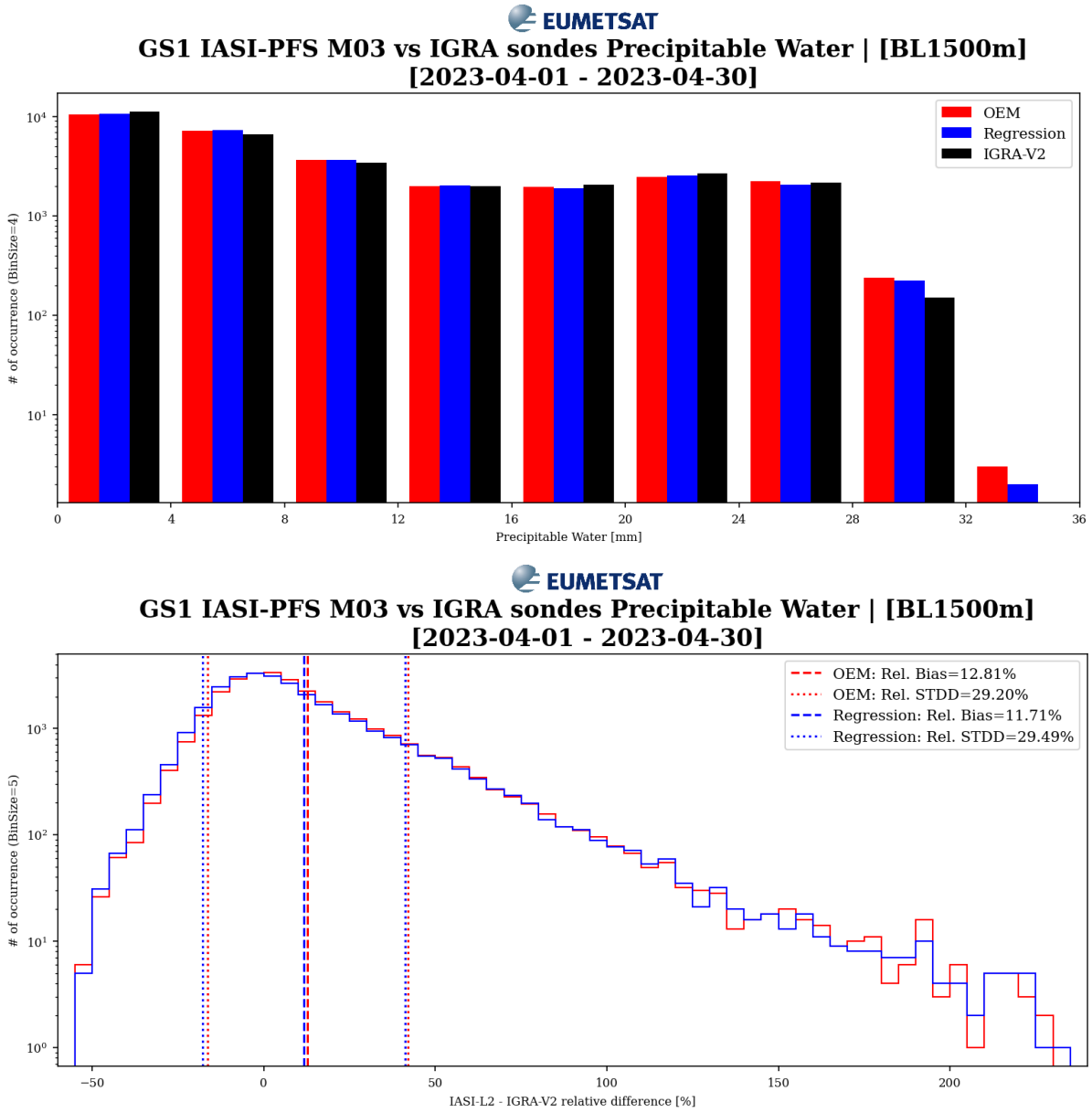

Figure 2.32: Histograms as barcharts in mm (top) and relative differences (bottom) between IASI L2 Precipitable Water and IGRA (ylog), with M03 IASI L2 from GS1 for 01-30/04/2023 for the layer 1.5 km above the surface.

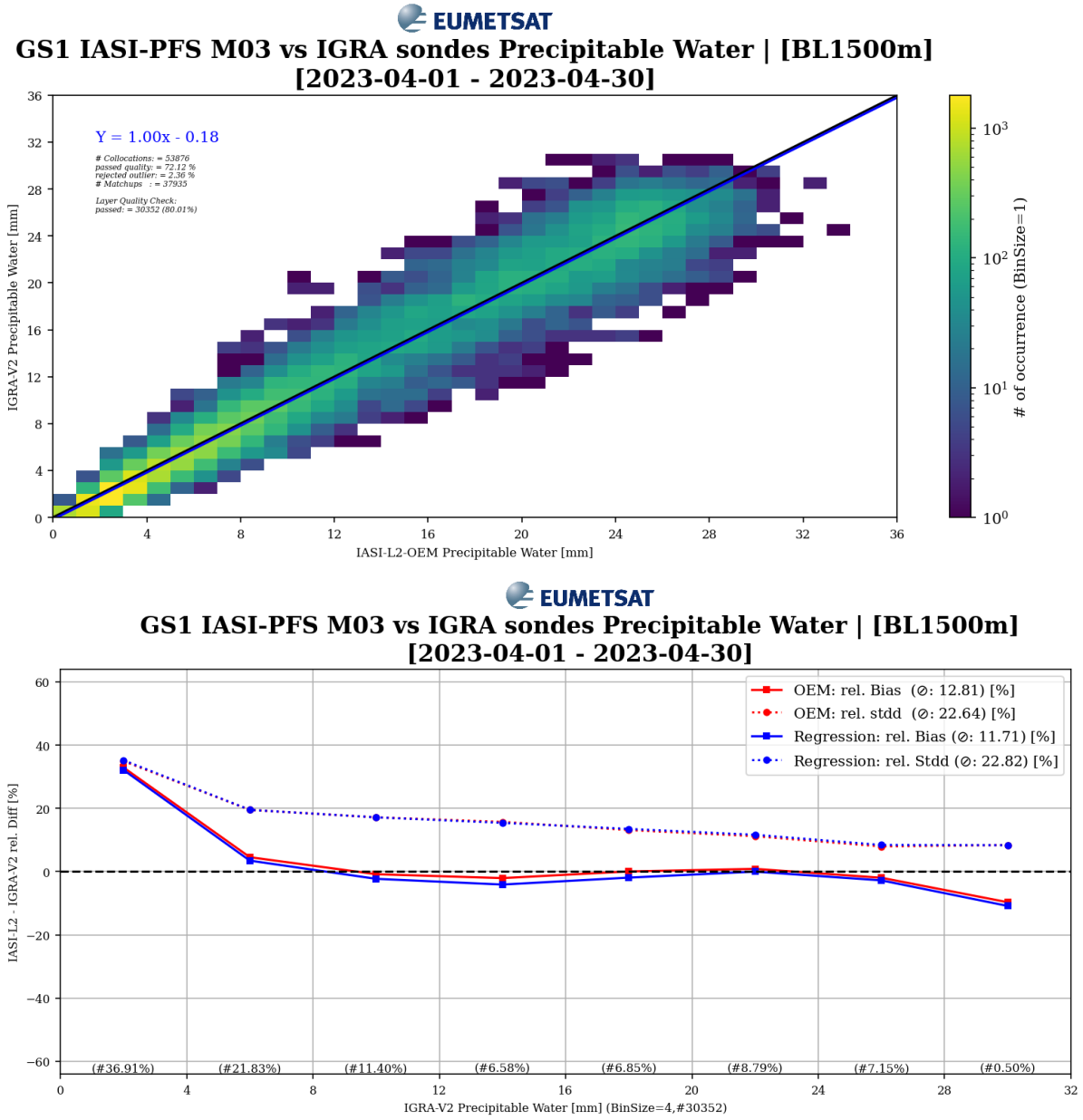

Figure 2.33: 2D Histogram (top) and bias and standard deviation as per 5-mm-sized-bin of the IGRA reference (bottom) between IASI L2 Precipitable Water and IGRA measurements, with M03 IASI L2 from GS1 for 01-30/04/2023 for the layer 1.5 km above the surface.

2.6.2.3 Layer: 850 - 500 hPa

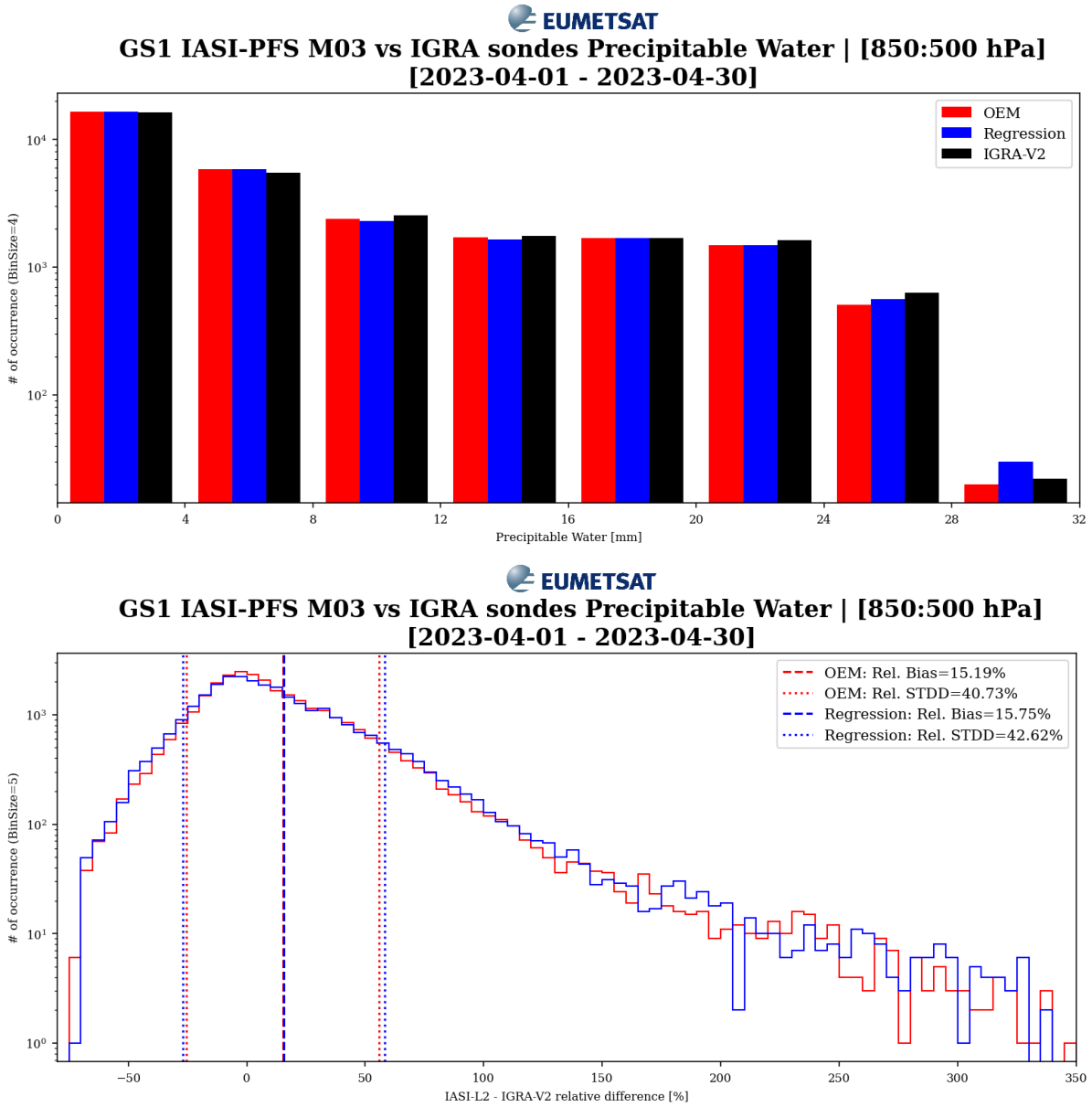

Figure 2.34: Histograms as barcharts in mm (top) and relative differences (bottom) between IASI L2 Precipitable Water and IGRA (ylog), with M03 IASI L2 from GS1 for 01-30/04/2023 for the layer from 850 to 500 hPa.

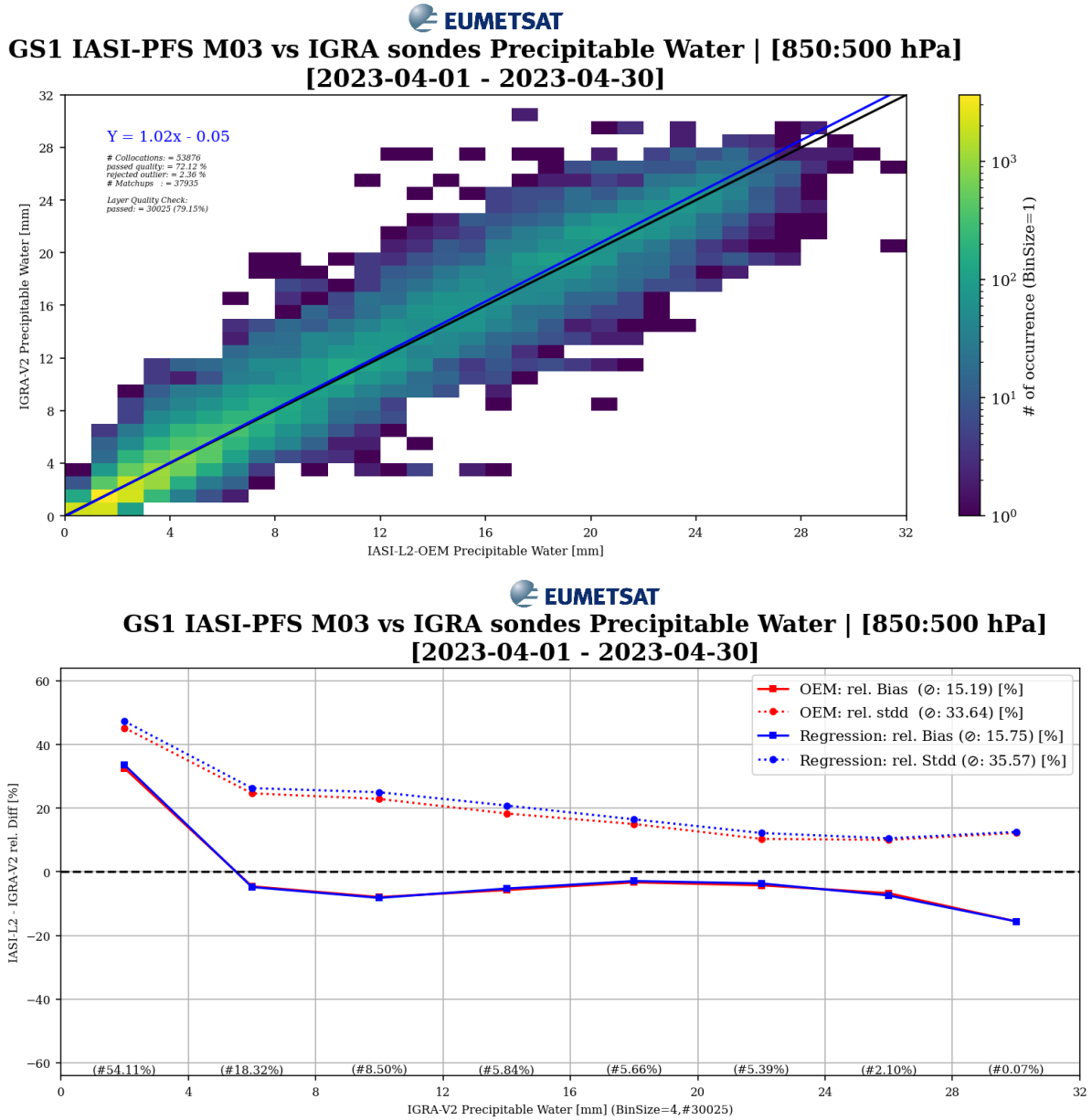

Figure 2.35: 2D Histogram (top) and bias and standard deviation as per 5-mm-sized-bin of the IGRA reference (bottom) between IASI L2 Precipitable Water and IGRA measurements, with M03 IASI L2 from GS1 for 01-30/04/2023 for the layer from 850 to 500 hPa.

2.6.2.4 Collocational dependencies

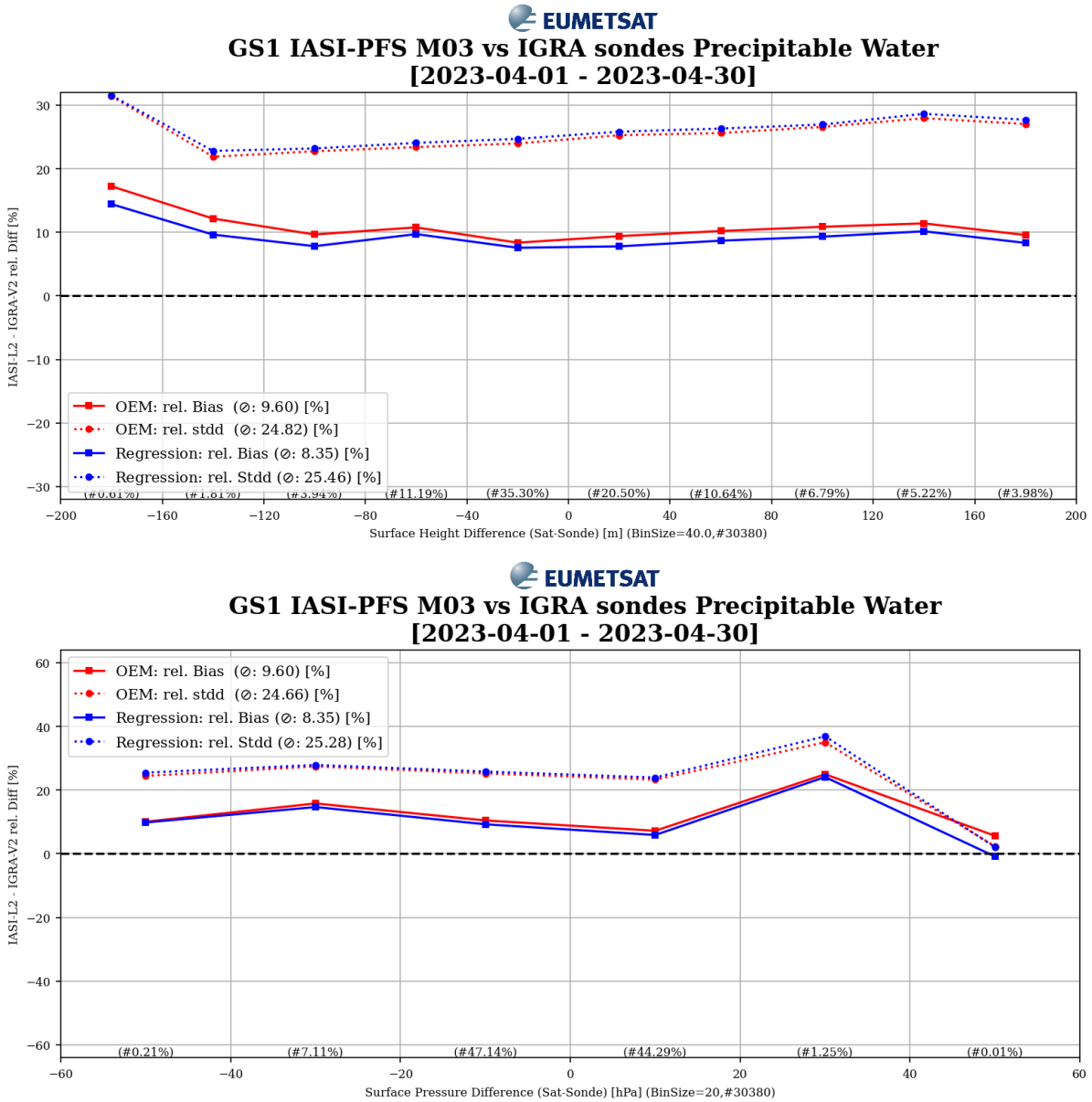

Figure 2.36: Relative bias and standard deviation histograms between IASI L2 Precipitable Water and IGRA (ylog), with M03 IASI L2 from GS1 for 01-30/04/2023 for different surface height (top) and surface pressure differences (bottom).

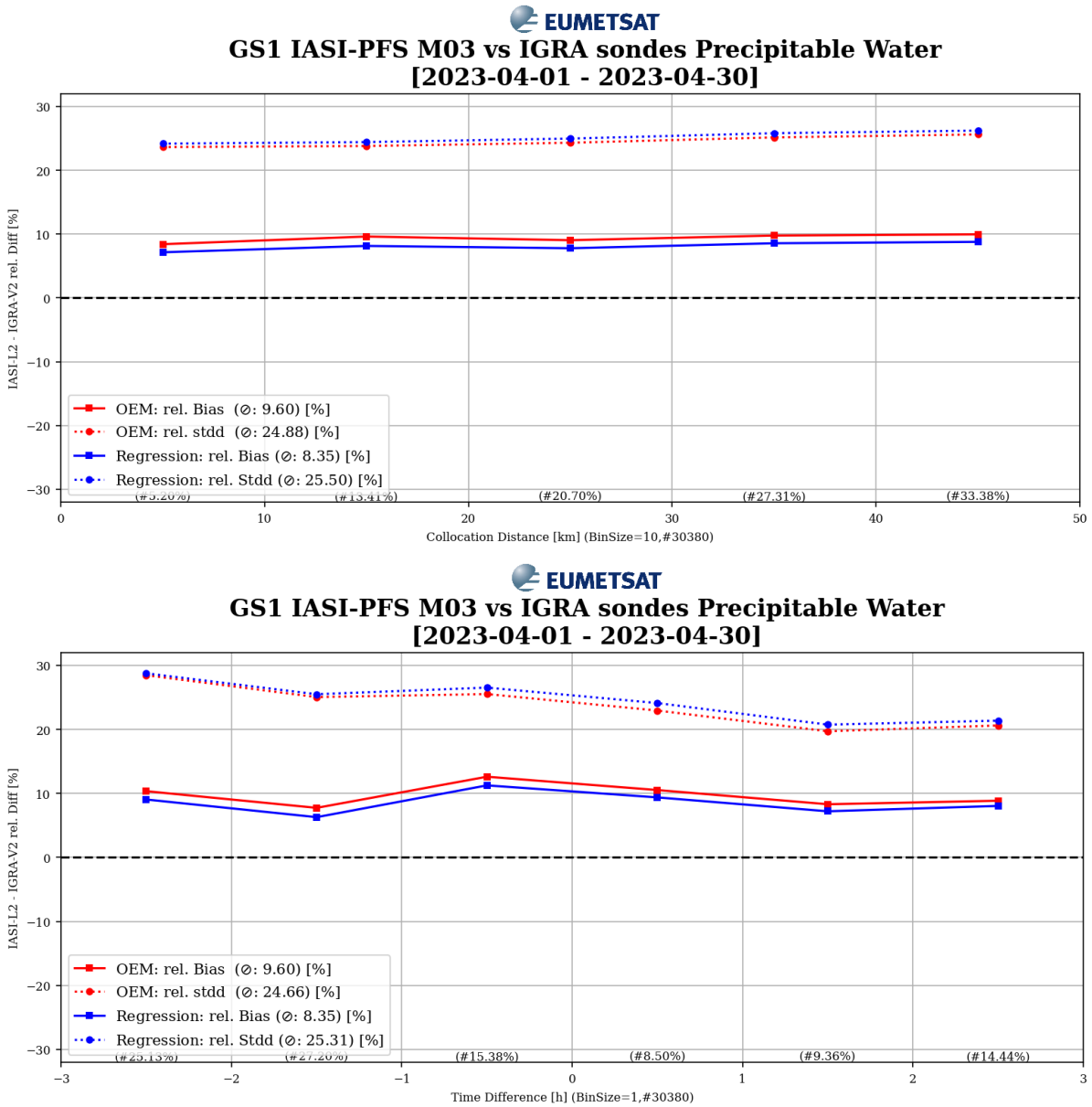

Figure 2.37: Relative bias and standard deviation histograms between IASI L2 Precipitable Water and IGRA (ylog), with M03 IASI L2 from GS1 for 01-30/04/2023 for different collocation spatial distances (top) and temporal differences (bottom).

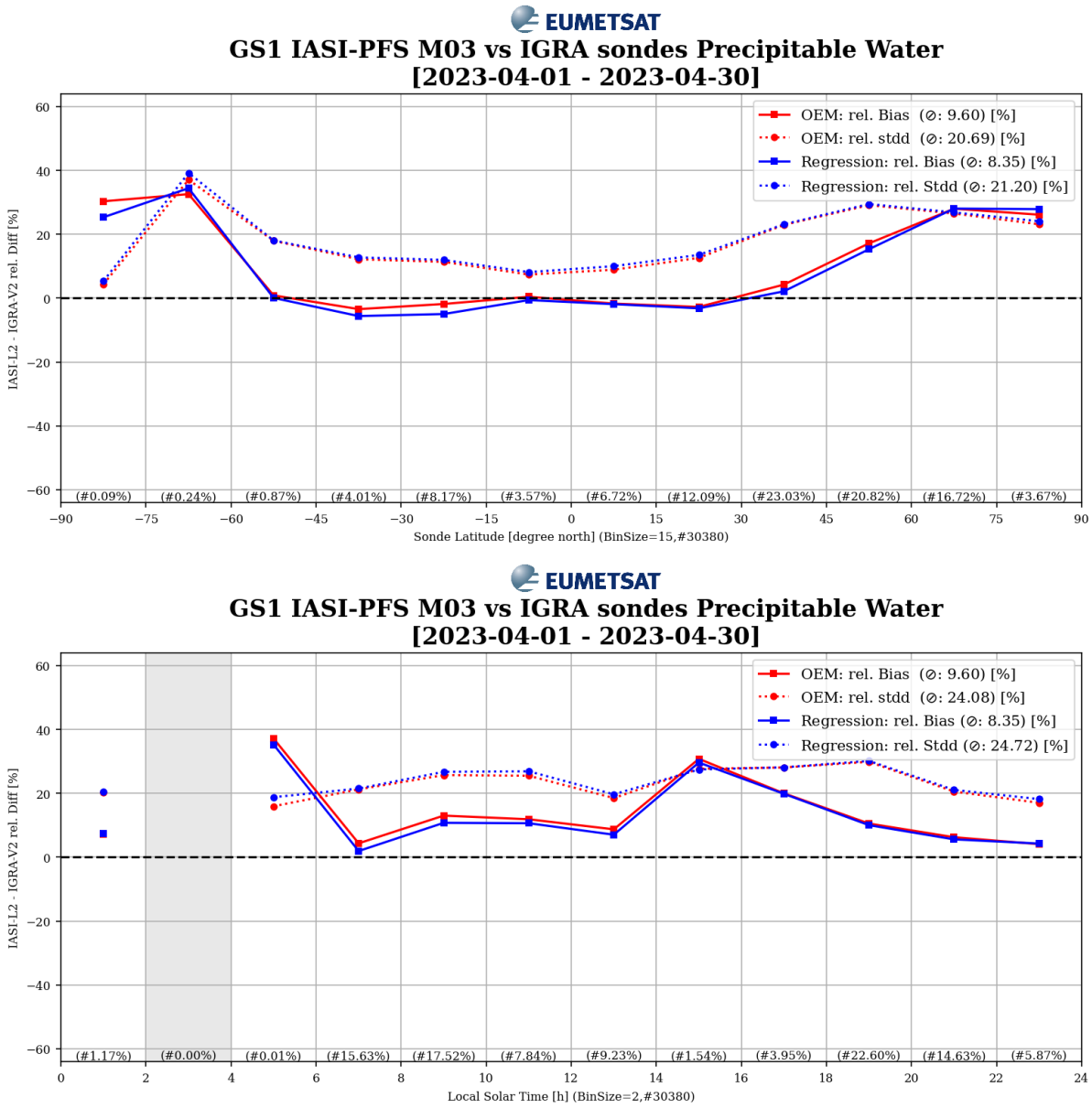

Figure 2.38: Relative bias and standard deviation histograms between IASI L2 Precipitable Water and IGRA (ylog), with M03 IASI L2 from GS1 for 01-30/04/2023 for different latitudes (top) and local solar times (bottom).

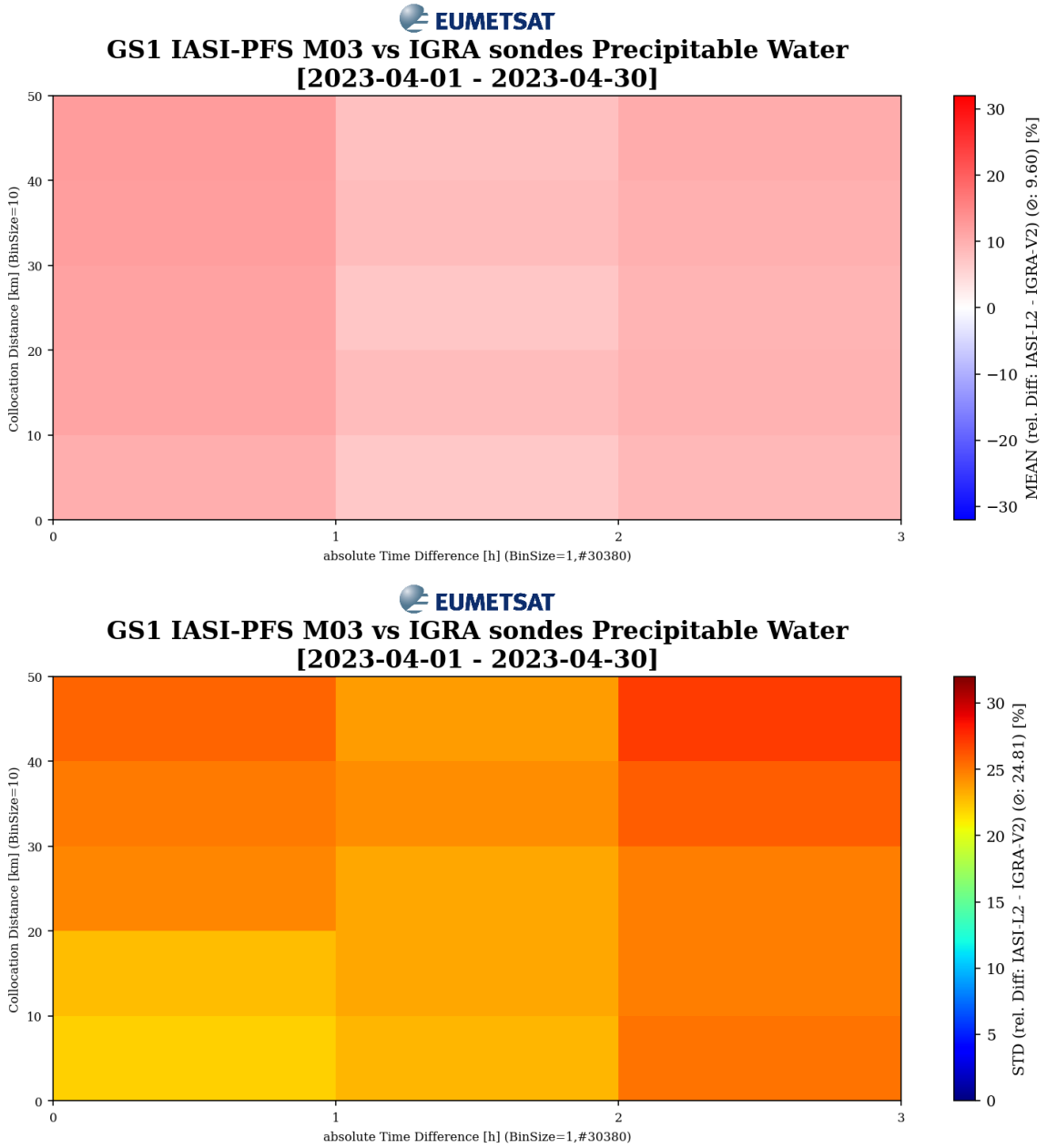

Figure 2.39: 2D Histograms bias (top) and standard deviation (bottom) for IASI L2 Precipitable Water and IGRA measurements, with M03 IASI L2 from GS1 for 01-30/04/2023 dependent of collocation temporal difference and spatial distances.

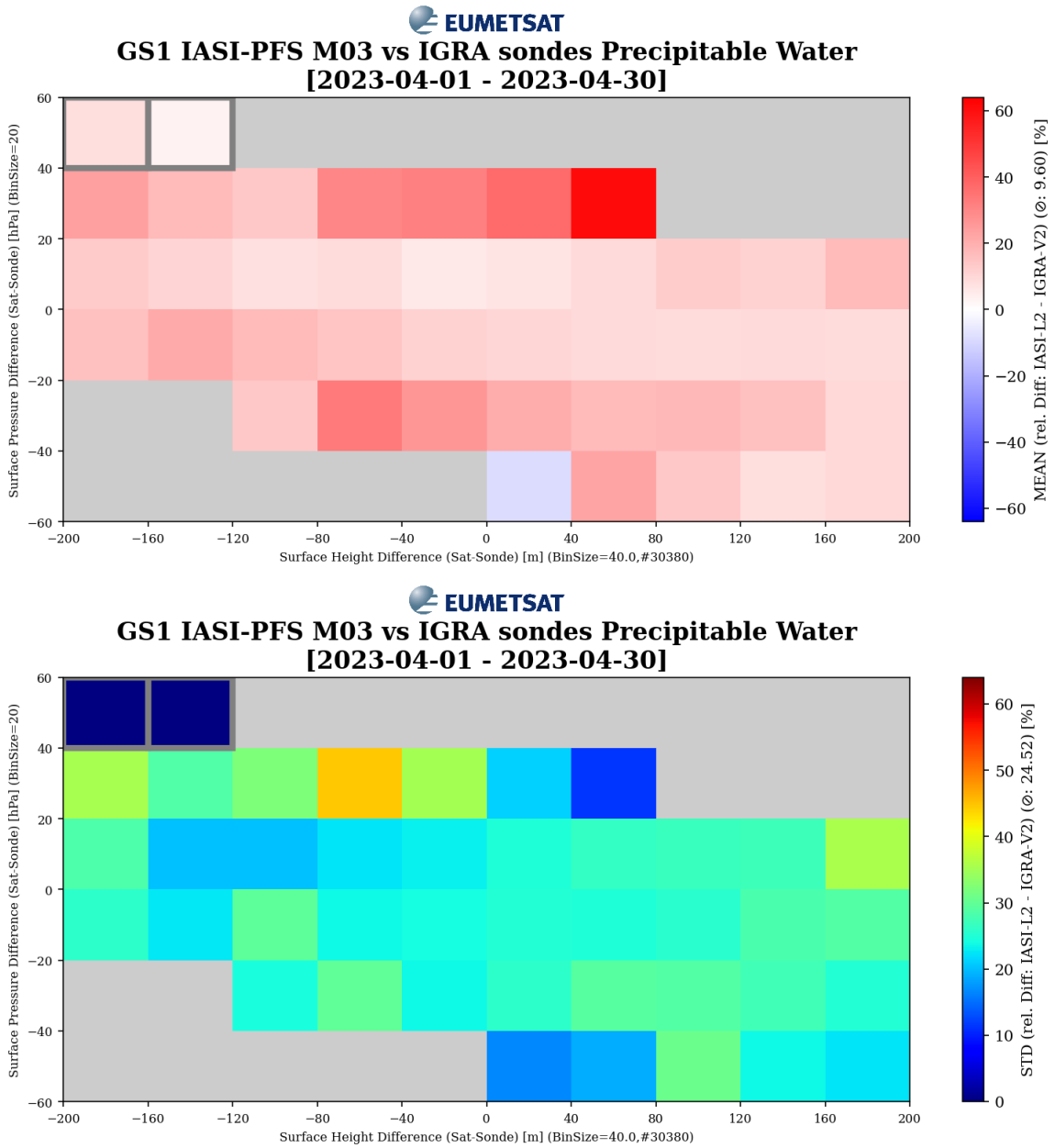

Figure 2.40: 2D Histograms bias (top) and standard deviation (bottom) for IASI L2 Precipitable Water and IGRA measurements, with M03 IASI L2 from GS1 for 01-30/04/2023 dependent of Surface Pressure Difference and Surface Pressure Difference.

2.6.2.5 Angular dependencies

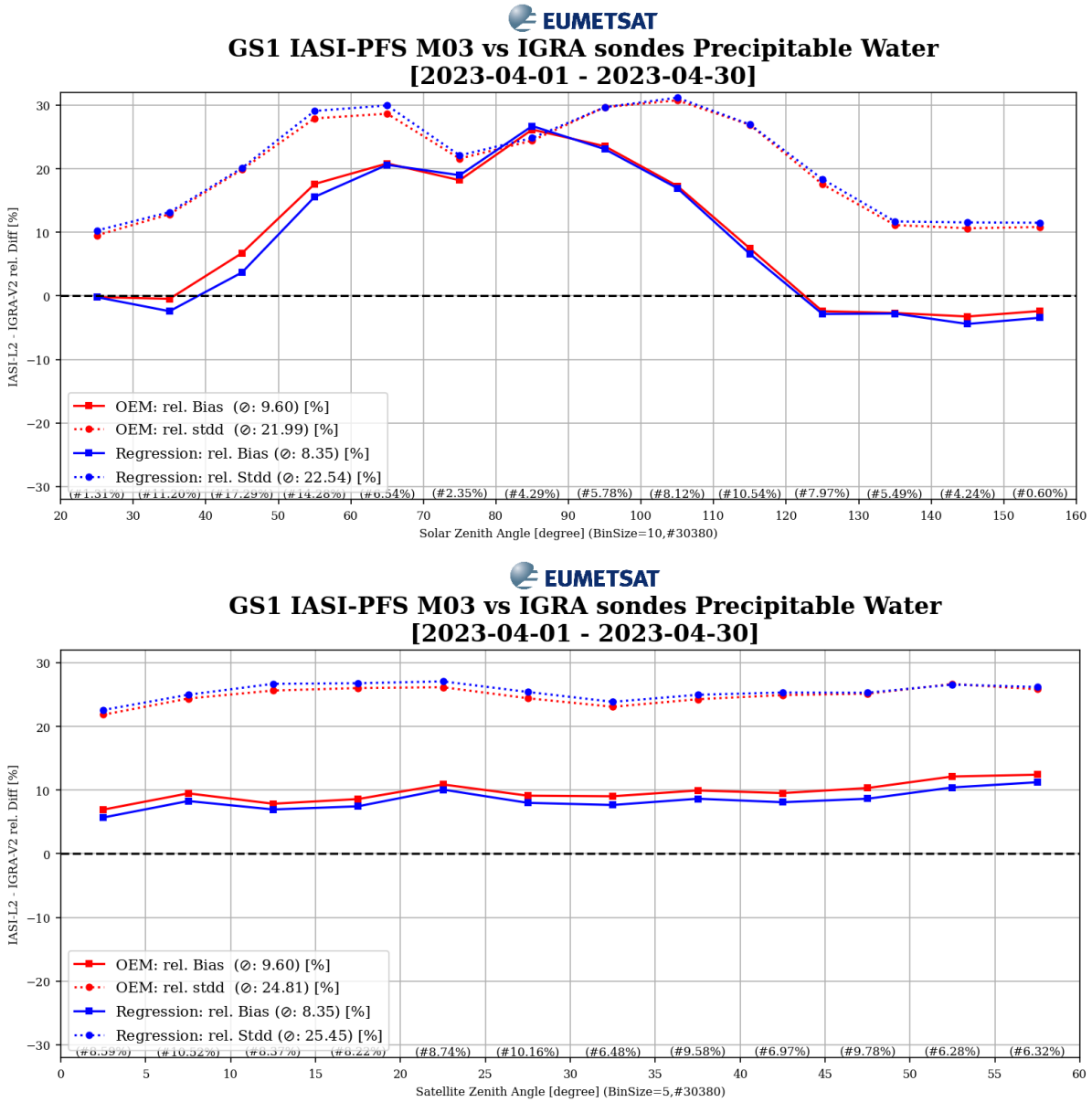

Figure 2.41: Relative bias and standard deviation histograms between IASI L2 Precipitable Water and IGRA (ylog), with M03 IASI L2 from GS1 for 01-30/04/2023 for different sun zenith angles (top) and satellite zenith angles (bottom).

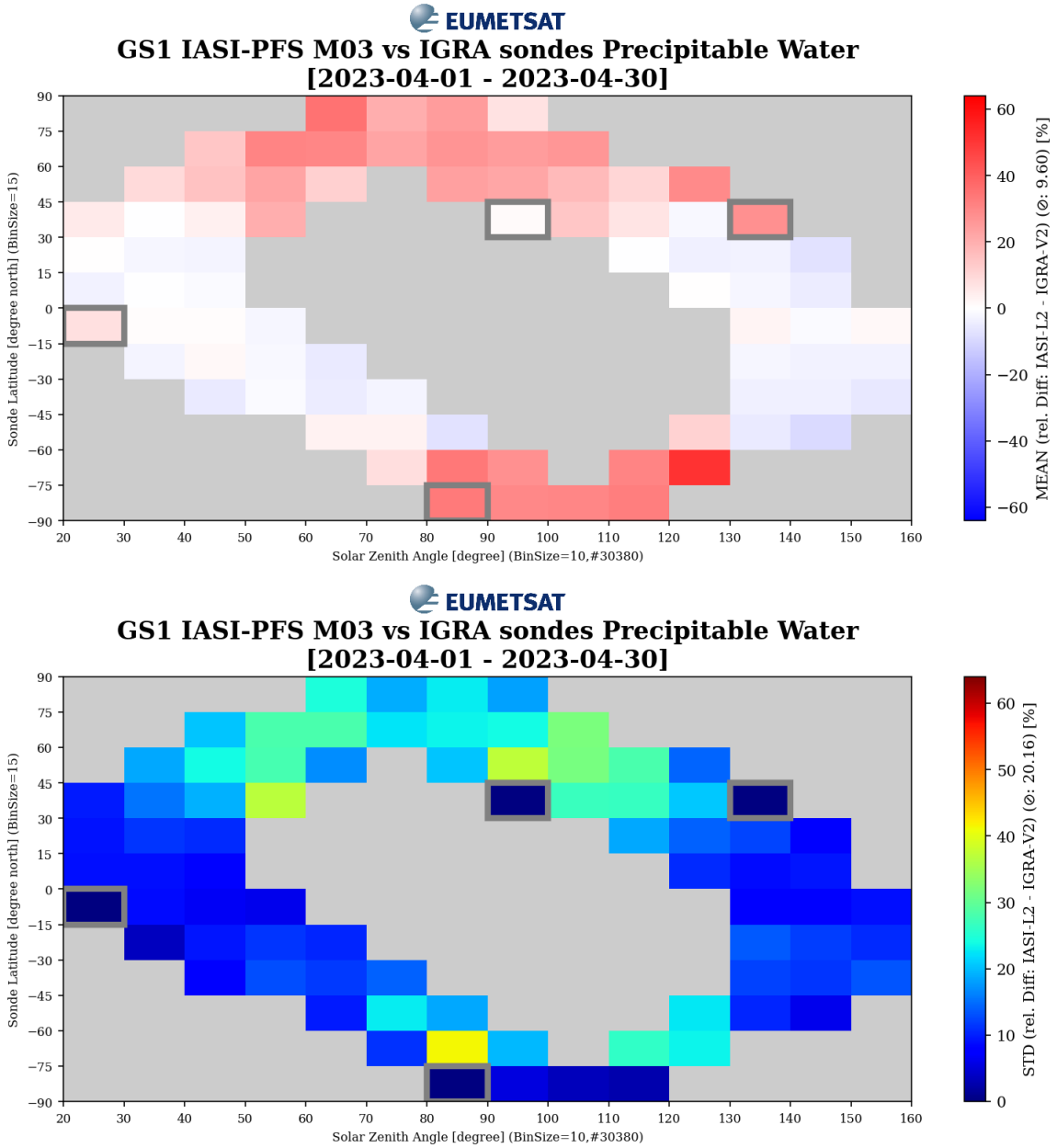

Figure 2.42: 2D Histograms bias (top) and standard deviation (bottom) for IASI L2 Precipitable Water and IGRA measurements, with M03 IASI L2 from GS1 for 01-30/04/2023 dependent of sun zenith angles and latitude.

3 REGIONAL EUROPE MONTHLY STATISTICS IN CLEAR-SKY PIXEL

3.1 Matchups

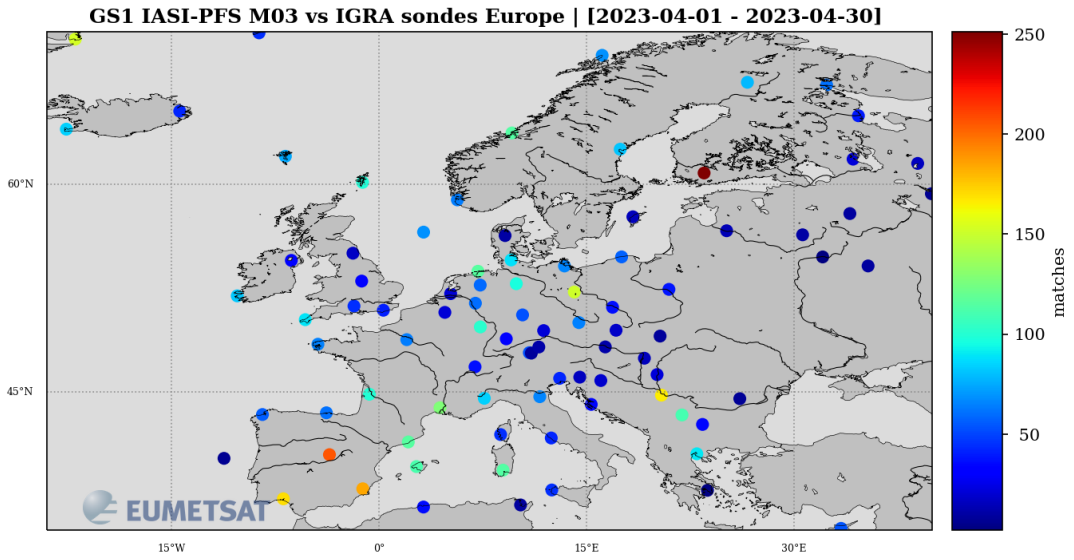

Figure 3.1: Number of match-ups per station with M03 IASI L2 from GS1 for 01-30/04/2023

3.2 Vertical profile statistics

3.2.1 Temperature

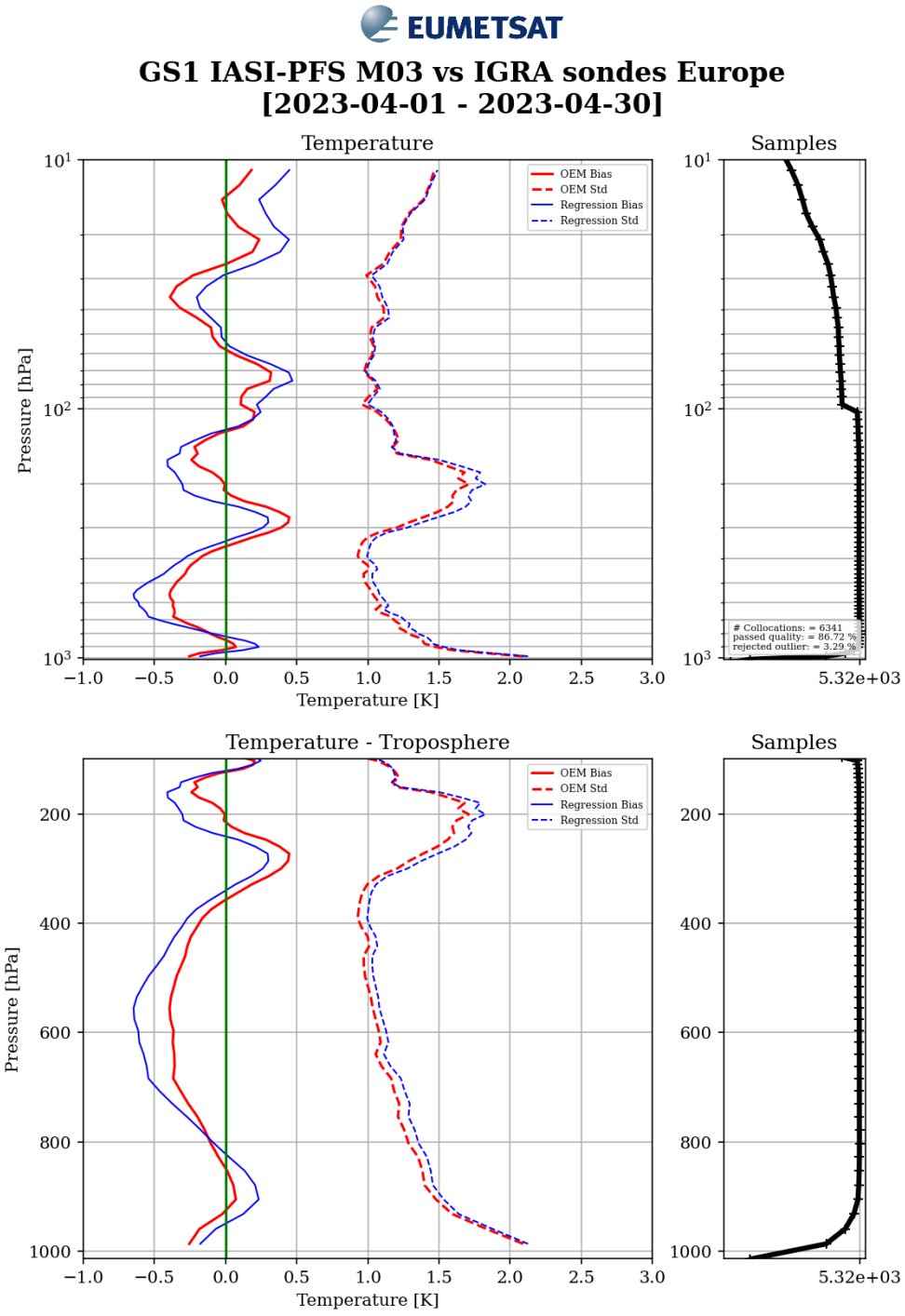

Figure 3.2: IASI *vs* sonde mean (solid line) difference and standard deviation (dash line) in temperature with the statistical (blue) and optimal estimation (red) retrieval methods (top: pressure log scale, bottom: linear scale). Regional Europe statistics with M03 IASI L2 from GS1 for 01-30/04/2023

3.2.2 Specific Humidity

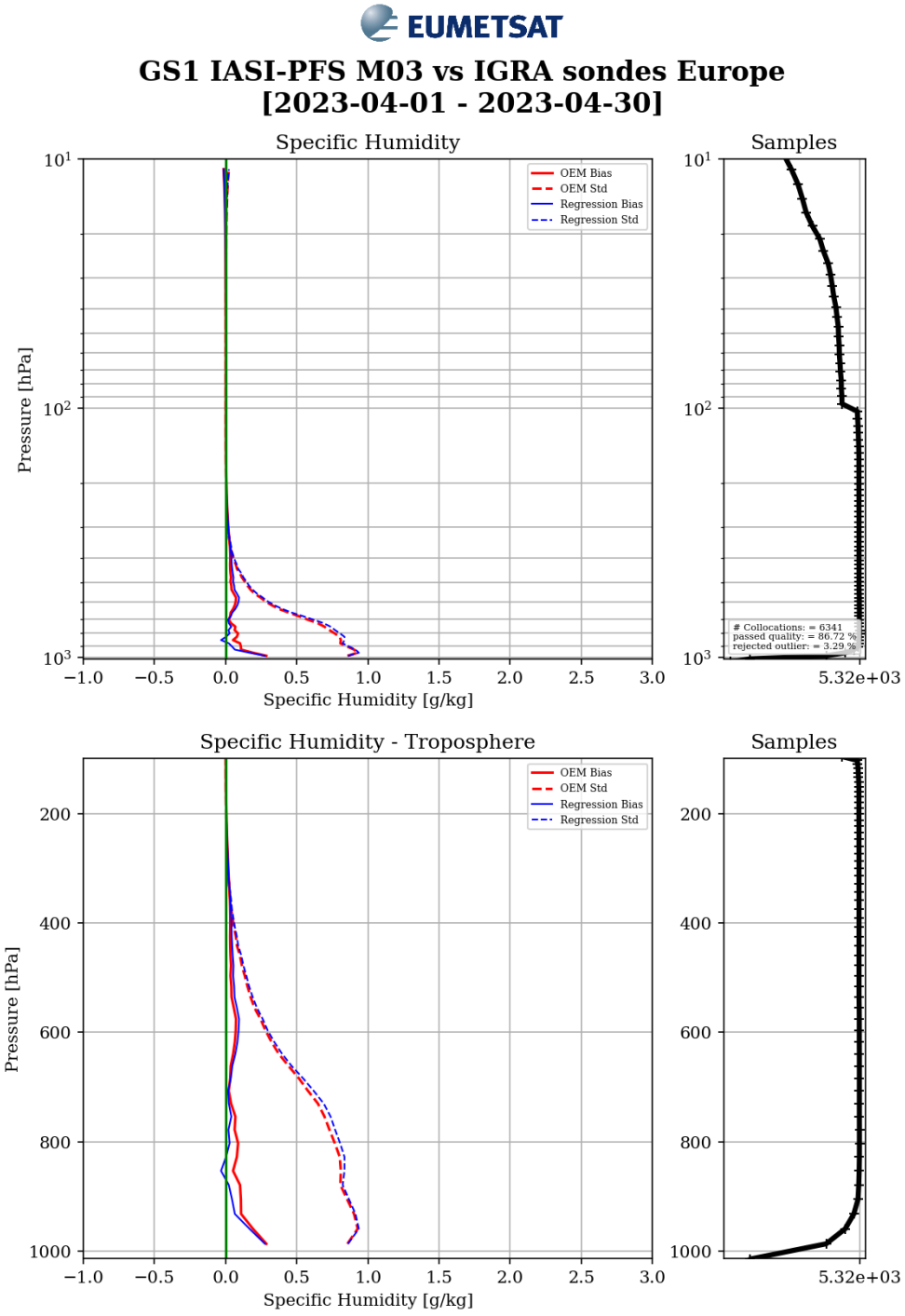

Figure 3.3: IASI *vs* sonde mean (solid line) difference and standard deviation (dash line) in specific humidity with the statistical (blue) and optimal estimation (red) retrieval methods (top: pressure log scale, bottom: linear scale). Regional Europe statistics with M03 IASI L2 from GS1 for 01-30/04/2023

3.2.3 Relative Humidity

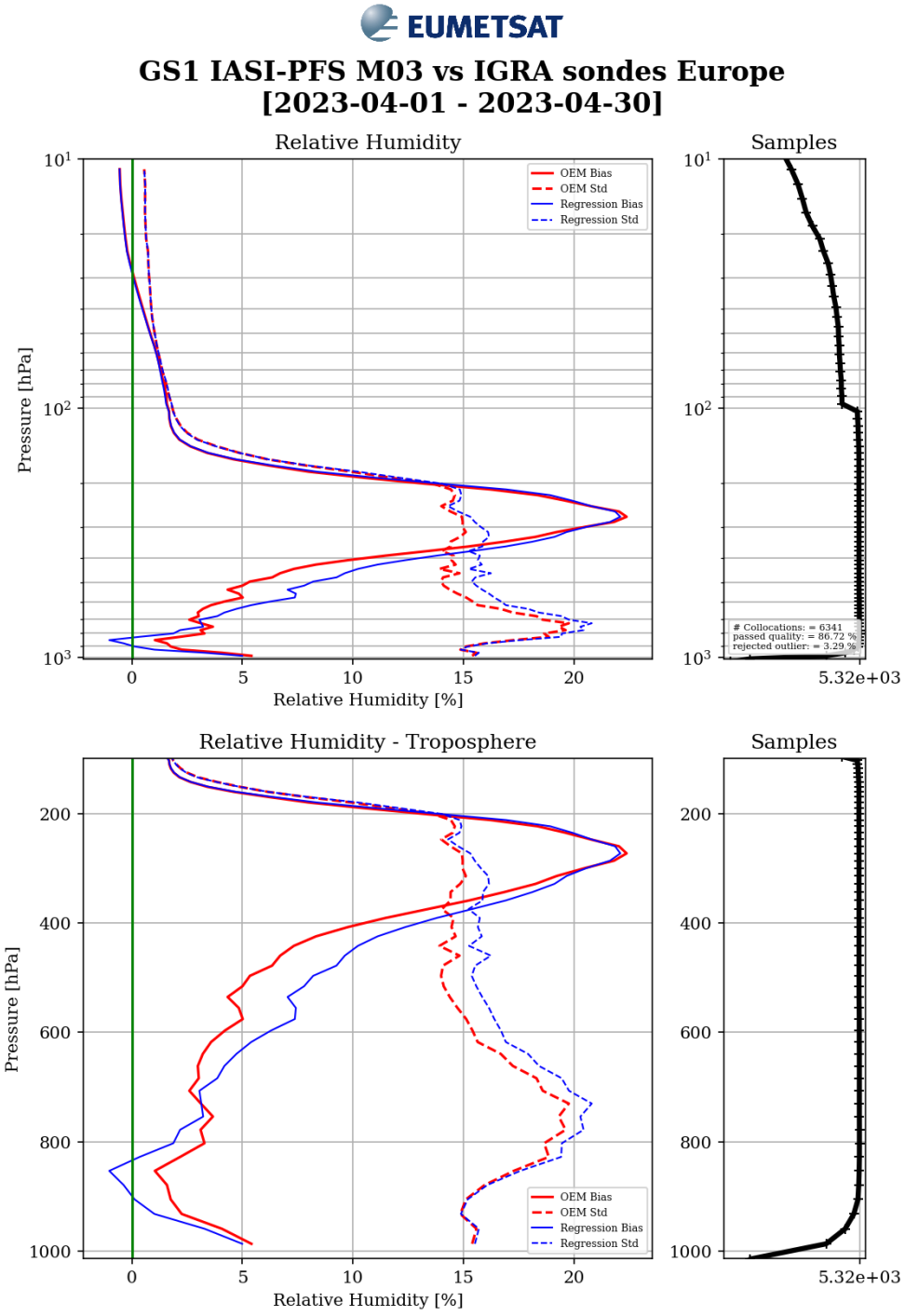

Figure 3.4: IASI *vs* sonde mean (solid line) difference and standard deviation (dash line) in relative humidity with the statistical (blue) and optimal estimation (red) retrieval methods (top: pressure log scale, bottom: linear scale). Global statistics with M03 IASI L2 from GS1 for for 01-30/04/2023

3.3 Monthly time series

3.3.1 Temperature / Humidity

3.3.1.1 Level: 10 hPa

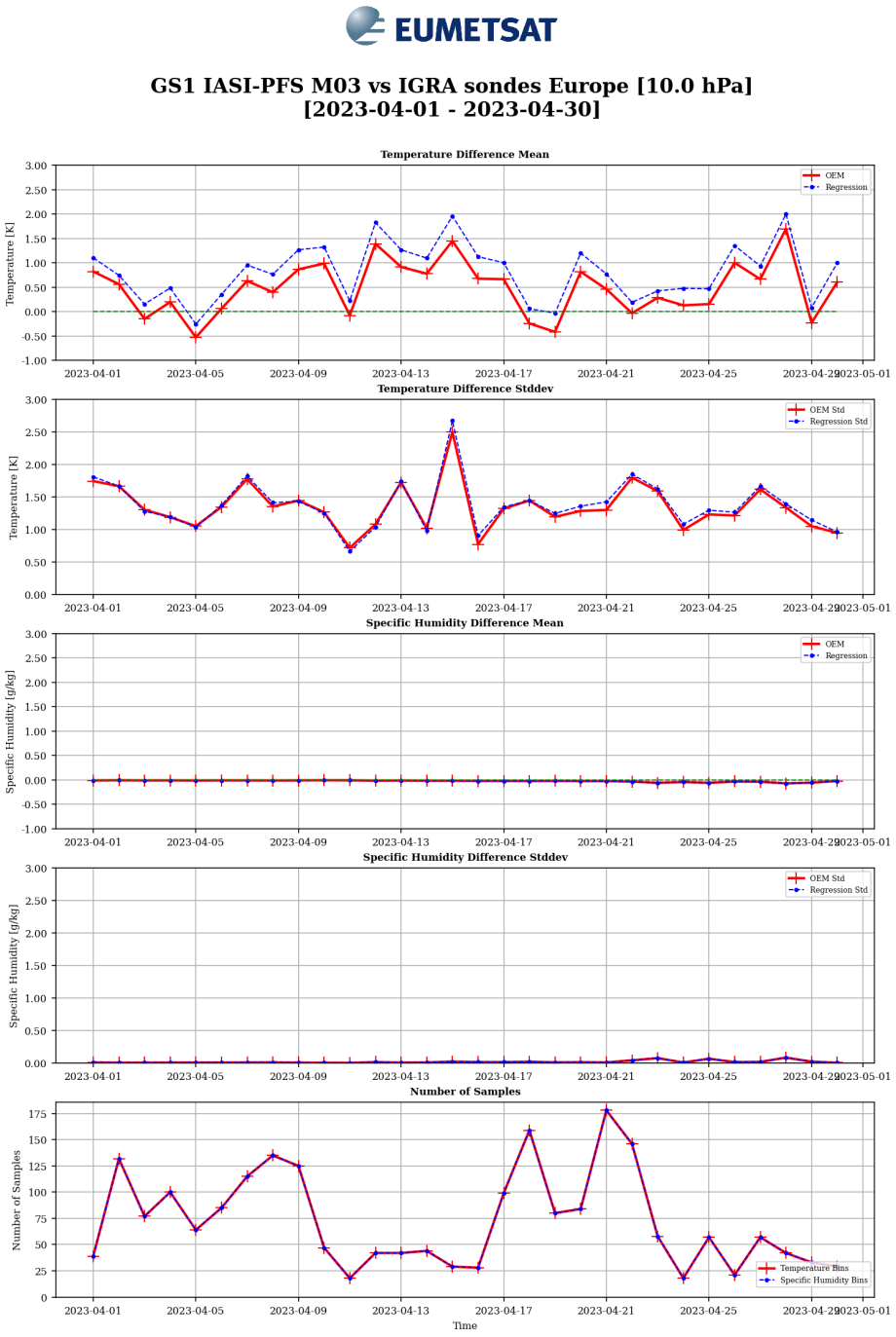

Figure 3.5: Monthly time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 10 hPa. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 for 01-30/04/2023

3.3.1.2 Level: 100 hPa

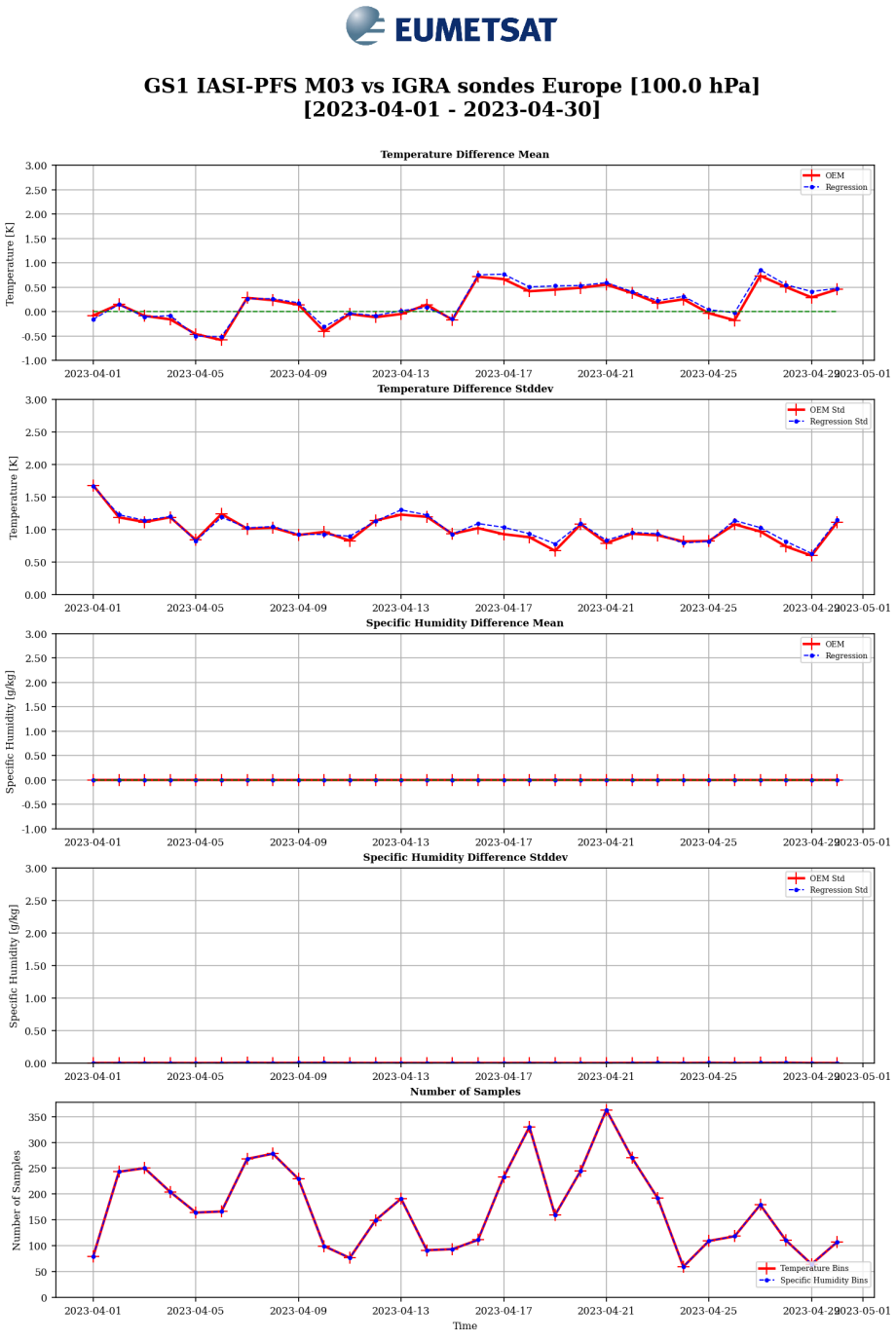

Figure 3.6: Monthly time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 100 hPa. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 for 01-30/04/2023

3.3.1.3 Level: 200 hPa

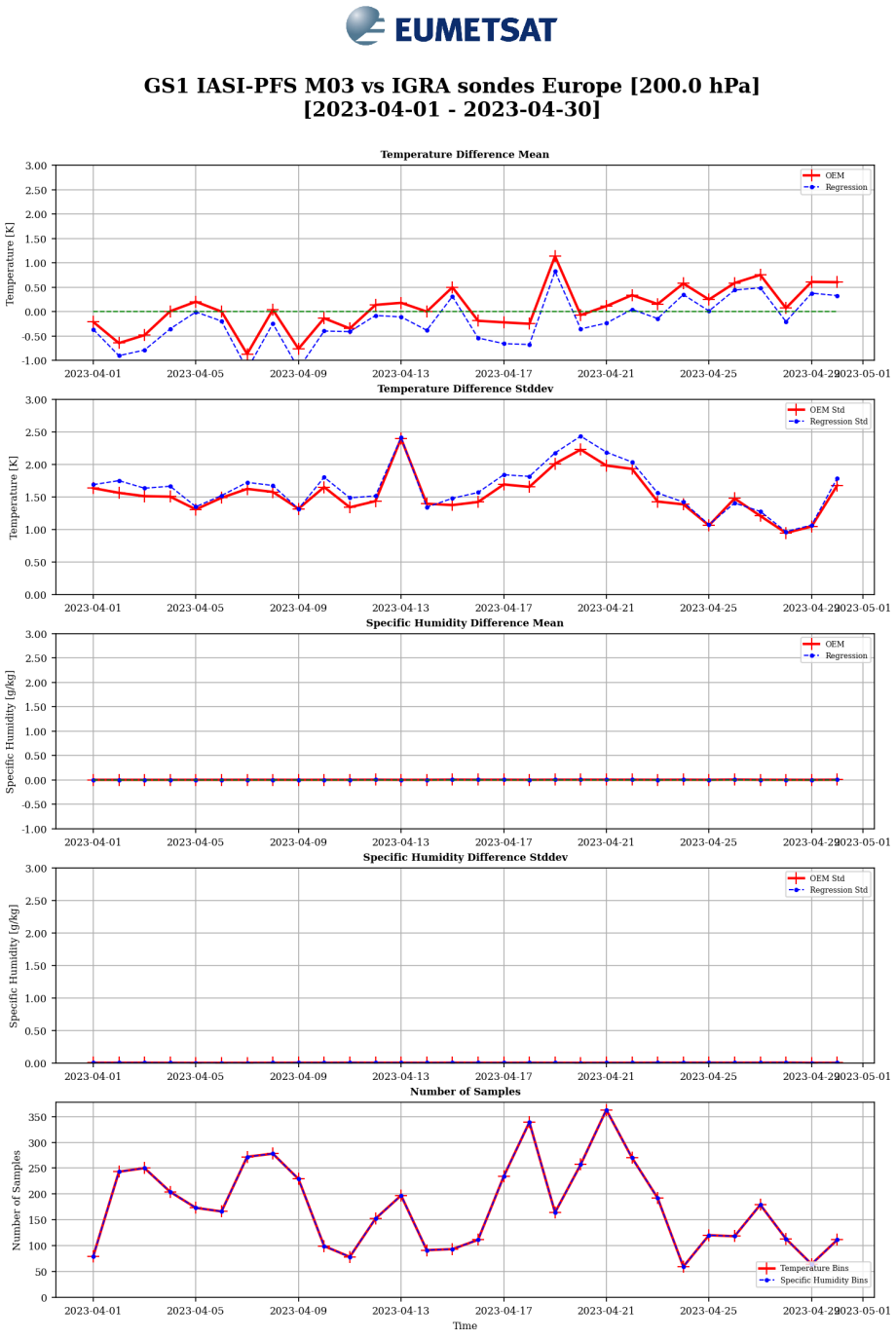

Figure 3.7: Monthly time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 200 hPa. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 for 01-30/04/2023

3.3.1.4 Level: 300 hPa

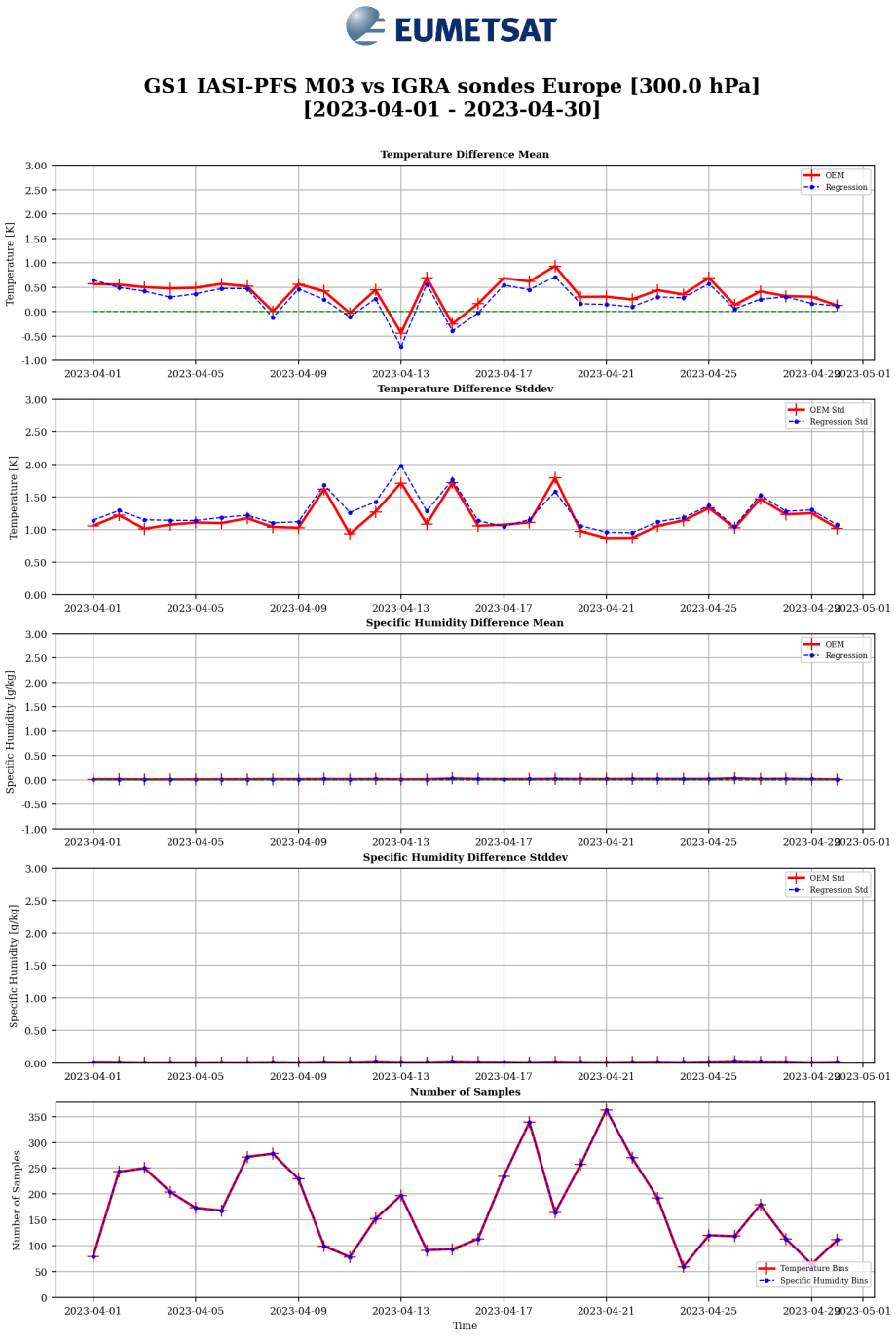

Figure 3.8: Monthly time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 300 hPa. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 for 01-30/04/2023

3.3.1.5 Level: 500 hPa

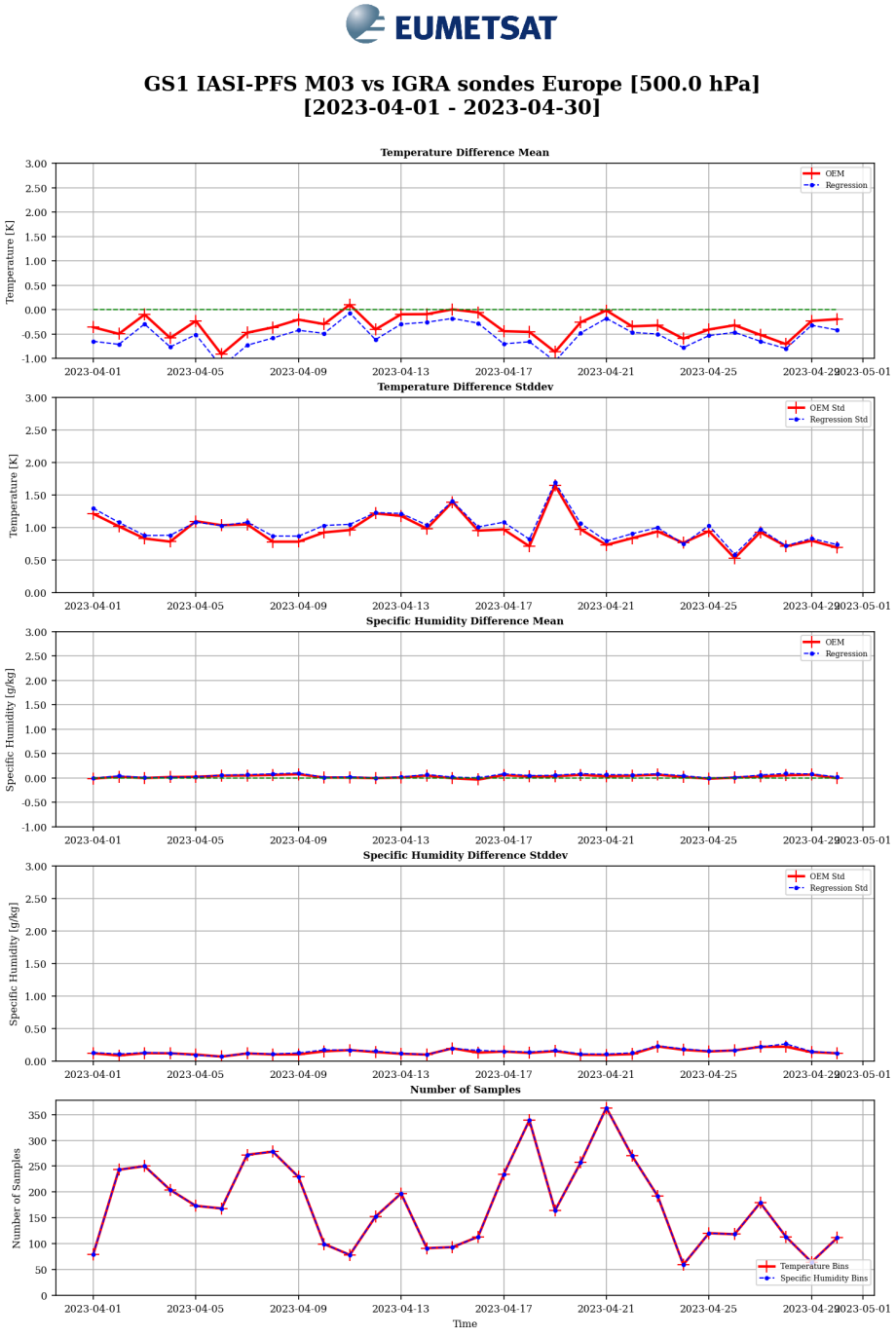

Figure 3.9: Monthly time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 500 hPa. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 for 01-30/04/2023

3.3.1.6 Level: 600 hPa

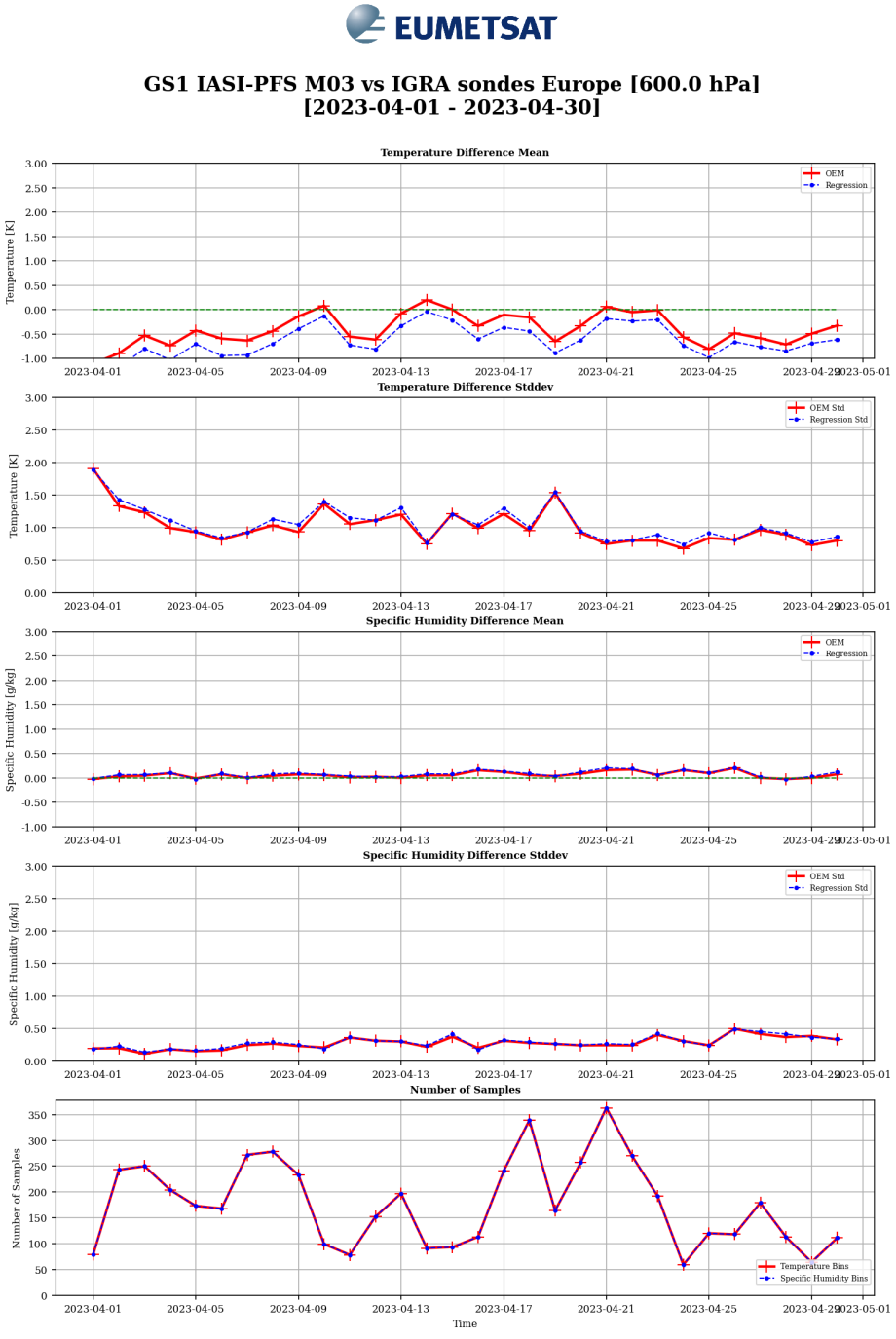

Figure 3.10: Monthly time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 600 hPa. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 for 01-30/04/2023

3.3.1.7 Level: 800 hPa

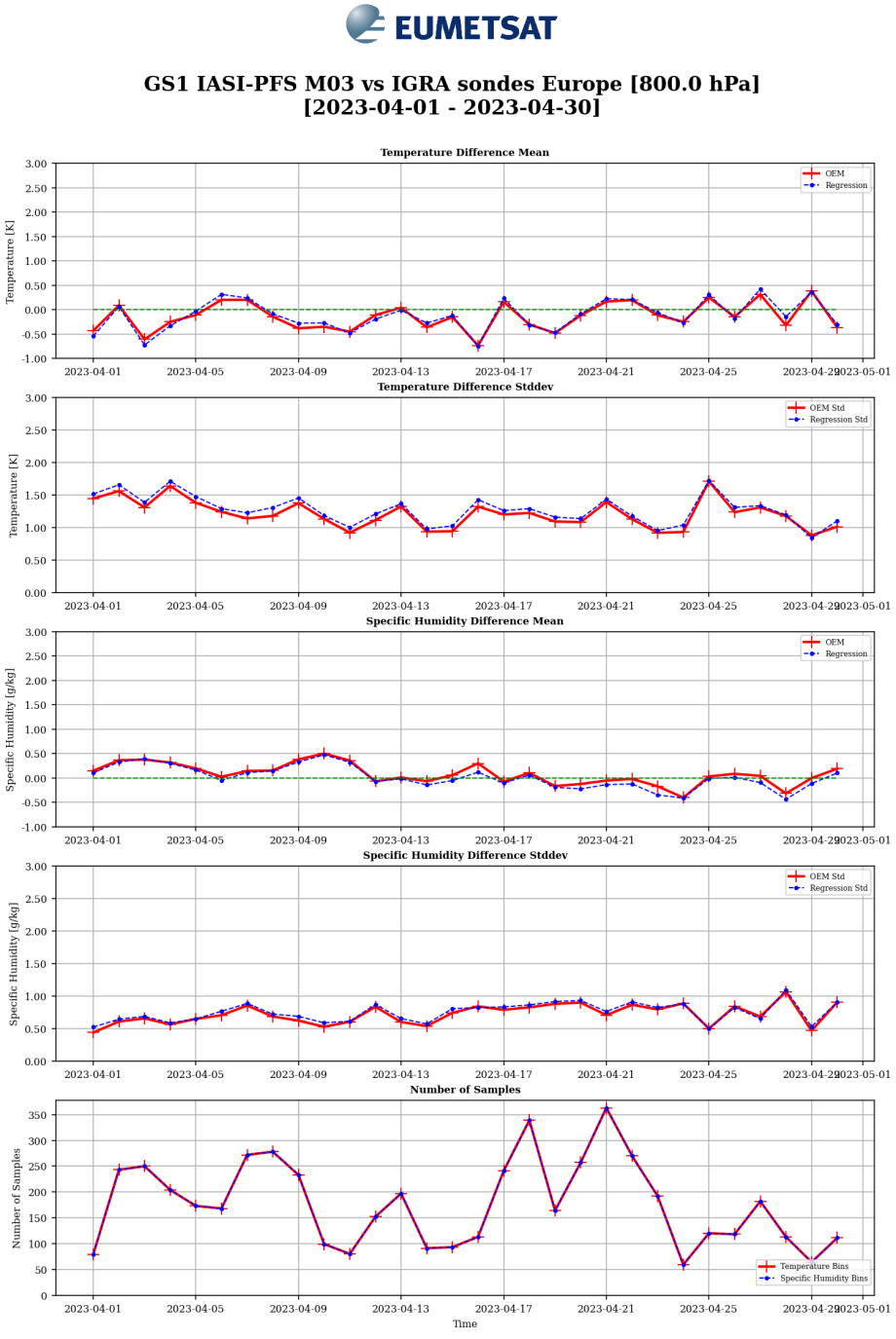

Figure 3.11: Monthly time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 800 hPa. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 for 01-30/04/2023

3.3.1.8 Level: 1000 hPa

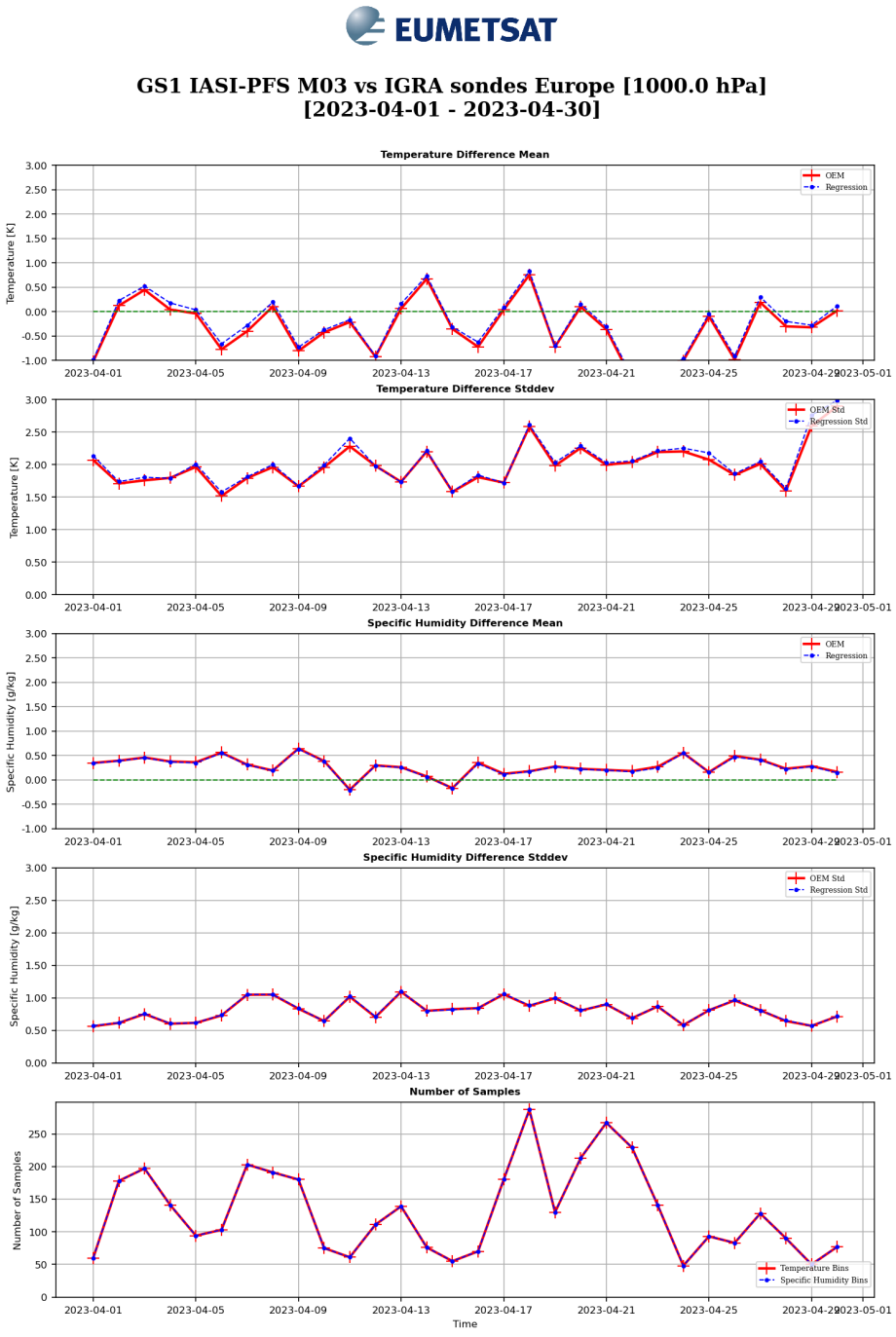

Figure 3.12: Monthly time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 1000 hPa. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 for 01-30/04/2023

3.3.2 Precipitable Water

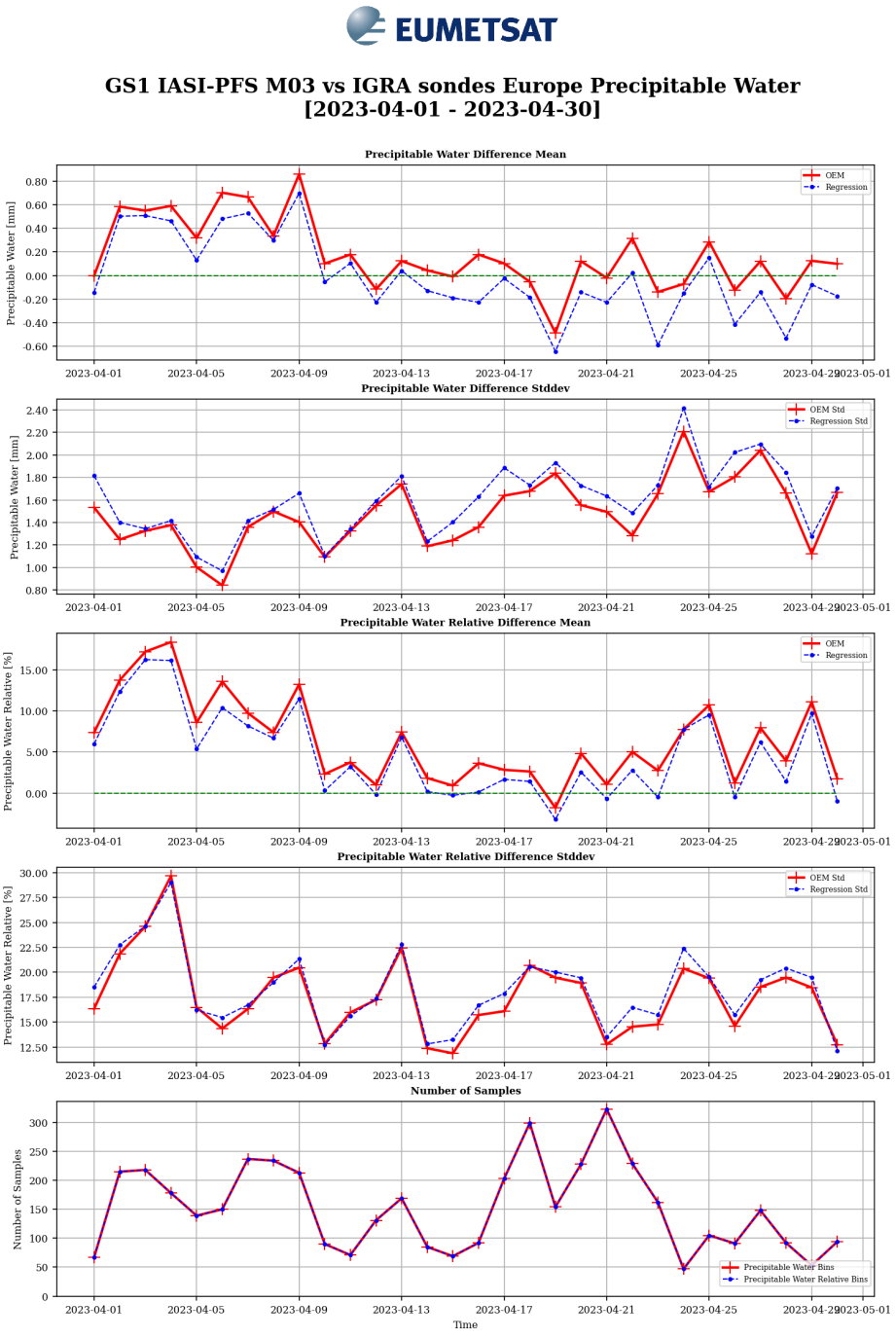

Figure 3.13: Monthly time series of Precipitable Water mean difference and standard deviation in absolute (top 2 panels) and relative Difference (middle 2 panels) between IASI L2 and IGRA. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 for 01-30/04/2023

3.4 Long-term time series

3.4.1 Temperature / Humidity

3.4.1.1 Level: 10 hPa

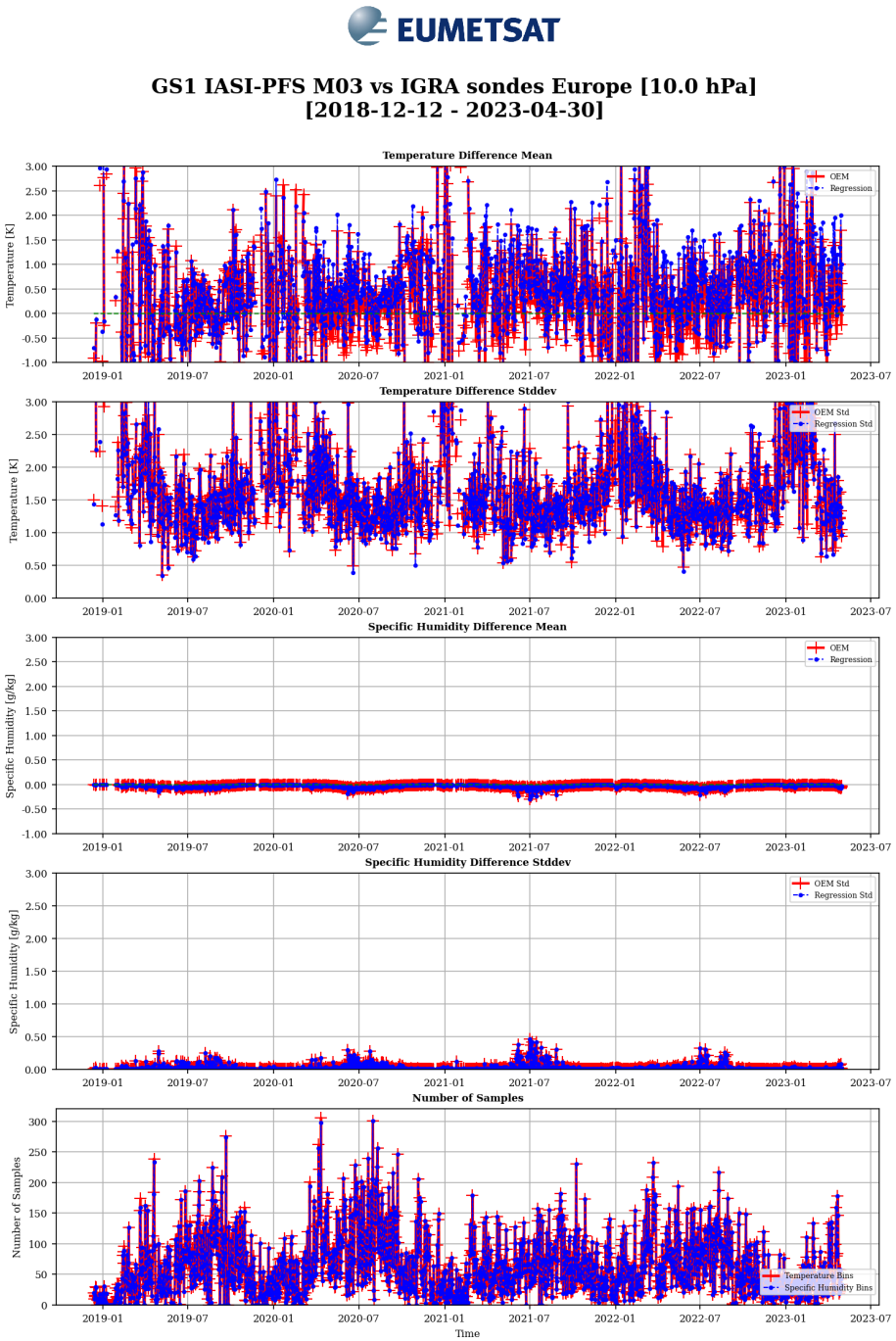

Figure 3.14: Long-term time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 10 hPa. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 updated on 30/04/2023

3.4.1.2 Level: 100 hPa

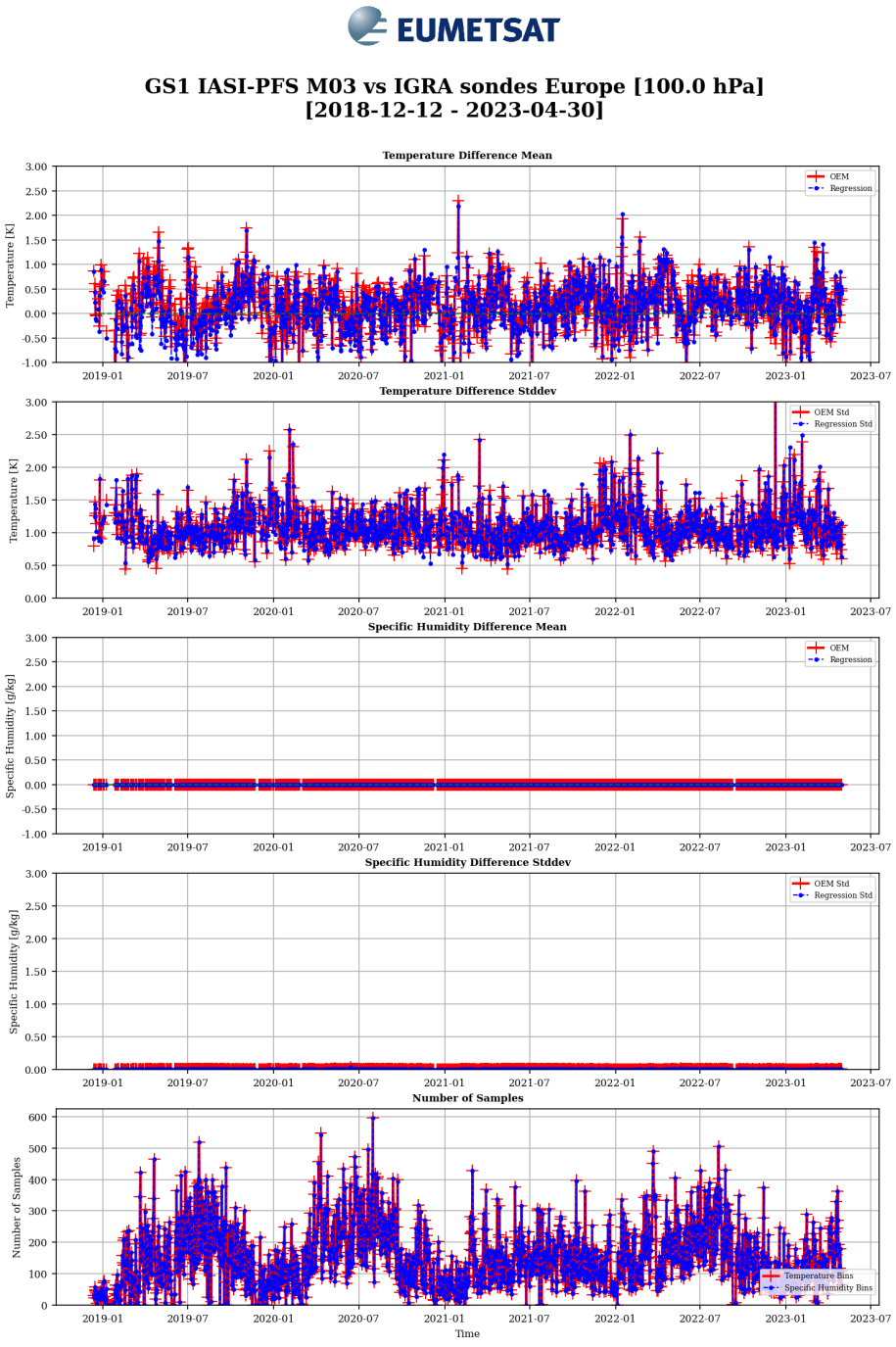

Figure 3.15: Long-term time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 100 hPa. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 updated on 30/04/2023

3.4.1.3 Level: 200 hPa

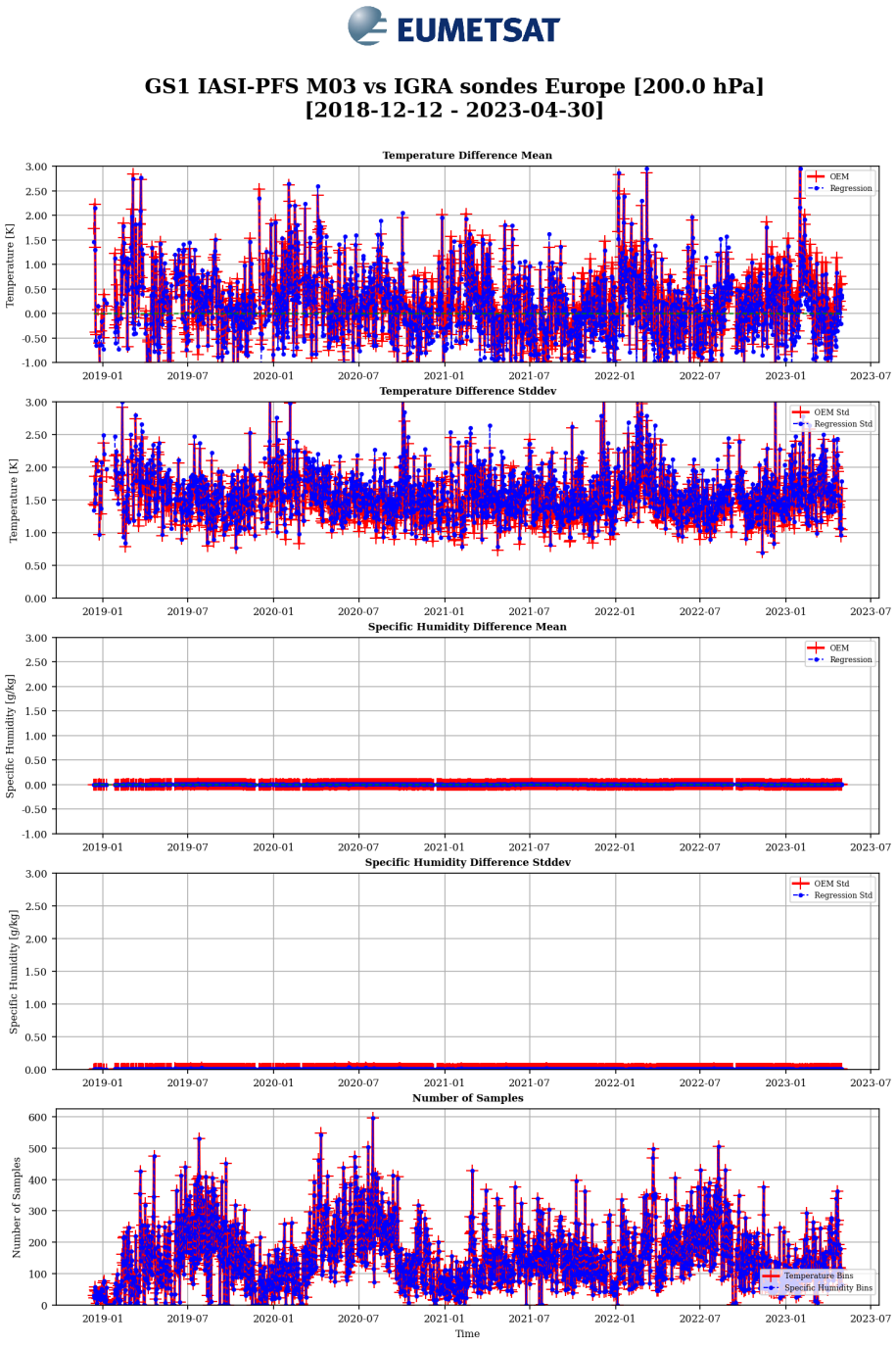

Figure 3.16: Long-term time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 200 hPa. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 updated on 30/04/2023

3.4.1.4 Level: 300 hPa

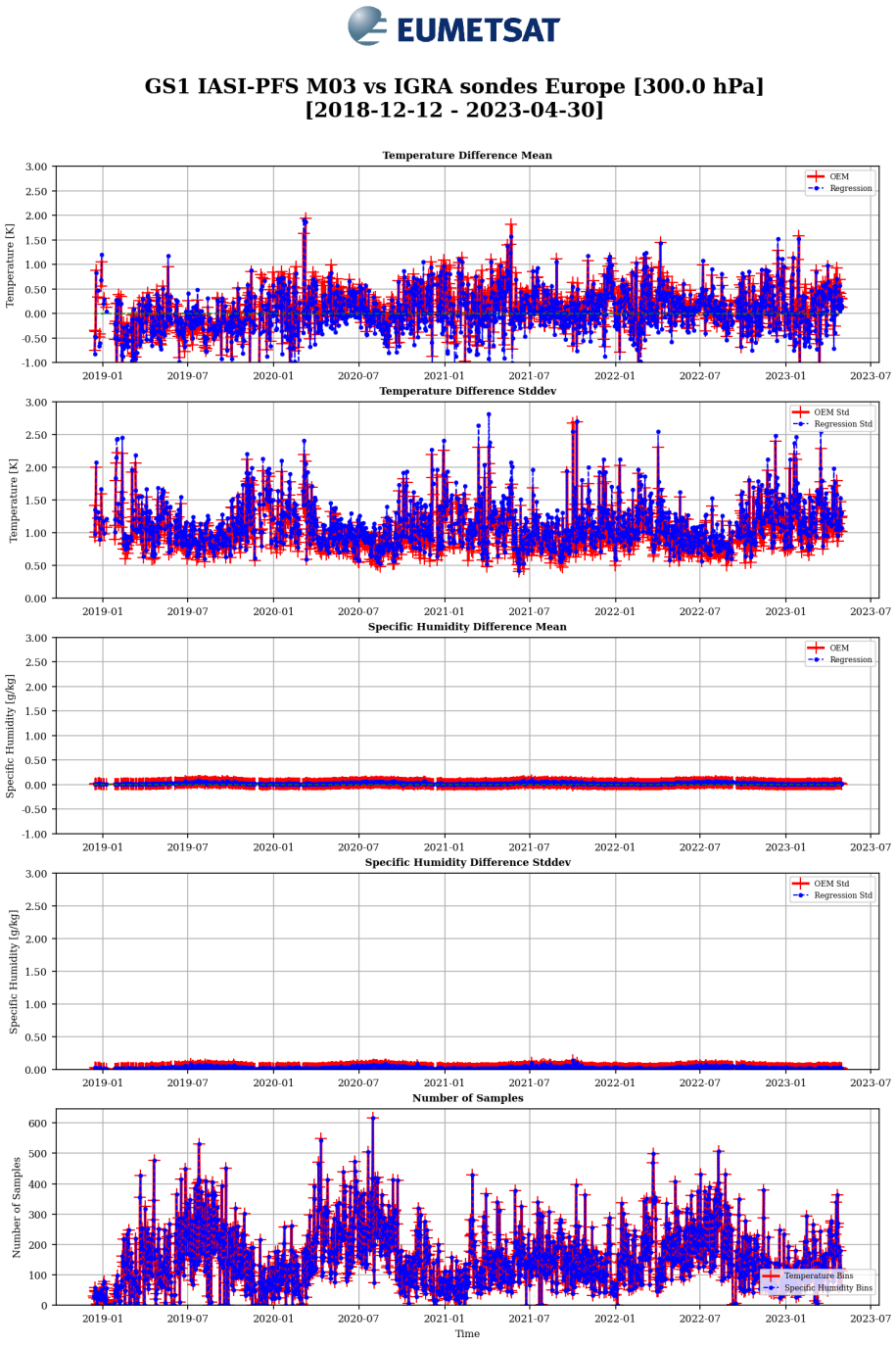

Figure 3.17: Long-term time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 300 hPa. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 updated on 30/04/2023

3.4.1.5 Level: 500 hPa

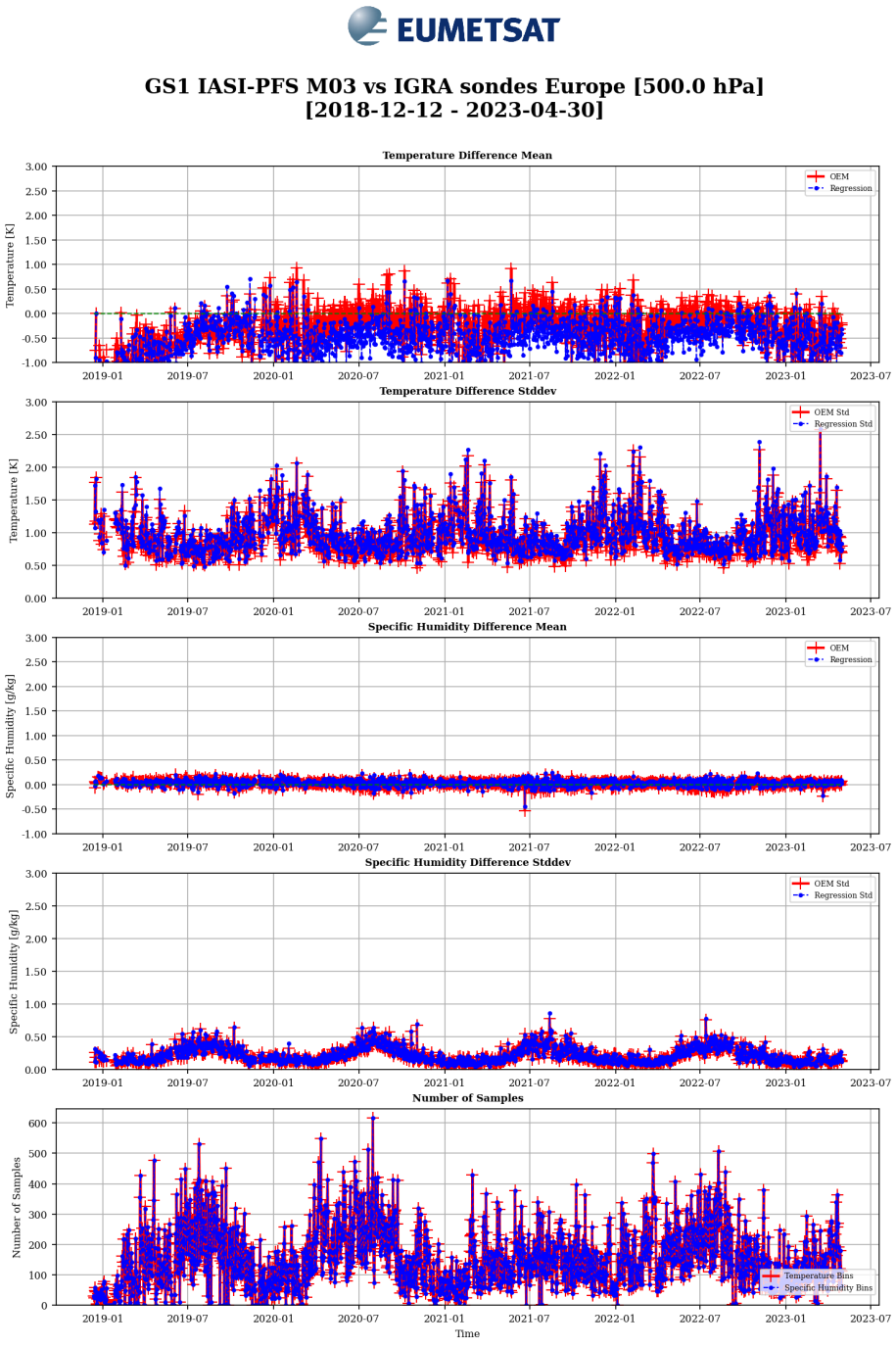

Figure 3.18: Long-term time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 500 hPa. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 updated on 30/04/2023

3.4.1.6 Level: 600 hPa

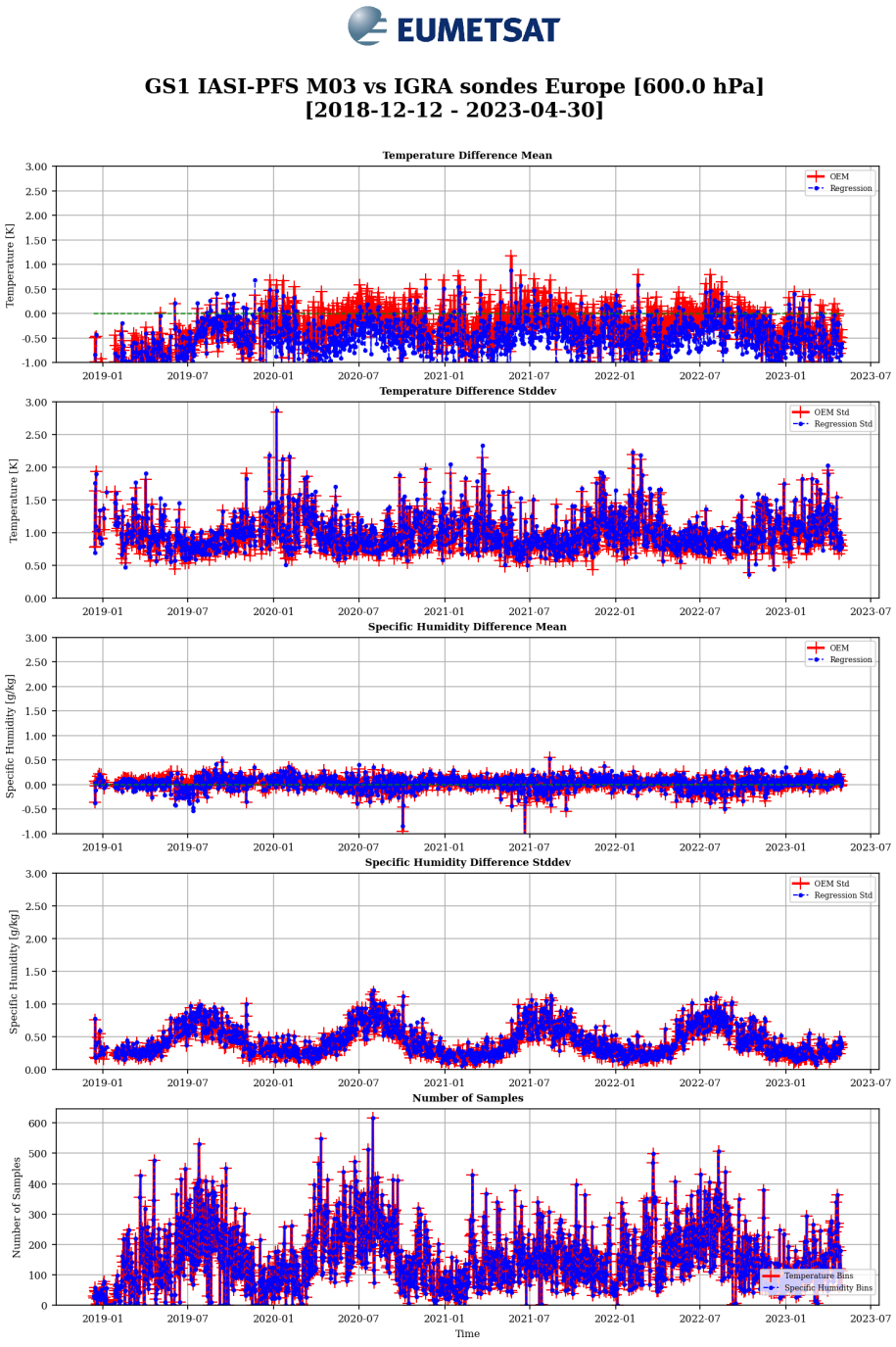

Figure 3.19: Long-term time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 600 hPa. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 updated on 30/04/2023

3.4.1.7 Level: 800 hPa

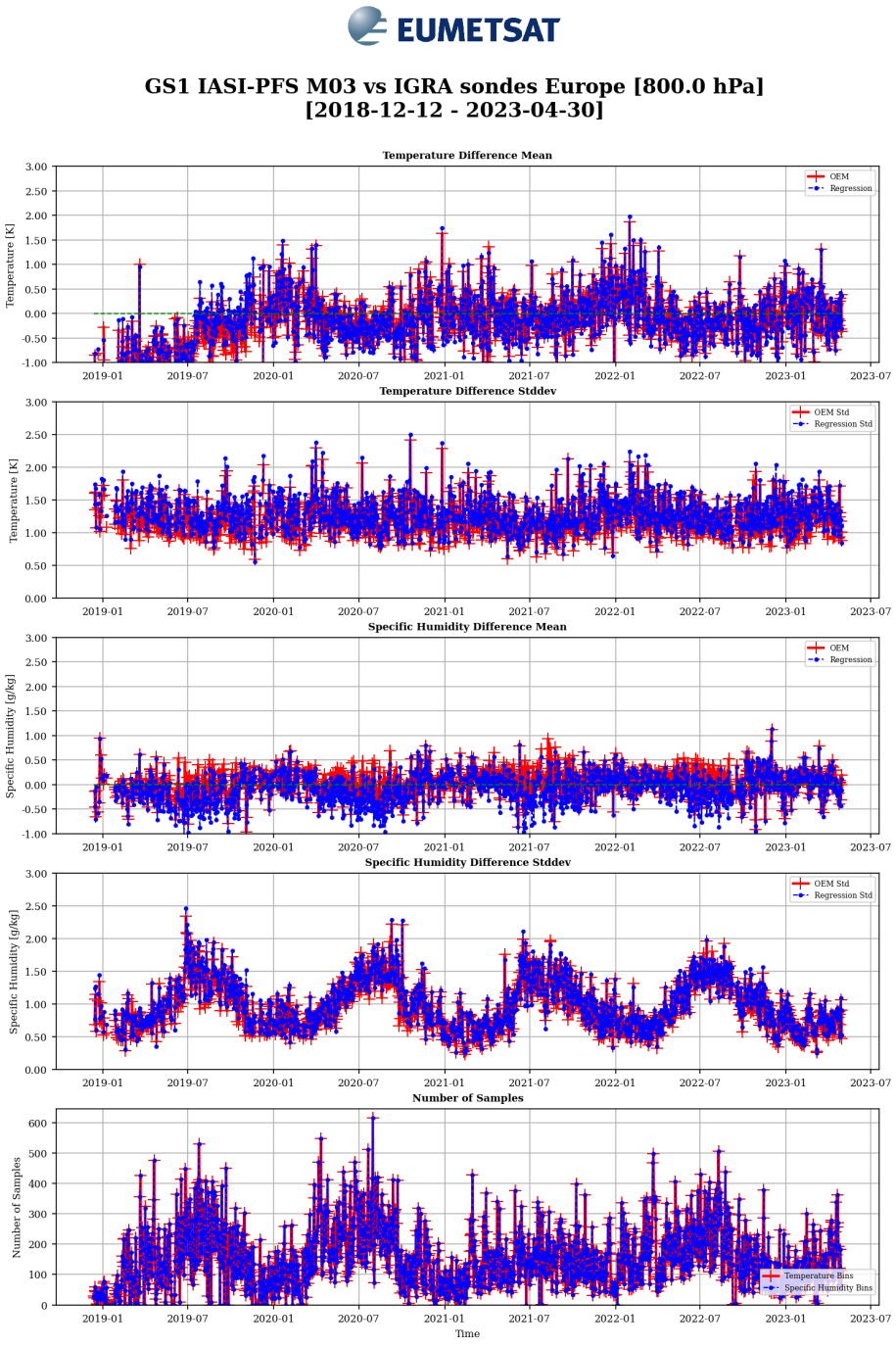

Figure 3.20: Long-term time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 800 hPa. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 updated on 30/04/2023

3.4.1.8 Level: 1000 hPa

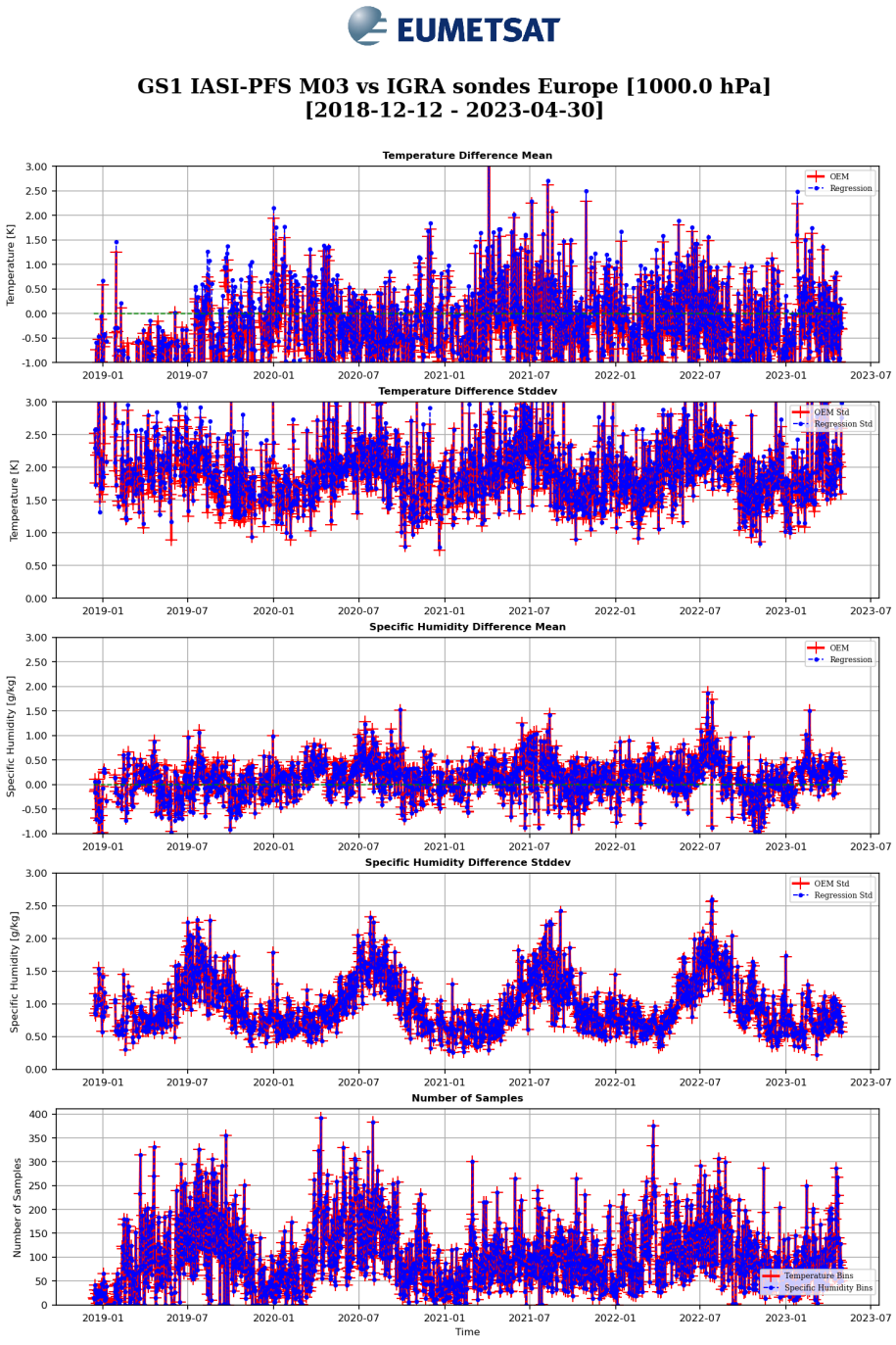

Figure 3.21: Long-term time series of mean difference and standard deviation in temperature (top 2 panels) and humidity (middle 2 panels) between IASI L2 and sondes at 1000 hPa. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 updated on 30/04/2023

3.4.2 Precipitable Water

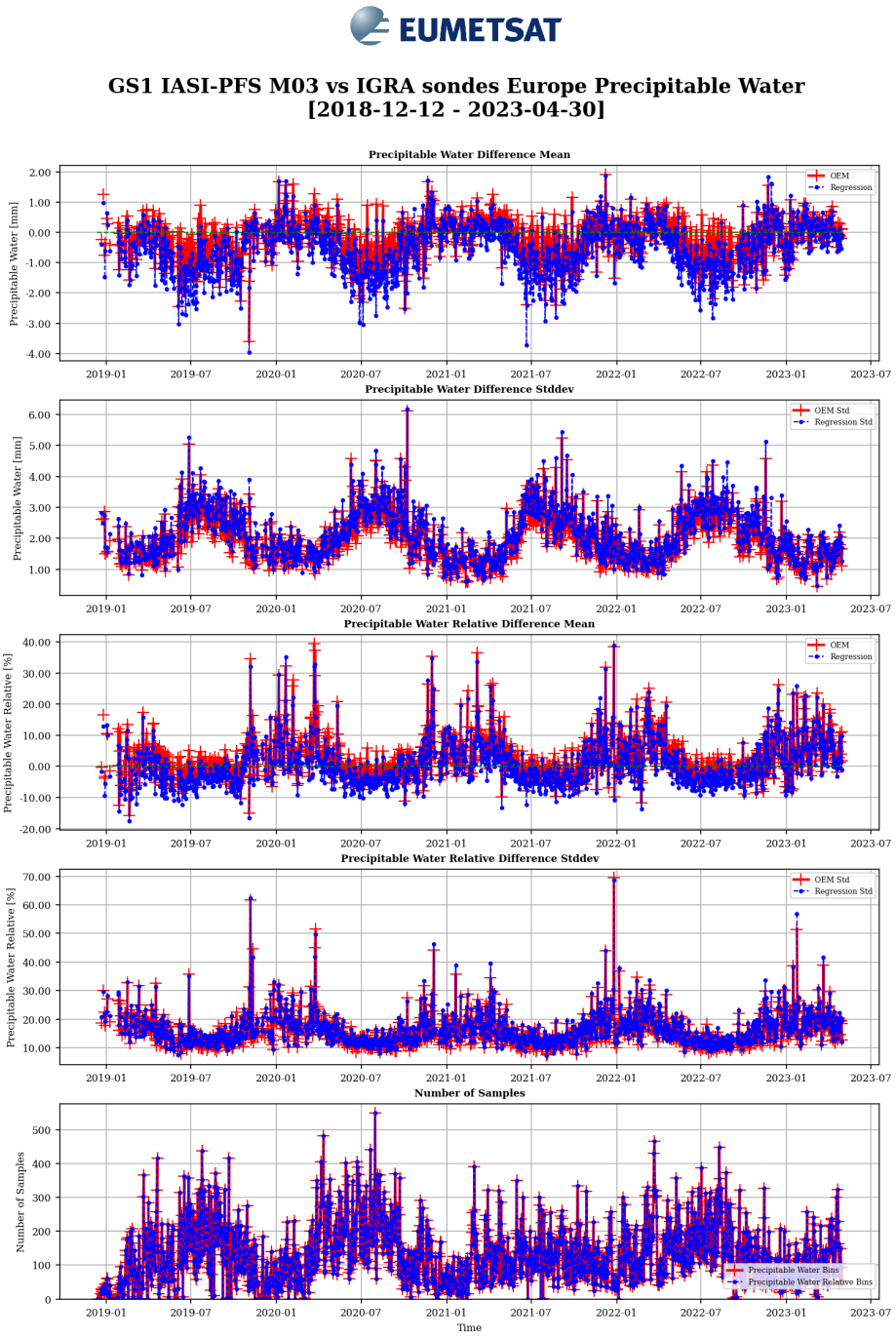

Figure 3.22: Long-term time series of Precipitable Water mean difference and standard deviation in absolute (top 2 panels) and relative Difference (middle 2 panels) between IASI L2 and IGRA. The bottom panel shows the number of Monthly match-ups. Regional Europe statistics with M03 IASI L2 from GS1 for 01-30/04/2023

3.5 Histograms

3.5.1 Moist adiabatic lapse rate

3.5.1.1 Layer: 1500m above Surface

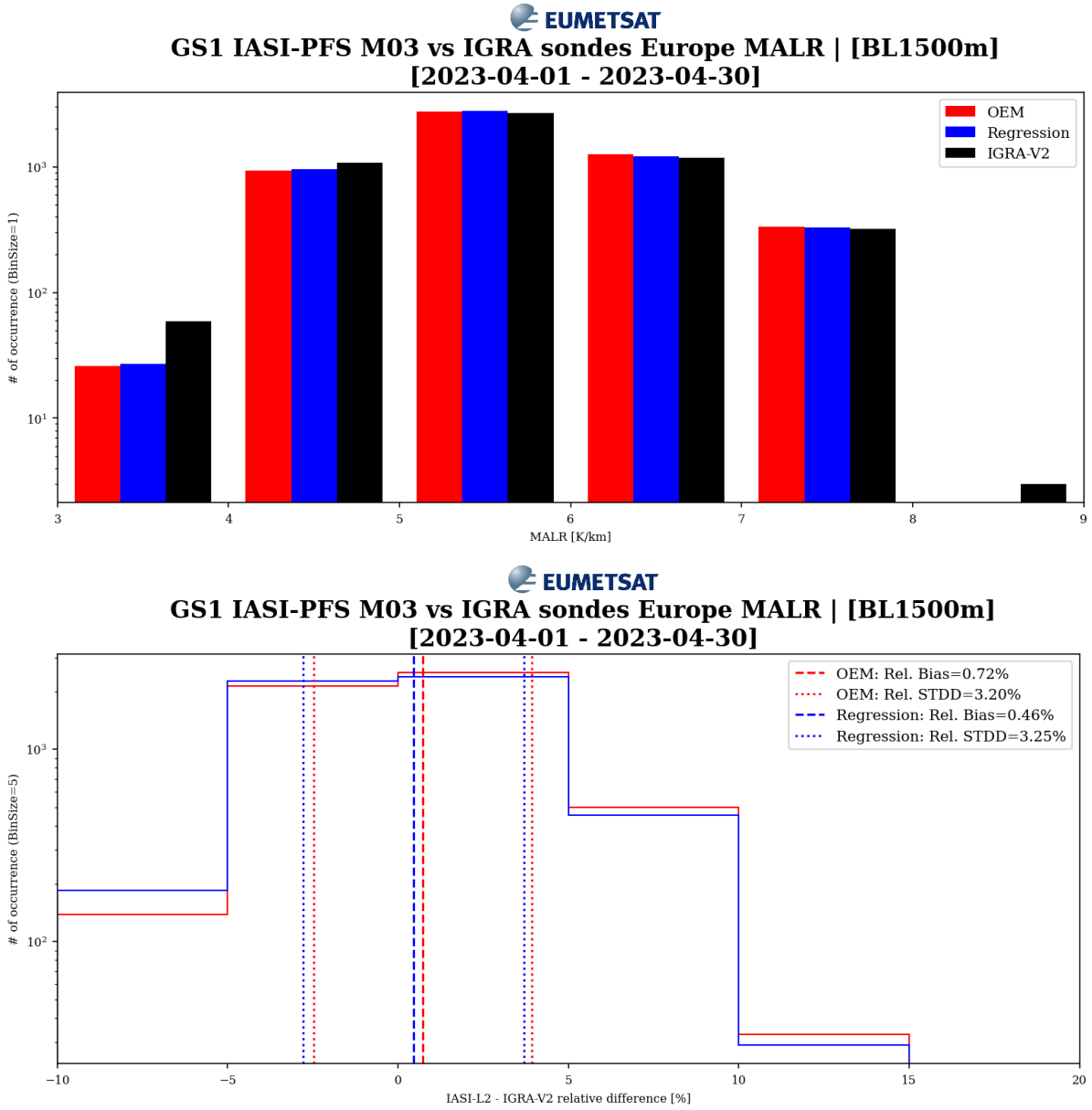

Figure 3.23: Mean Moist Adiabatic Lapse Rate (MA-Lapse Rate) Histograms as barcharts in absolute units (top) and relative differences (bottom) between IASI L2 and IGRA (ylog). Regional Europe statistics with M03 IASI L2 from GS1 for 01-30/04/2023 for the layer 1.5 km above the surface.

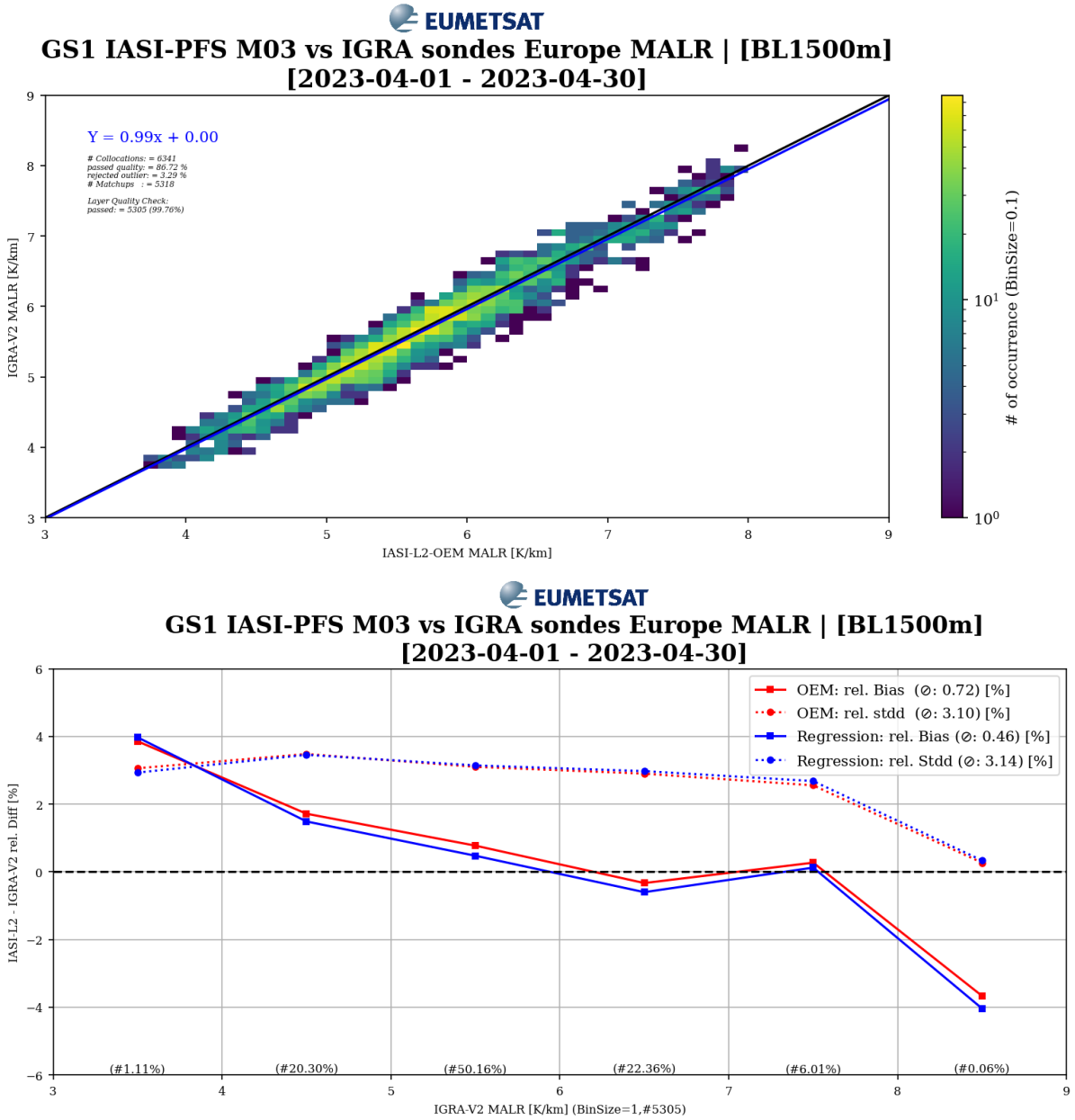

Figure 3.24: Mean Moist Adiabatic Lapse Rate (MA-Lapse Rate) 2D-Histogram (top) and bias and standard deviation as per pre-defined bins of the IGRA reference (bottom) between IASI L2 and IGRA measurements. Regional Europe statistics with M03 IASI L2 from GS1 for 01-30/04/2023 for the layer 1.5 km above the surface.

3.5.1.2 Layer: 850 - 500 hPa

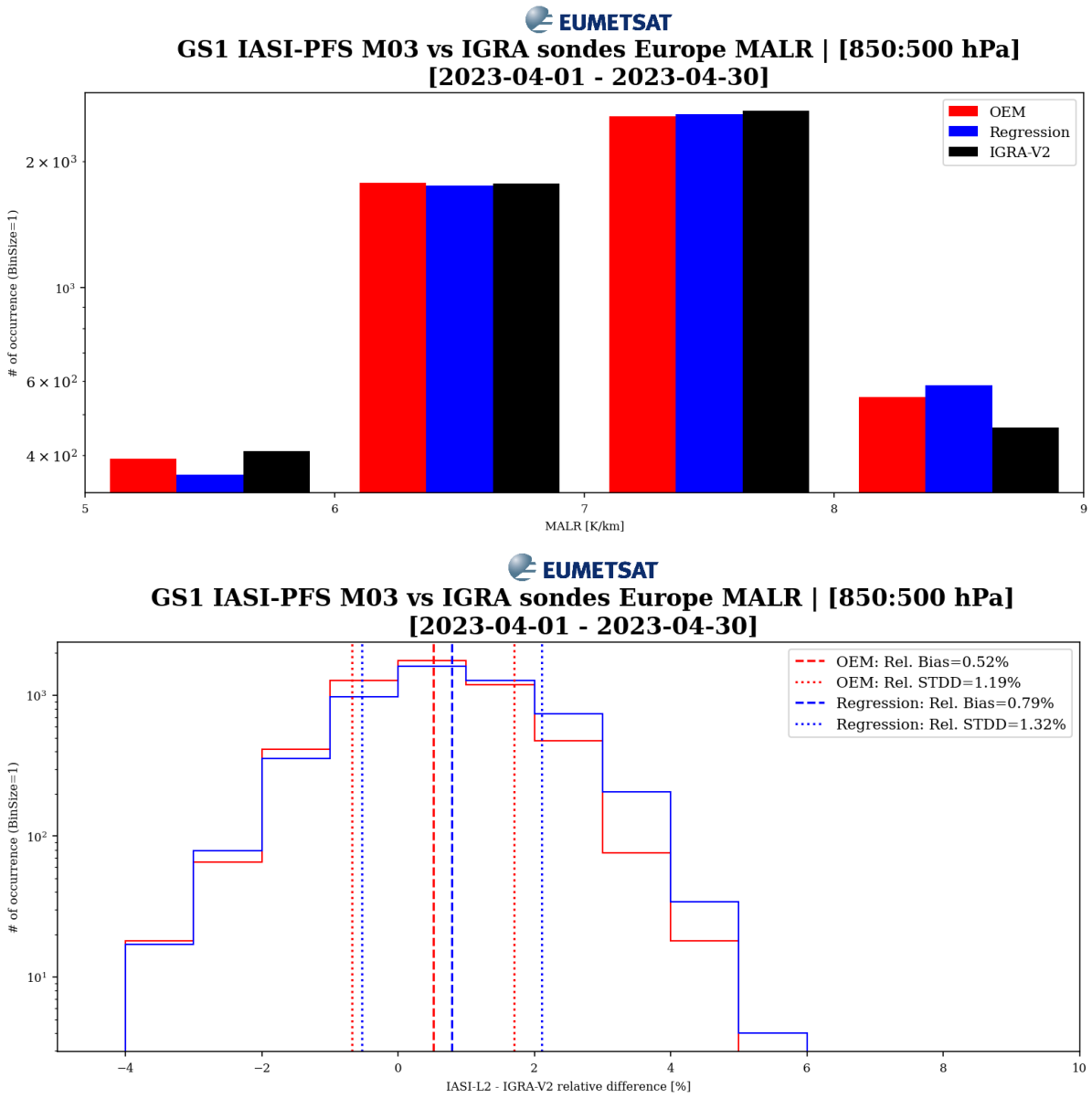

Figure 3.25: Mean Moist Adiabatic Lapse Rate (MA-Lapse Rate) Histograms as barcharts in absolute units (top) and relative differences (bottom) between IASI L2 and IGRA (ylog). Regional Europe statistics with M03 IASI L2 from GS1 for 01-30/04/2023 for the layer from 850 to 500 hPa.

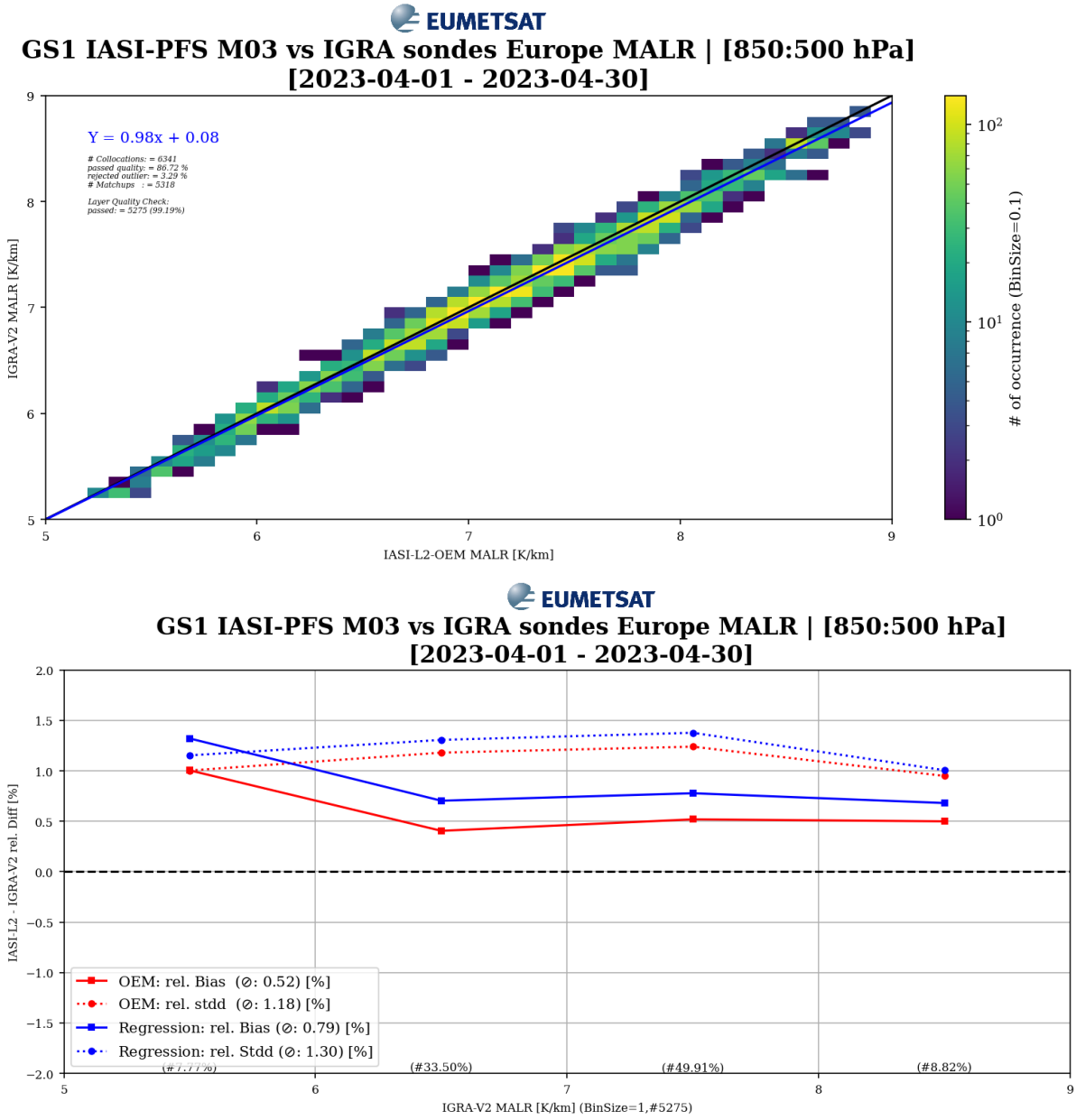

Figure 3.26: Mean Moist Adiabatic Lapse Rate (MA-Lapse Rate) 2D-Histogram (top) and bias and standard deviation as per pre-defined bins of the IGRA reference (bottom) between IASI L2 and IGRA measurements. Regional Europe statistics with M03 IASI L2 from GS1 for 01-30/04/2023 for the layer from 850 to 500 hPa.

3.5.2 Precipitable Water

3.5.2.1 Total Column

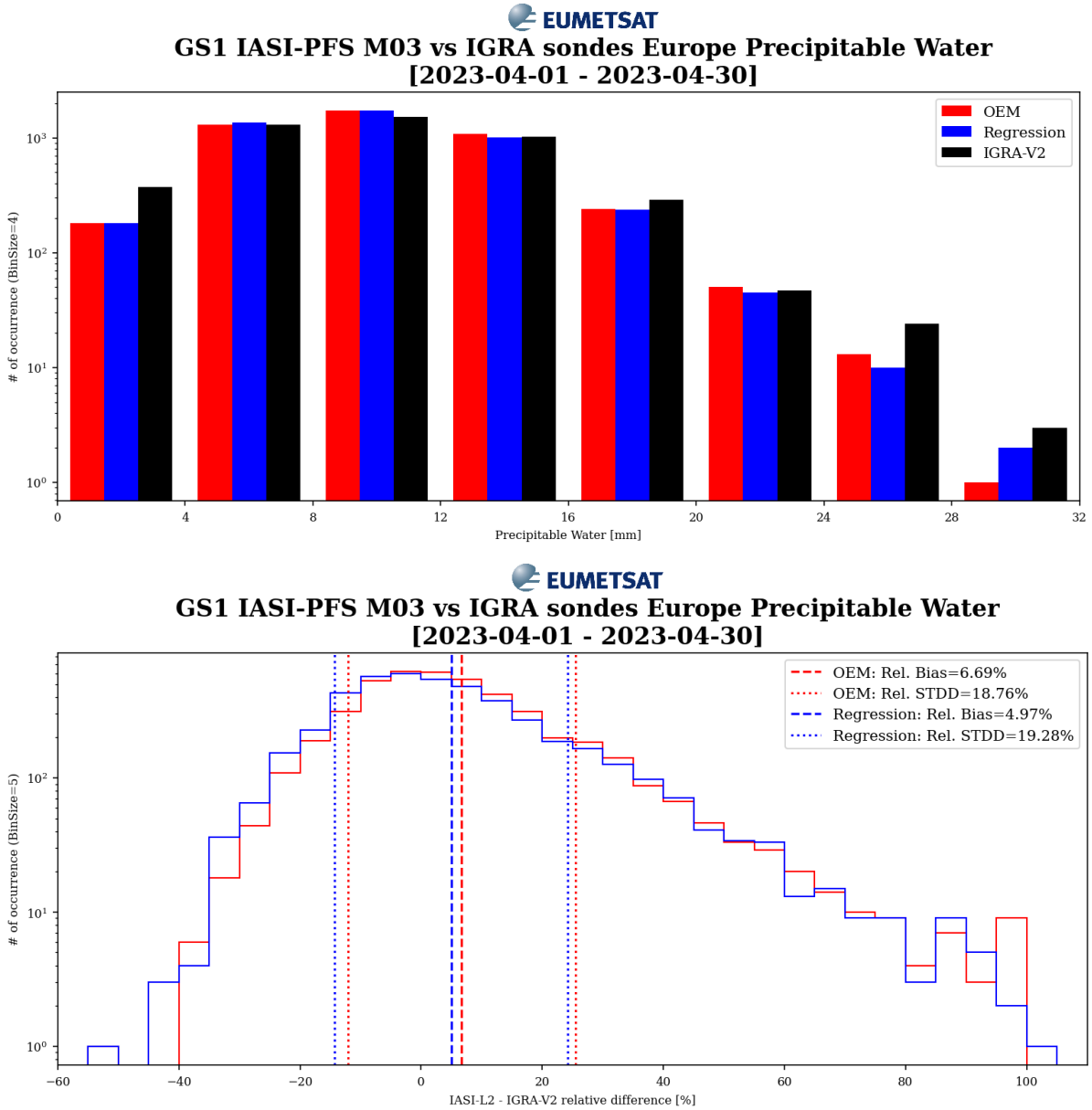

Figure 3.27: Histograms as barcharts in mm (top) and relative differences (bottom) between IASI L2 Precipitable Water and IGRA (ylog), with M03 IASI L2 from GS1 for 01-30/04/2023

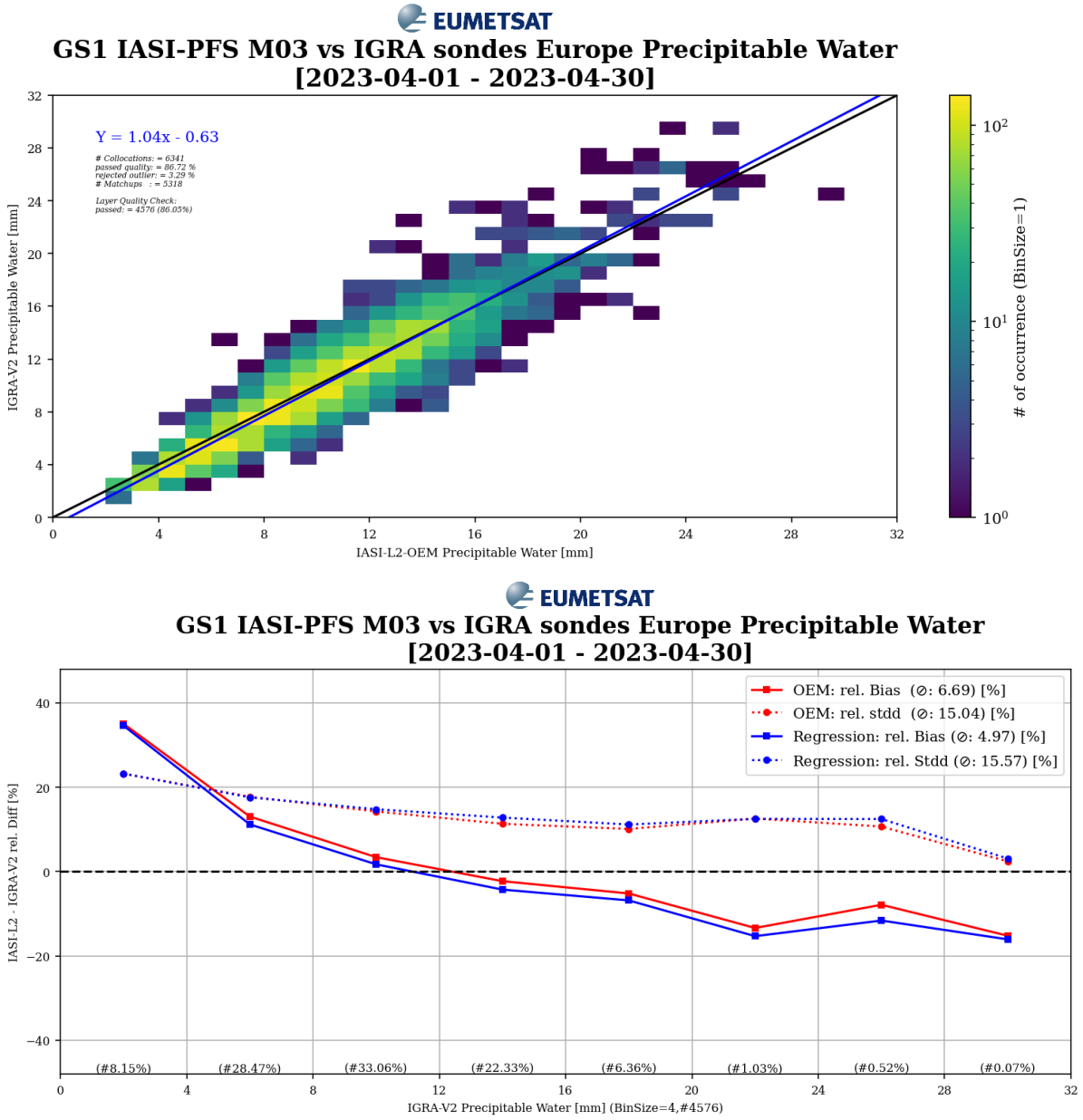

Figure 3.28: 2D Histogram (top) and bias and standard deviation as per 5-mm-sized-bin of the IGRA reference (bottom) between IASI L2 Precipitable Water and IGRA measurements, with M03 IASI L2 from GS1 for 01-30/04/2023

3.5.2.2 Layer: 1500m above Surface

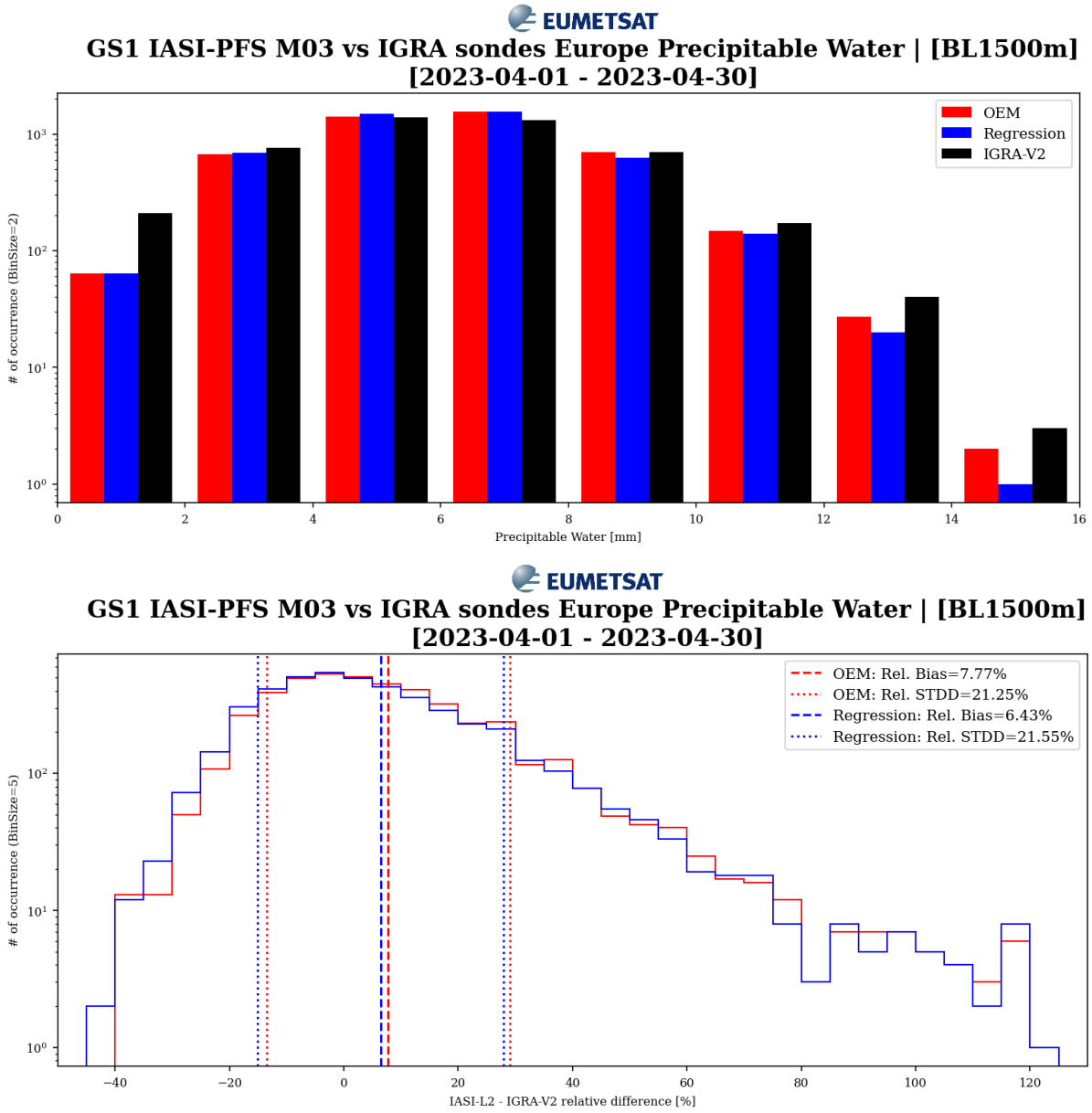

Figure 3.29: Histograms as barcharts in mm (top) and relative differences (bottom) between IASI L2 Precipitable Water and IGRA (ylog), with M03 IASI L2 from GS1 for 01-30/04/2023 for the layer 1.5 km above the surface.

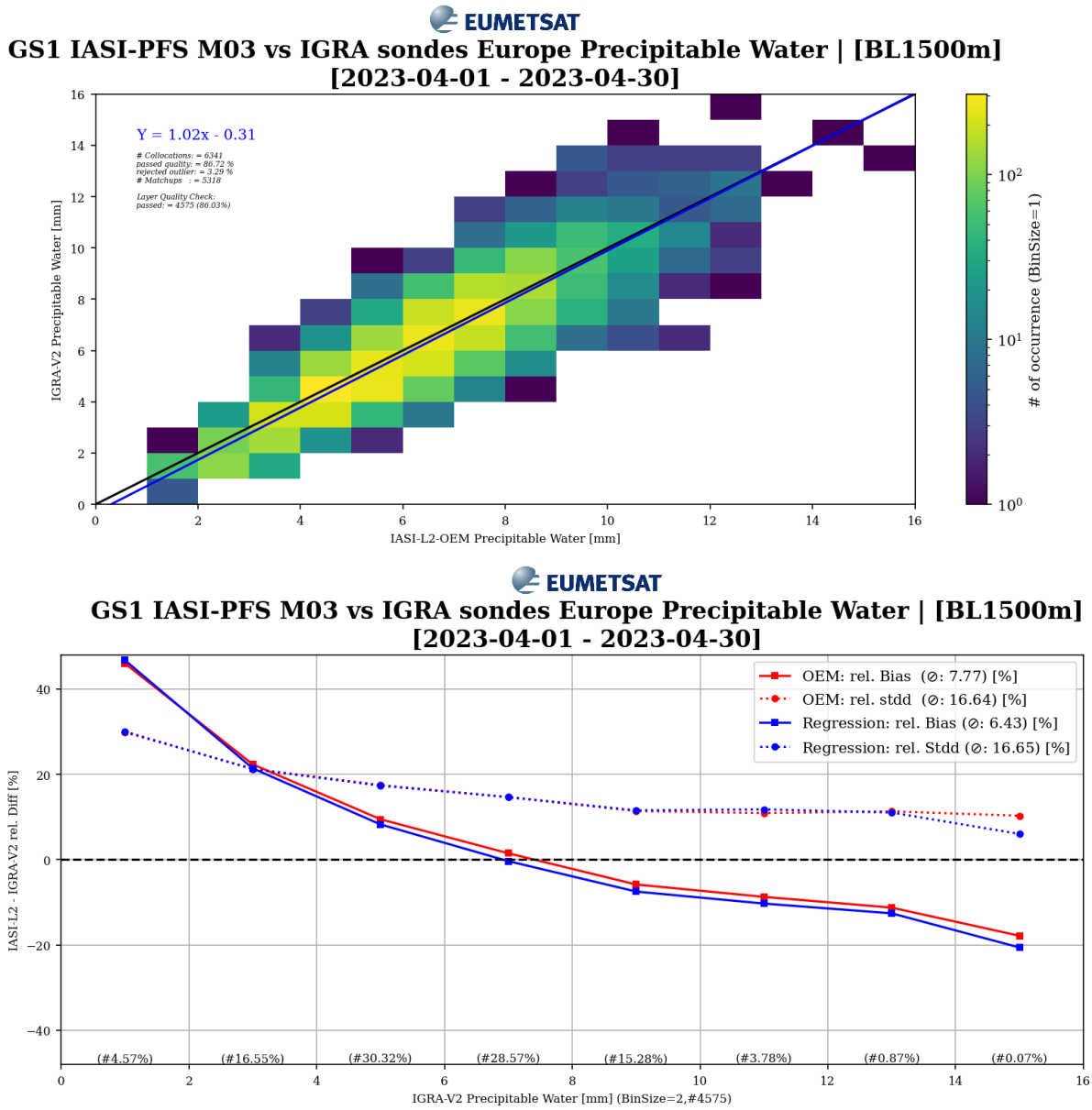

Figure 3.30: 2D Histogram (top) and bias and standard deviation as per 5-mm-sized-bin of the IGRA reference (bottom) between IASI L2 Precipitable Water and IGRA measurements, with M03 IASI L2 from GS1 for 01-30/04/2023 for the layer 1.5 km above the surface.

3.5.2.3 Layer: 850 - 500 hPa

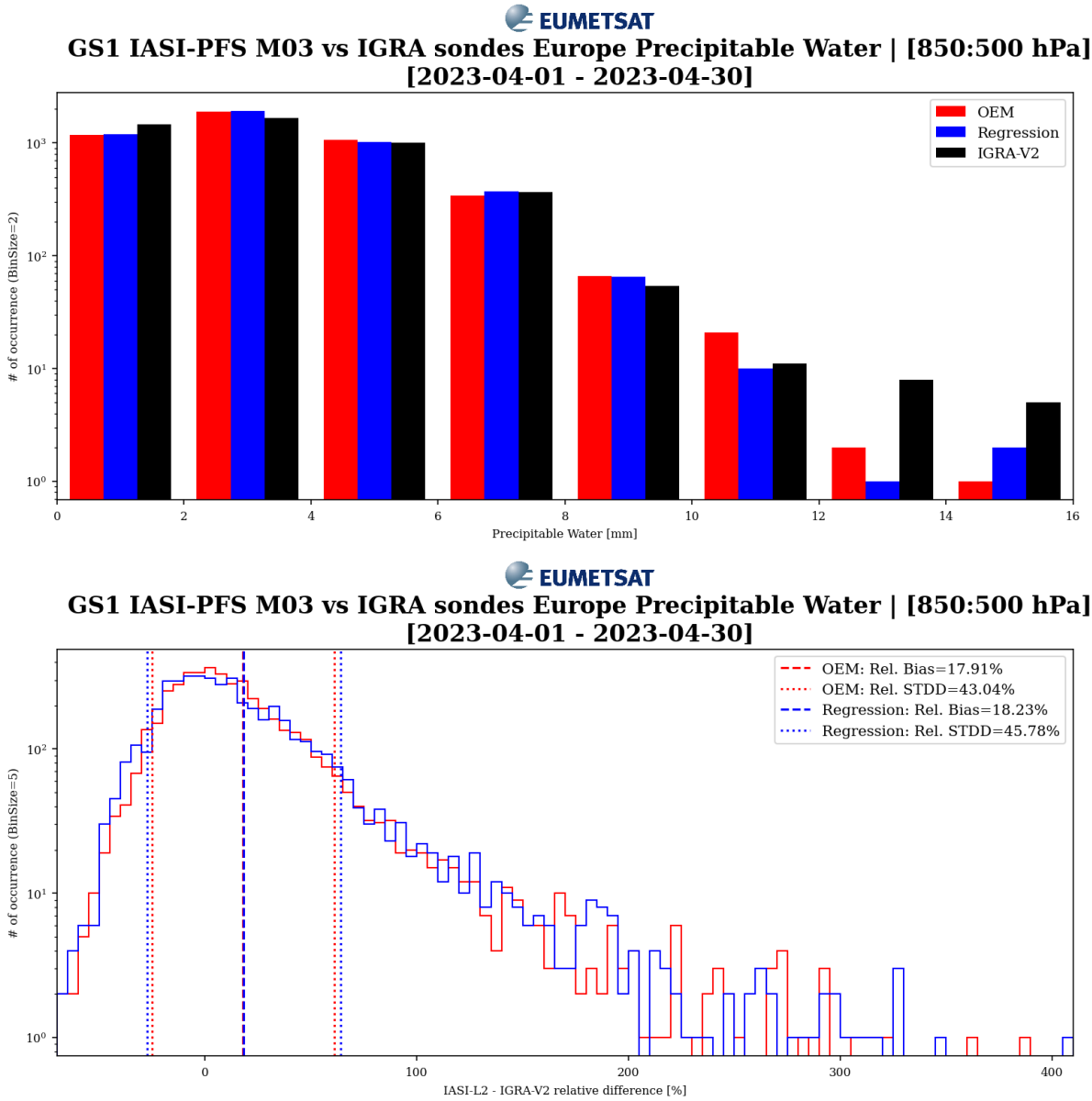

Figure 3.31: Histograms as barcharts mm (top) and relative differences (bottom) between IASI L2 Precipitable Water and IGRA (ylog), with M03 IASI L2 from GS1 for 01-30/04/2023 for the layer from 850 to 500 hPa

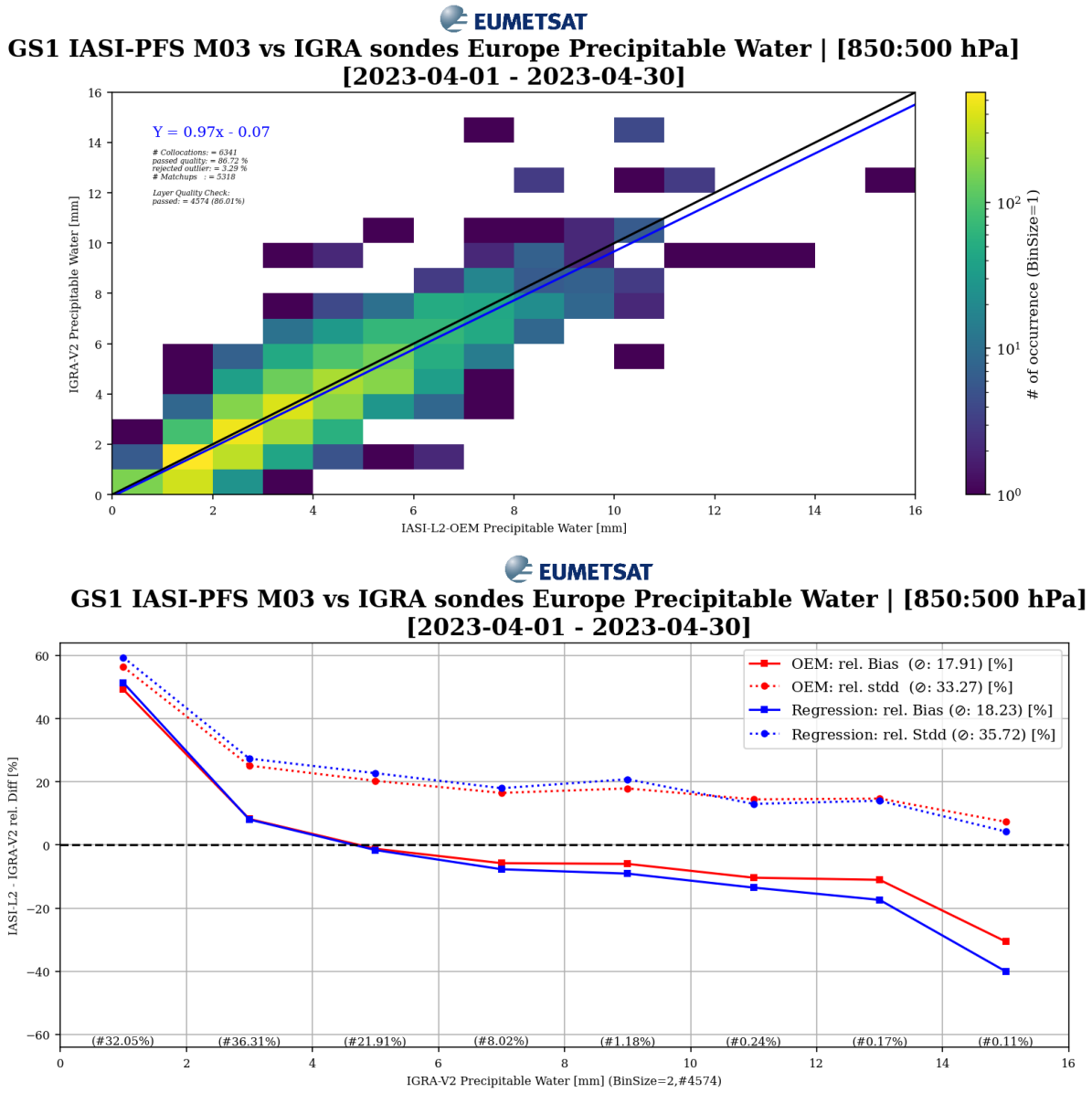

Figure 3.32: 2D Histogram (top) and bias and standard deviation as per 5-mm-sized-bin of the IGRA reference (bottom) between IASI L2 Precipitable Water and IGRA measurements, with M03 IASI L2 from GS1 for 01-30/04/2023 for the layer from 850 to 500 hPa

3.5.2.4 Collocational dependencies

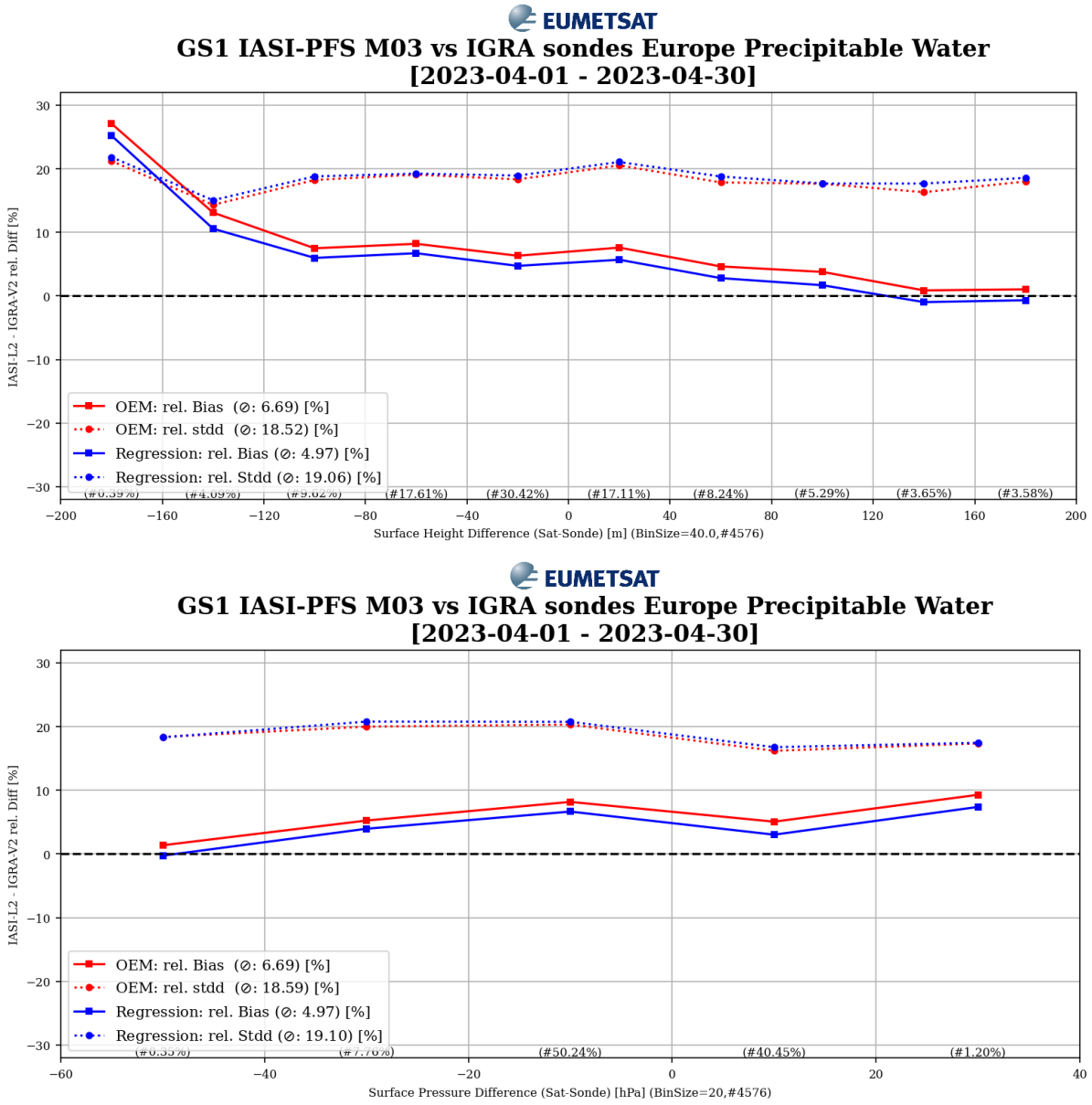

Figure 3.33: Relative bias and standard deviation histograms between IASI L2 Precipitable Water and IGRA (ylog), for Europe with M03 IASI L2 from GS1 for 01-30/04/2023 for different surface height (top) and surface pressure differences (bottom).

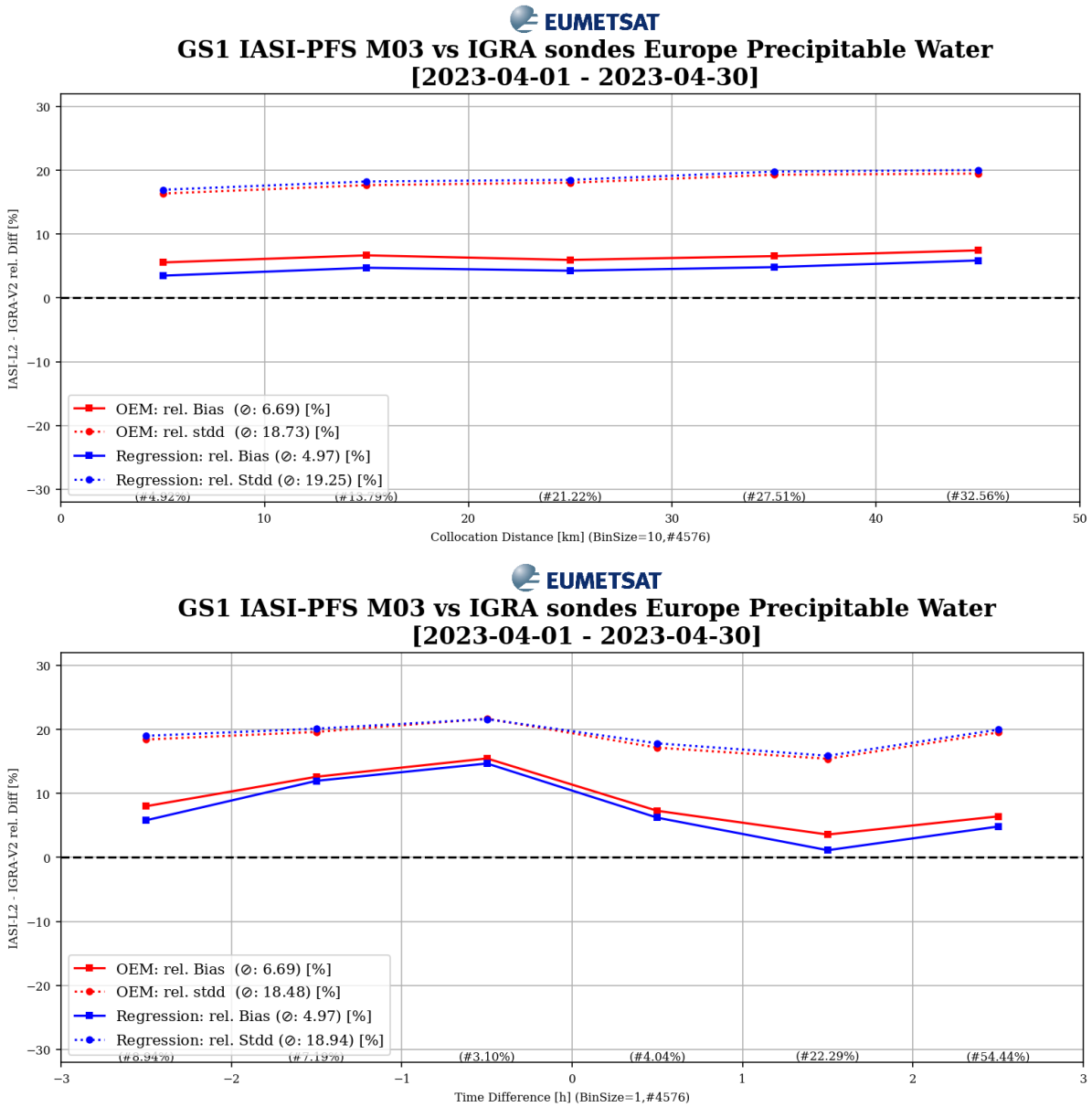

Figure 3.34: Relative bias and standard deviation histograms between IASI L2 Precipitable Water and IGRA (ylog), for Europe with M03 IASI L2 from GS1 for 01-30/04/2023 for different collocation spatial distances (top) and temporal differences (bottom).

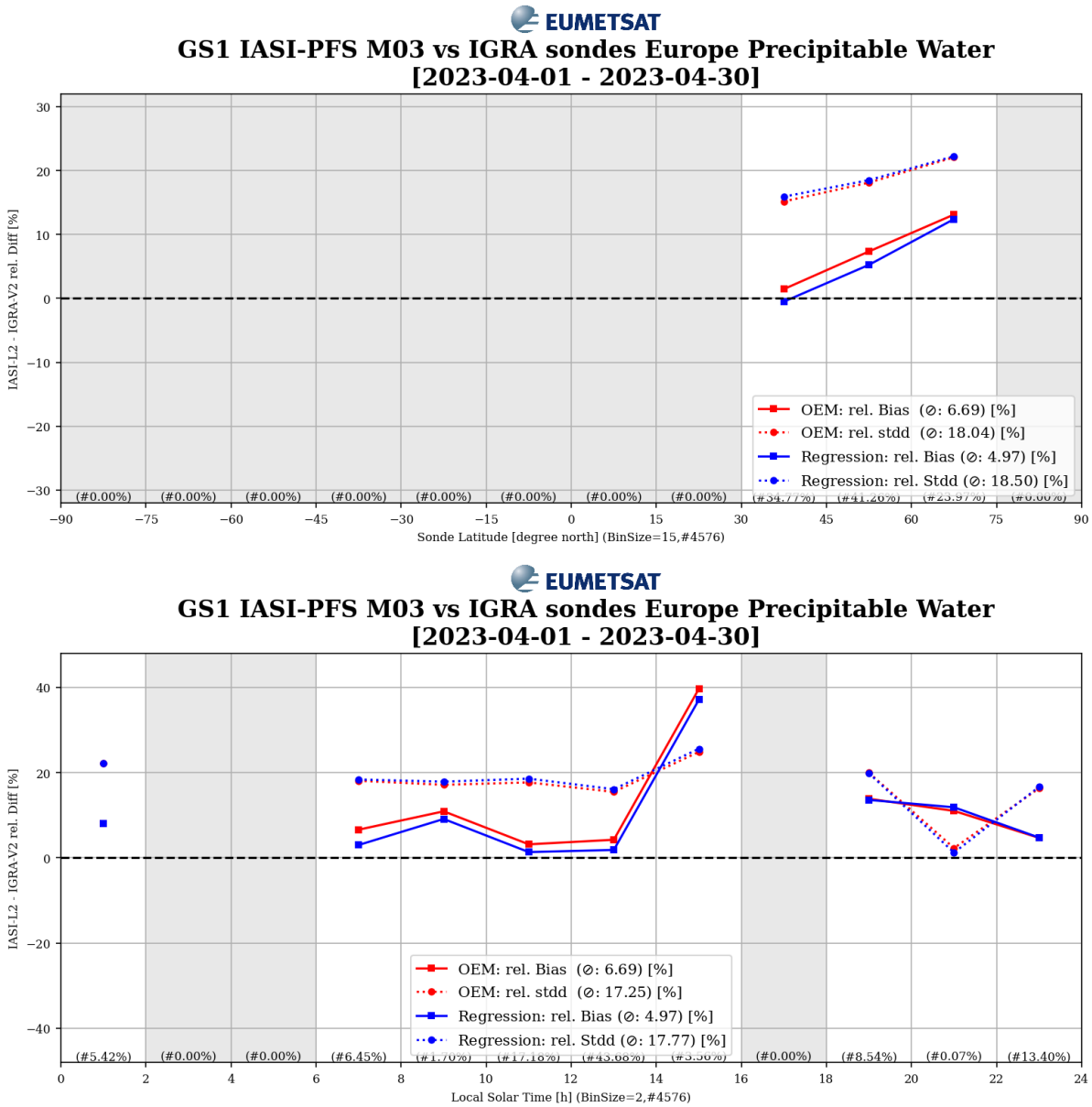

Figure 3.35: Relative bias and standard deviation histograms between IASI L2 Precipitable Water and IGRA (ylog), for Europe with M03 IASI L2 from GS1 for 01-30/04/2023 for different latitudes (top) and local solar times (bottom).

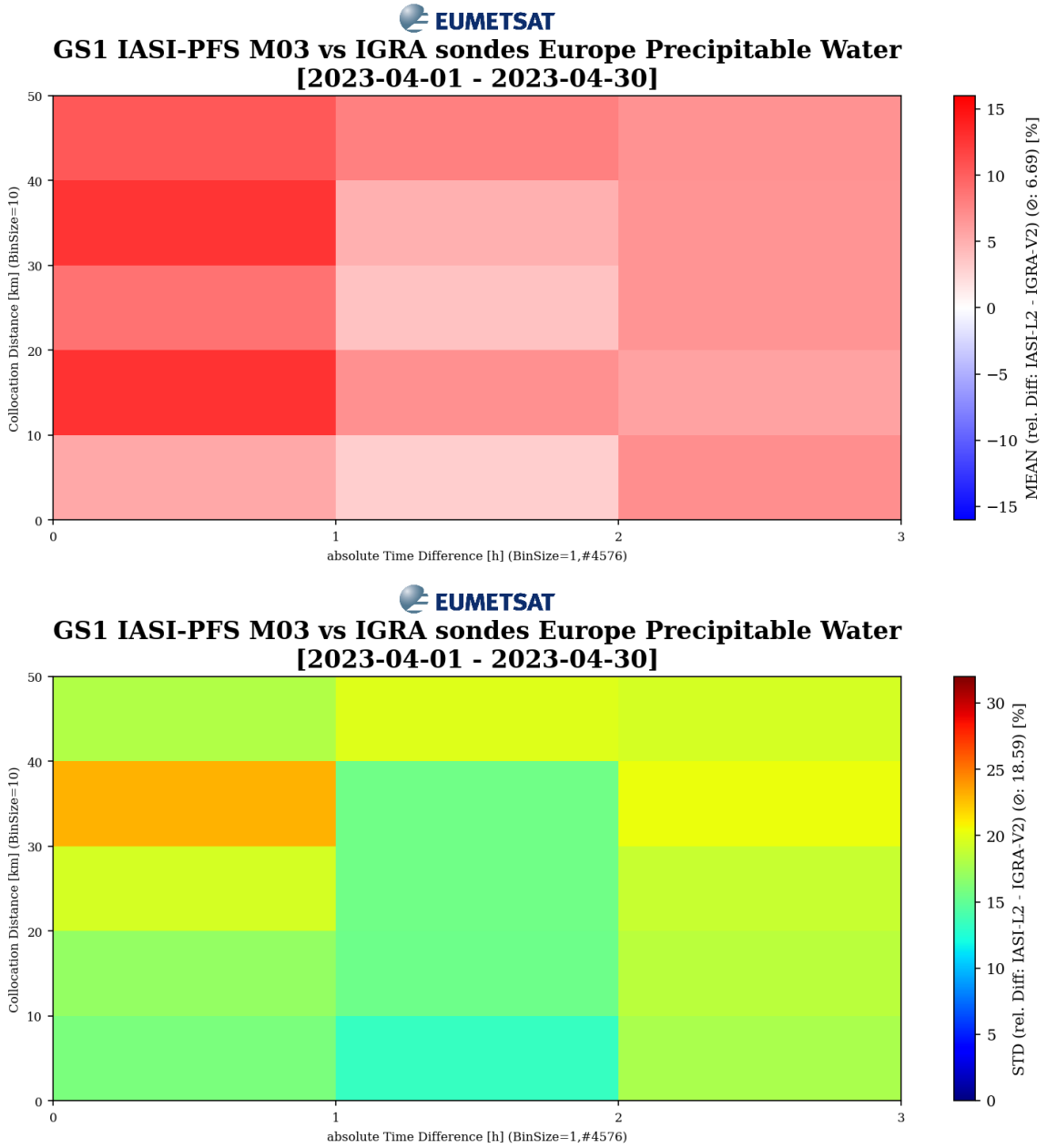

Figure 3.36: 2D Histograms bias (top) and standard deviation (bottom) for IASI L2 Precipitable Water and IGRA measurements, for Europe with M03 IASI L2 from GS1 for 01-30/04/2023 dependent of collocation temporal difference and spatial distances.

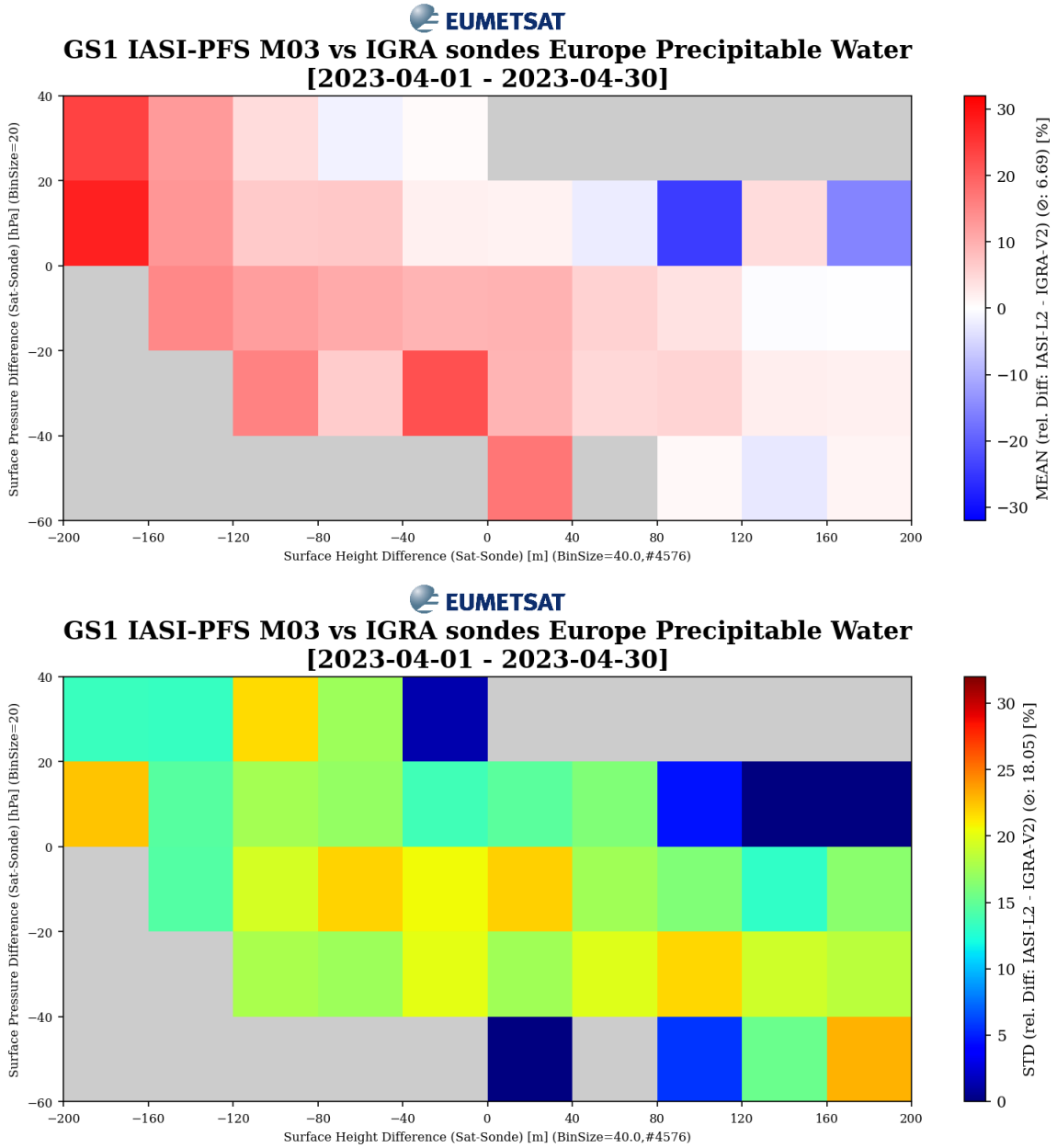

Figure 3.37: 2D Histograms bias (top) and standard deviation (bottom) for IASI L2 Precipitable Water and IGRA measurements, for Europe with M03 IASI L2 from GS1 for 01-30/04/2023 dependent of Surface Pressure Difference and Surface Pressure Difference.

3.5.2.5 Angular dependencies

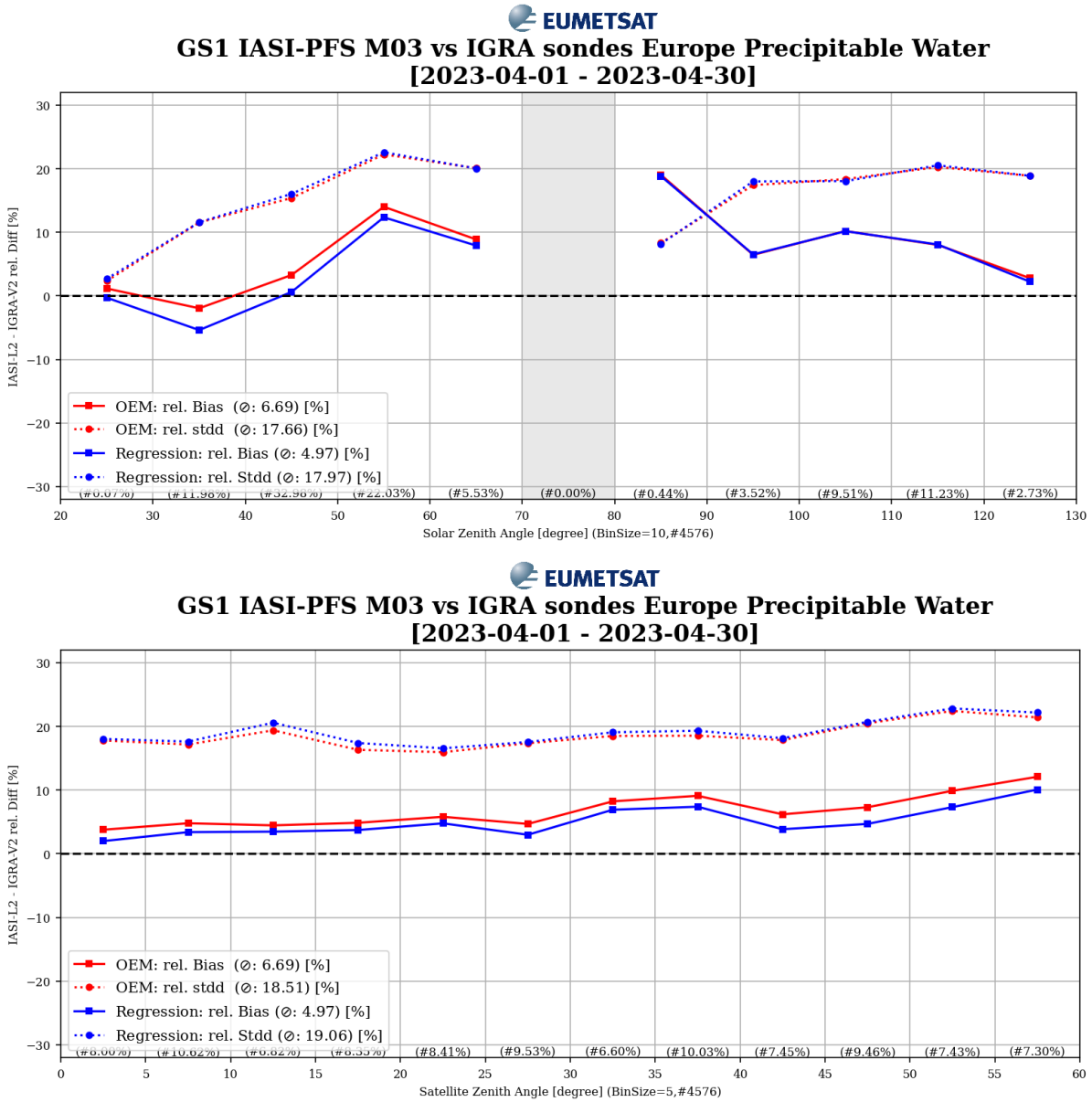

Figure 3.38: Relative bias and standard deviation histograms between IASI L2 Precipitable Water and IGRA (ylog), for Europe with M03 IASI L2 from GS1 for 01-30/04/2023 for different sun zenith angles (top) and satellite zenith angles (bottom).

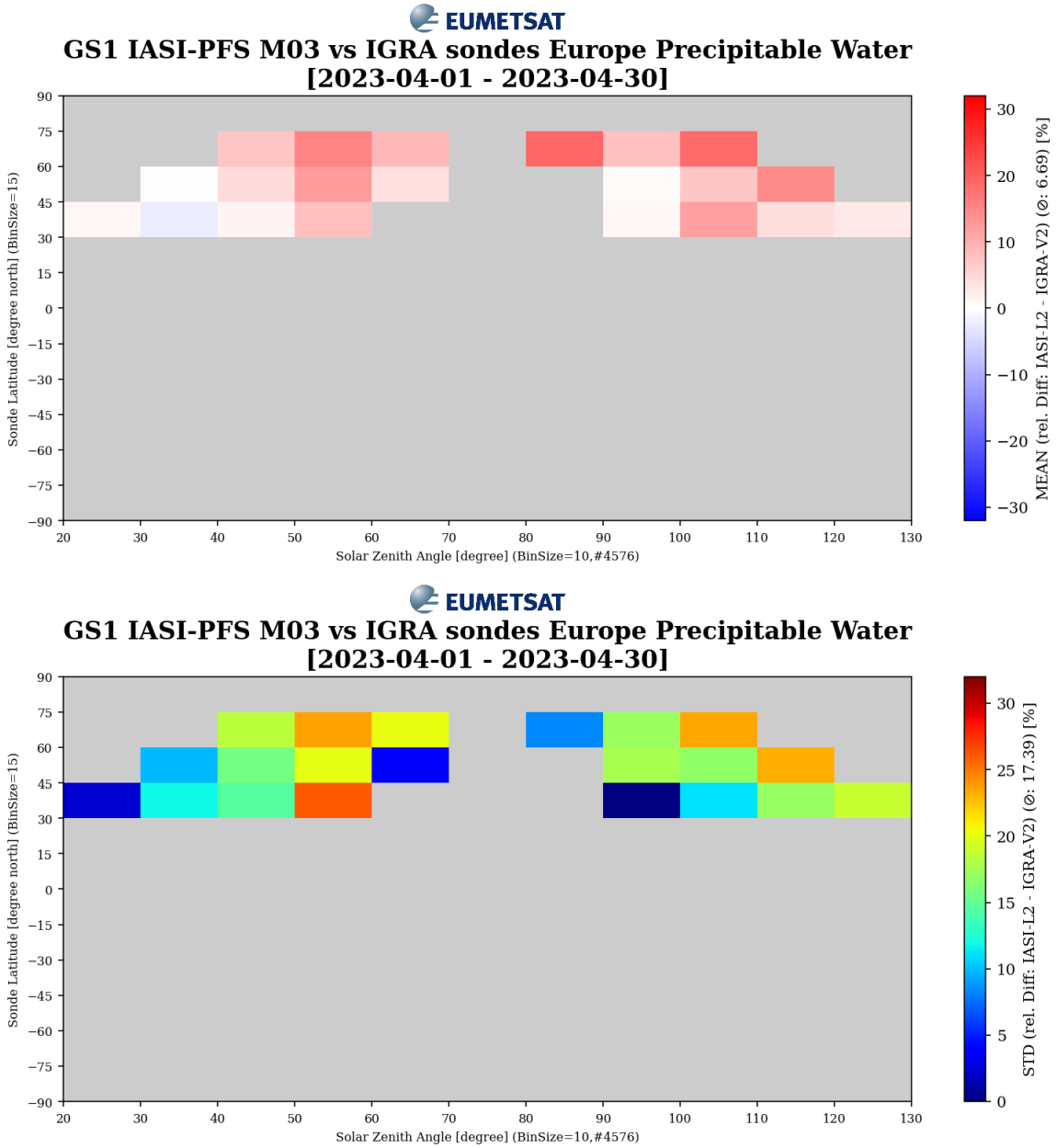

Figure 3.39: 2D Histograms bias (top) and standard deviation (bottom) for IASI L2 Precipitable Water and IGRA measurements, for Europe with M03 IASI L2 from GS1 for 01-30/04/2023 dependent of sun zenith angles and latitude.

4 GLOBAL MONTHLY STATISTICS PER STATION

4.1 Humidity difference maps

4.1.1 Layer: 100 - 10 hPa

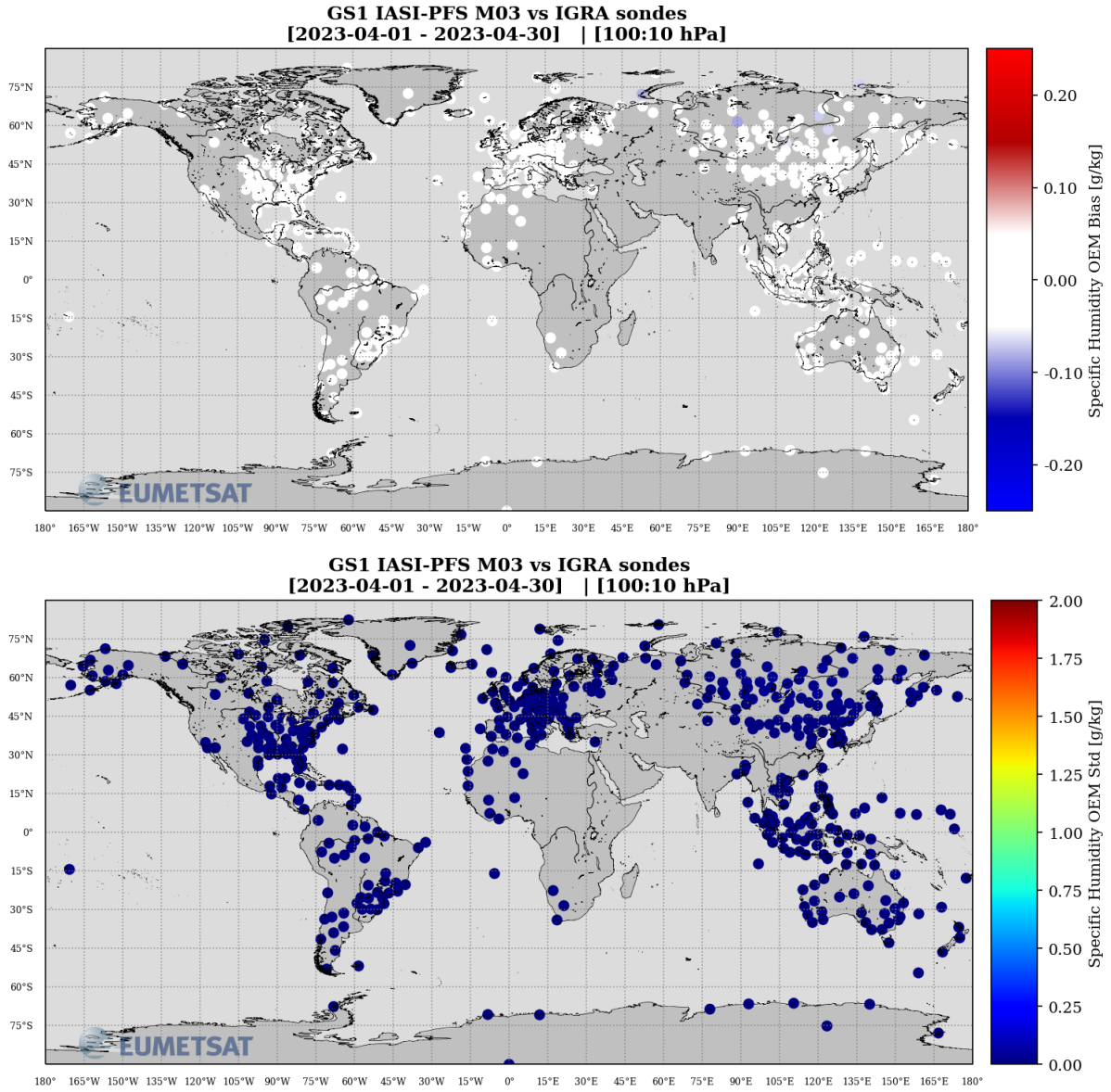

Figure 4.1: Maps of humidity mean (top) differences and standard deviation (bottom) between IASI L2 humidity and sondes in the layer [10-100hPa], with M03 IASI L2 from GS1 for 01-30/04/2023

4.1.2 Layer: 200 - 100 hPa

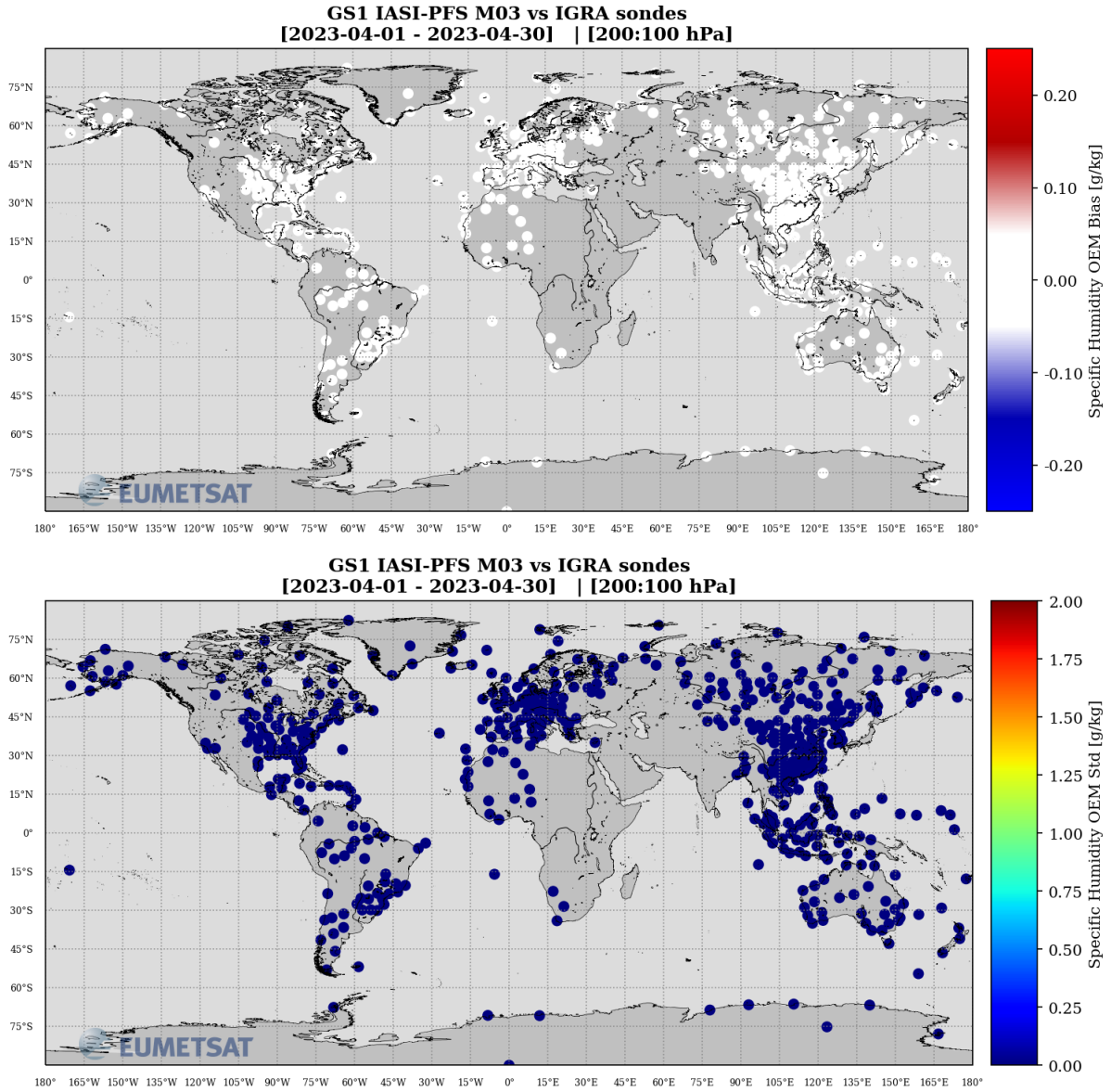

Figure 4.2: Maps of humidity mean (top) differences and standard deviation (bottom) between IASI L2 humidity and sondes in the layer [100-200hPa], with M03 IASI L2 from GS1 for 01-30/04/2023

4.1.3 Layer: 400 - 200 hPa

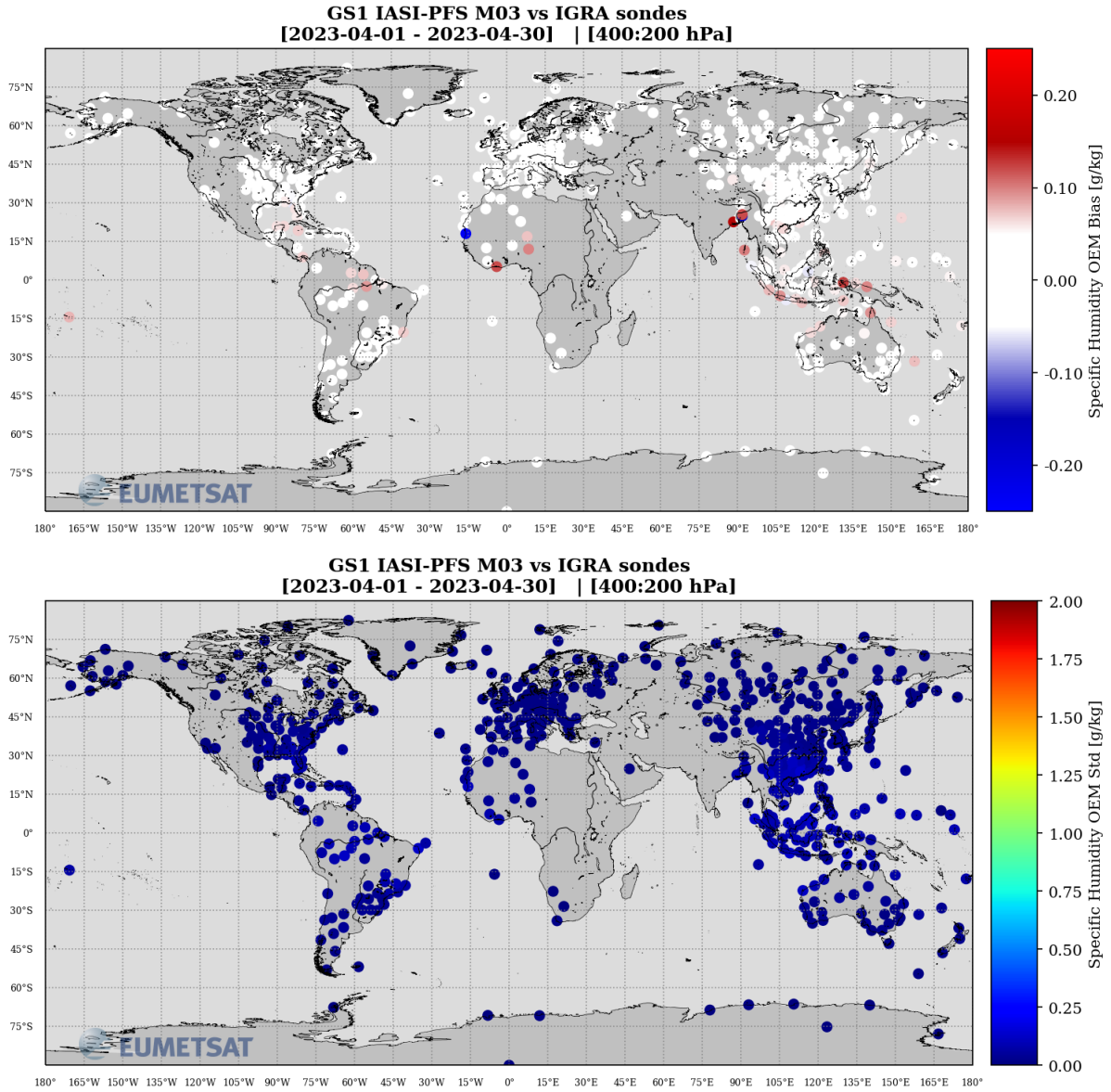

Figure 4.3: Maps of humidity mean (top) differences and standard deviation (bottom) between IASI L2 humidity and sondes in the layer [200-400hPa], with M03 IASI L2 from GS1 for 01-30/04/2023

4.1.4 Layer: 600 - 400 hPa

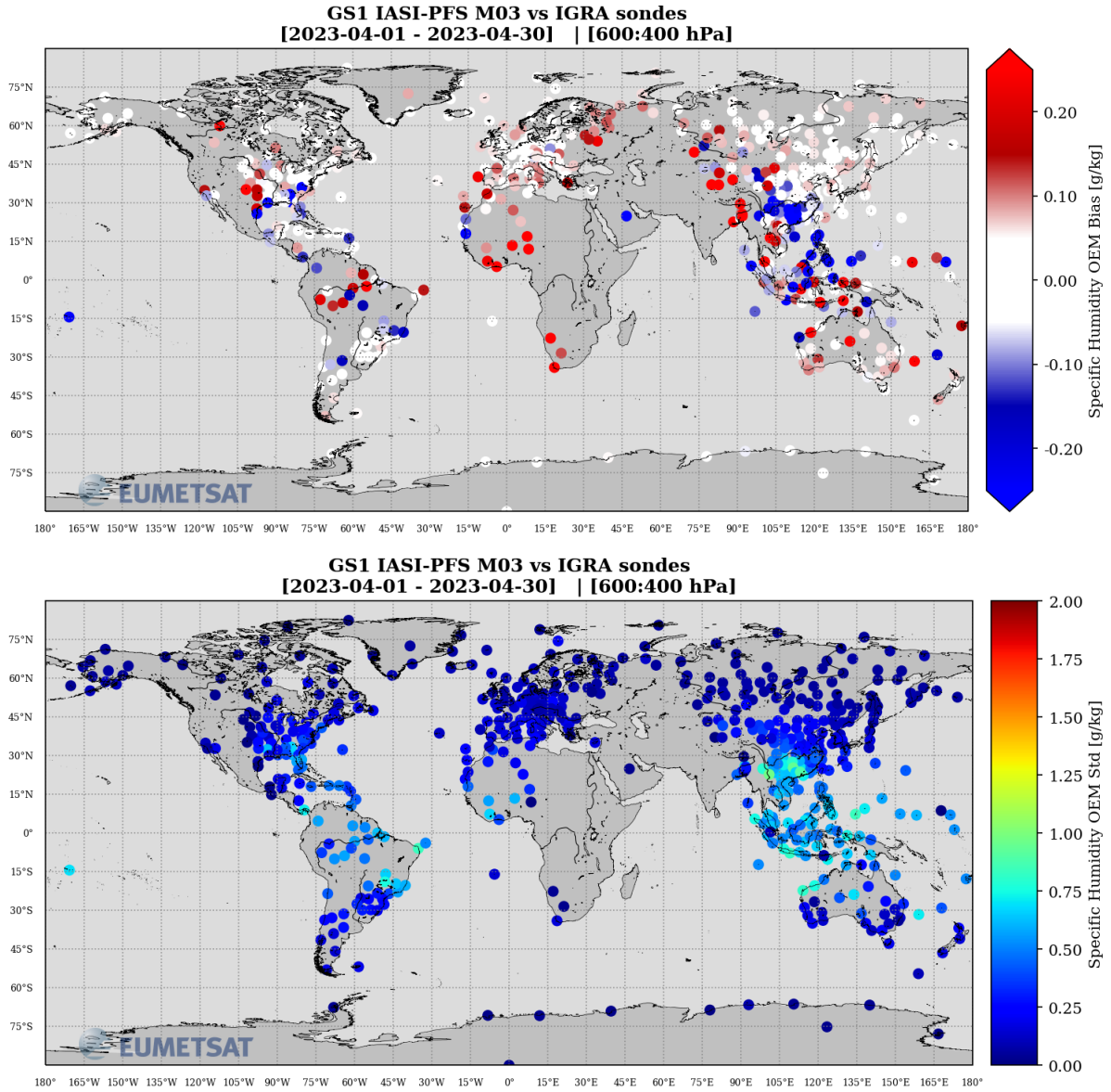

Figure 4.4: Maps of humidity mean (top) differences and standard deviation (bottom) between IASI L2 humidity and sondes in the layer [400-600hPa], with M03 IASI L2 from GS1 for 01-30/04/2023

4.1.5 Layer: 800 - 600 hPa

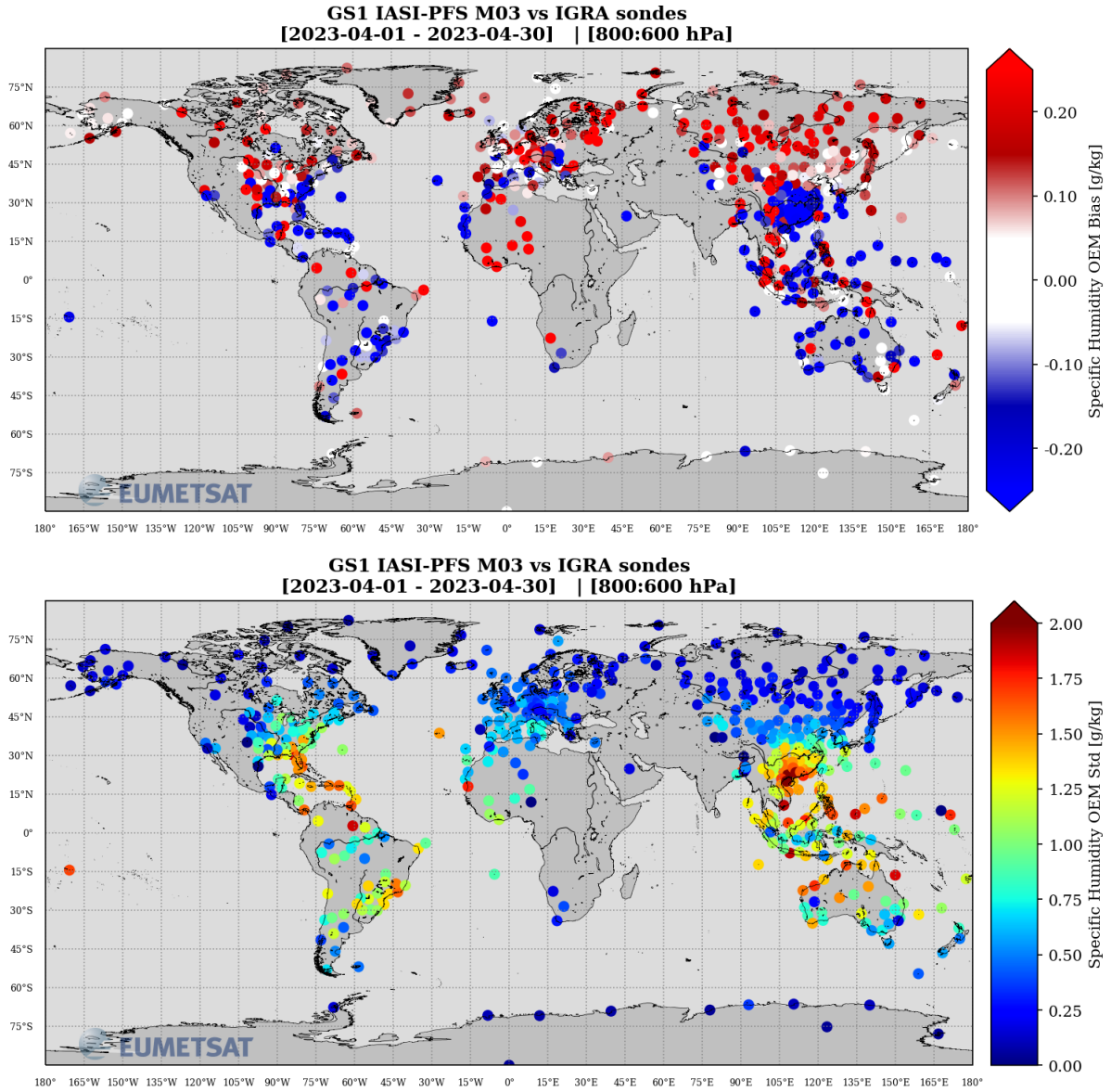

Figure 4.5: Maps of humidity mean (top) differences and standard deviation (bottom) between IASI L2 humidity and sondes in the layer [600-800hPa], with M03 IASI L2 from GS1 for 01-30/04/2023

4.1.6 Layer:1000 - 800 hPa

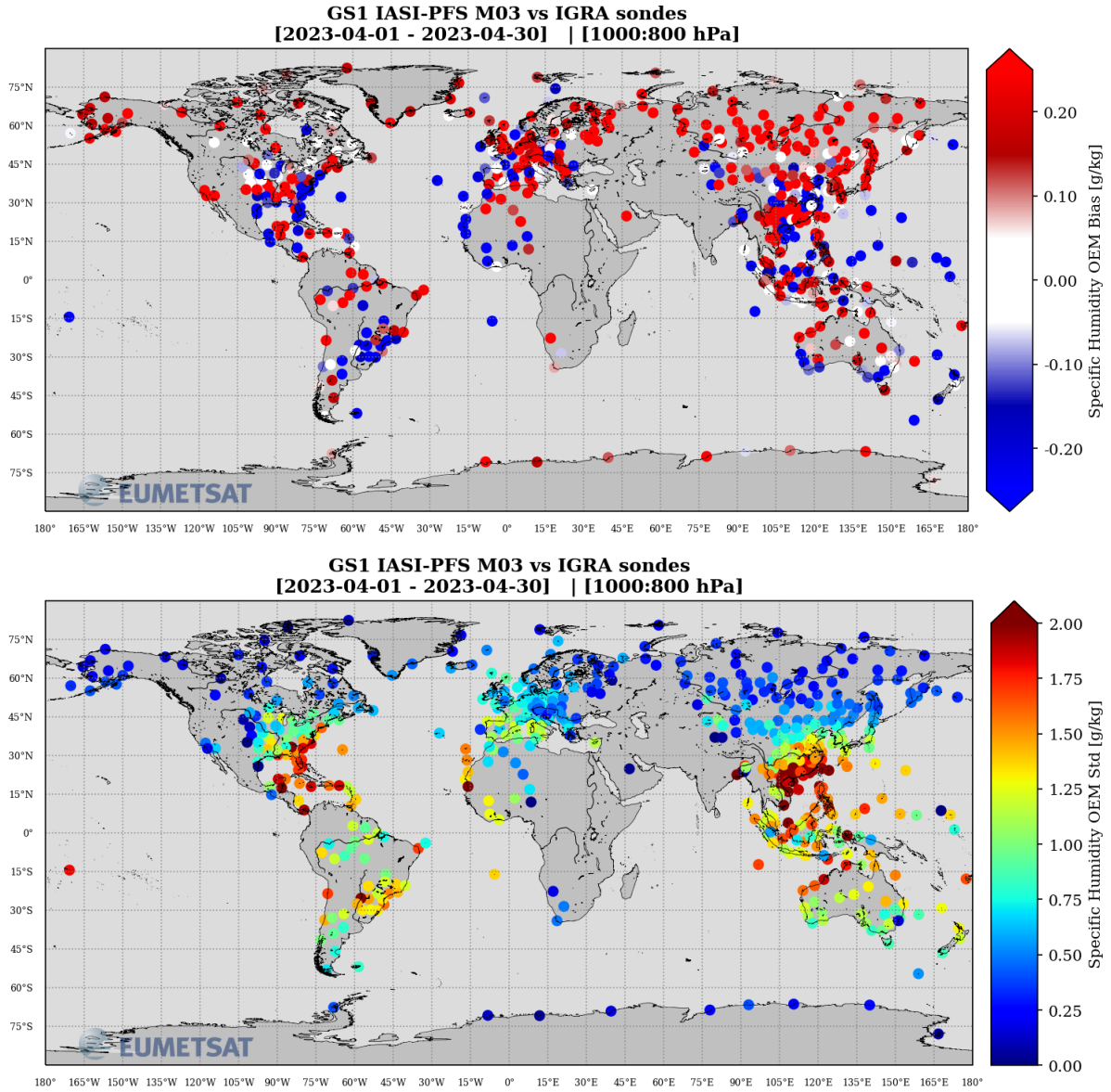

Figure 4.6: Maps of humidity mean (top) differences and standard deviation (bottom) between IASI L2 humidity and sondes in the layer [800-1000hPa], with M03 IASI L2 from GS1 for 01-30/04/2023

4.2 Temperature difference maps

4.2.1 Layer: 100 - 10 hPa

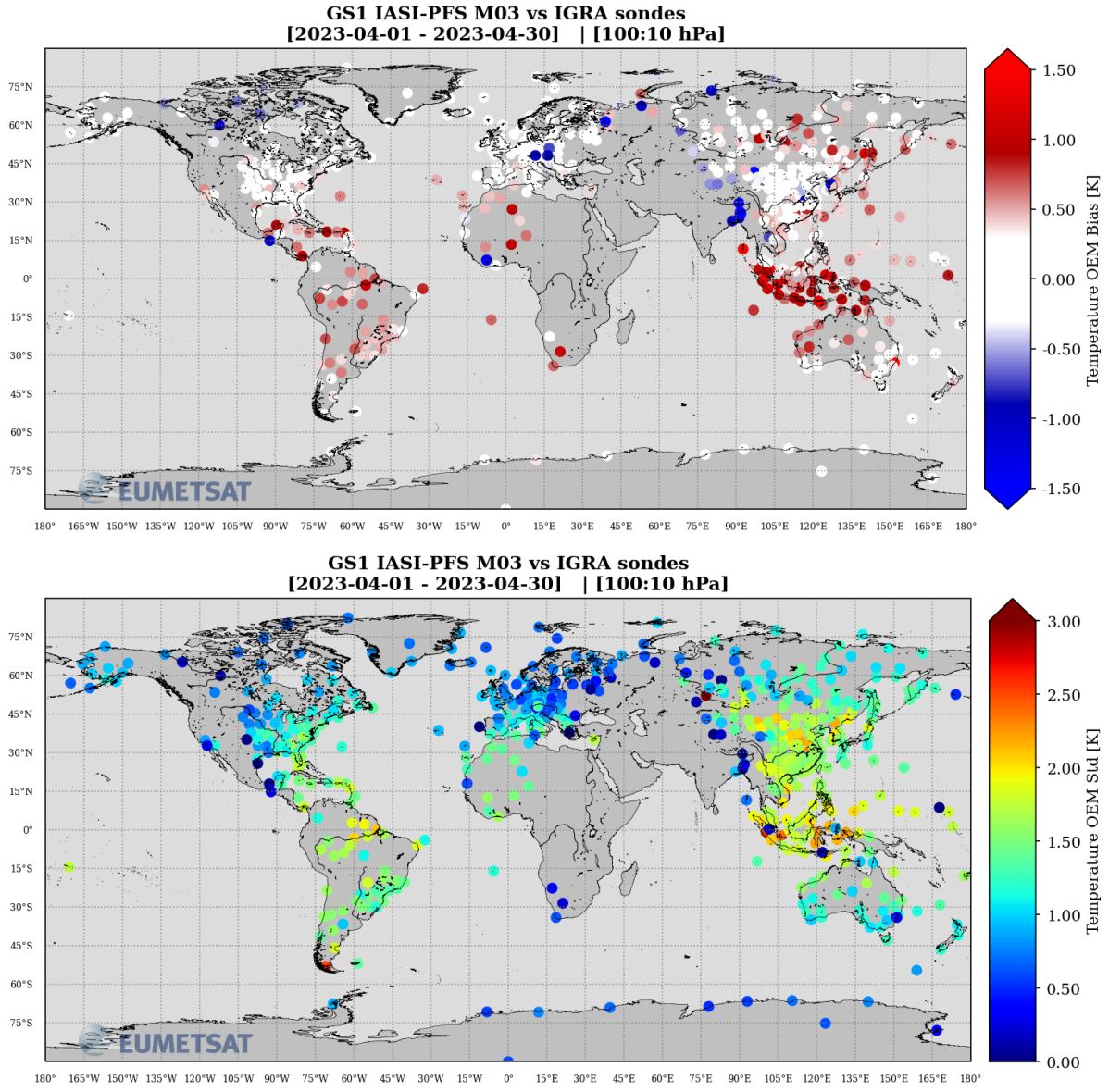

Figure 4.7: Maps of temperature mean (top) differences and standard deviation (bottom) between IASI L2 temperature and sondes in the layer [10-100hPa], with M03 IASI L2 from GS1 for 01-30/04/2023

4.2.2 Layer: 200 - 100 hPa

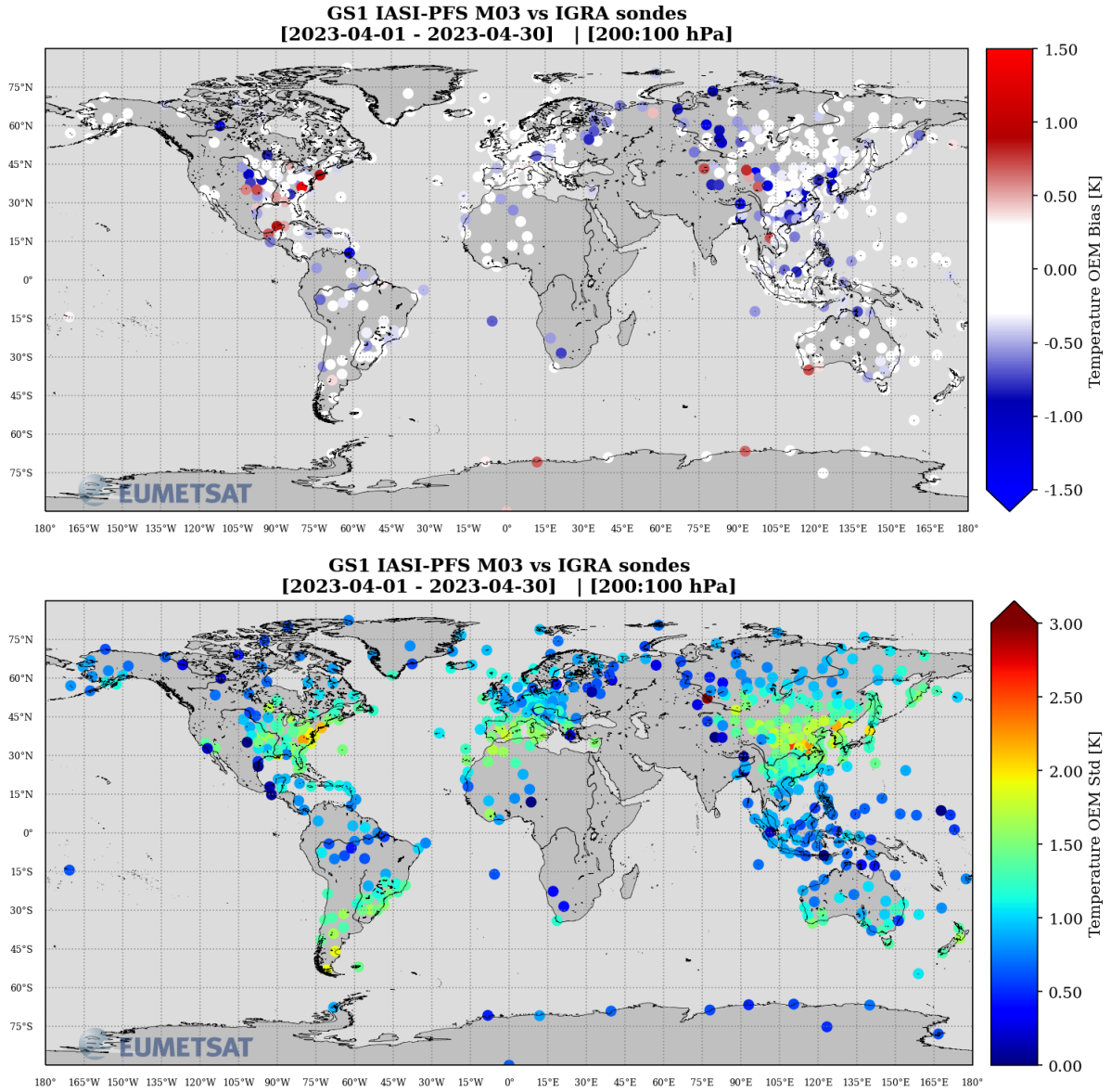

Figure 4.8: Maps of temperature mean (top) differences and standard deviation (bottom) between IASI L2 temperature and sondes in the layer [100-200hPa], with M03 IASI L2 from GS1 for 01-30/04/2023

4.2.3 Layer: 400 - 200 hPa

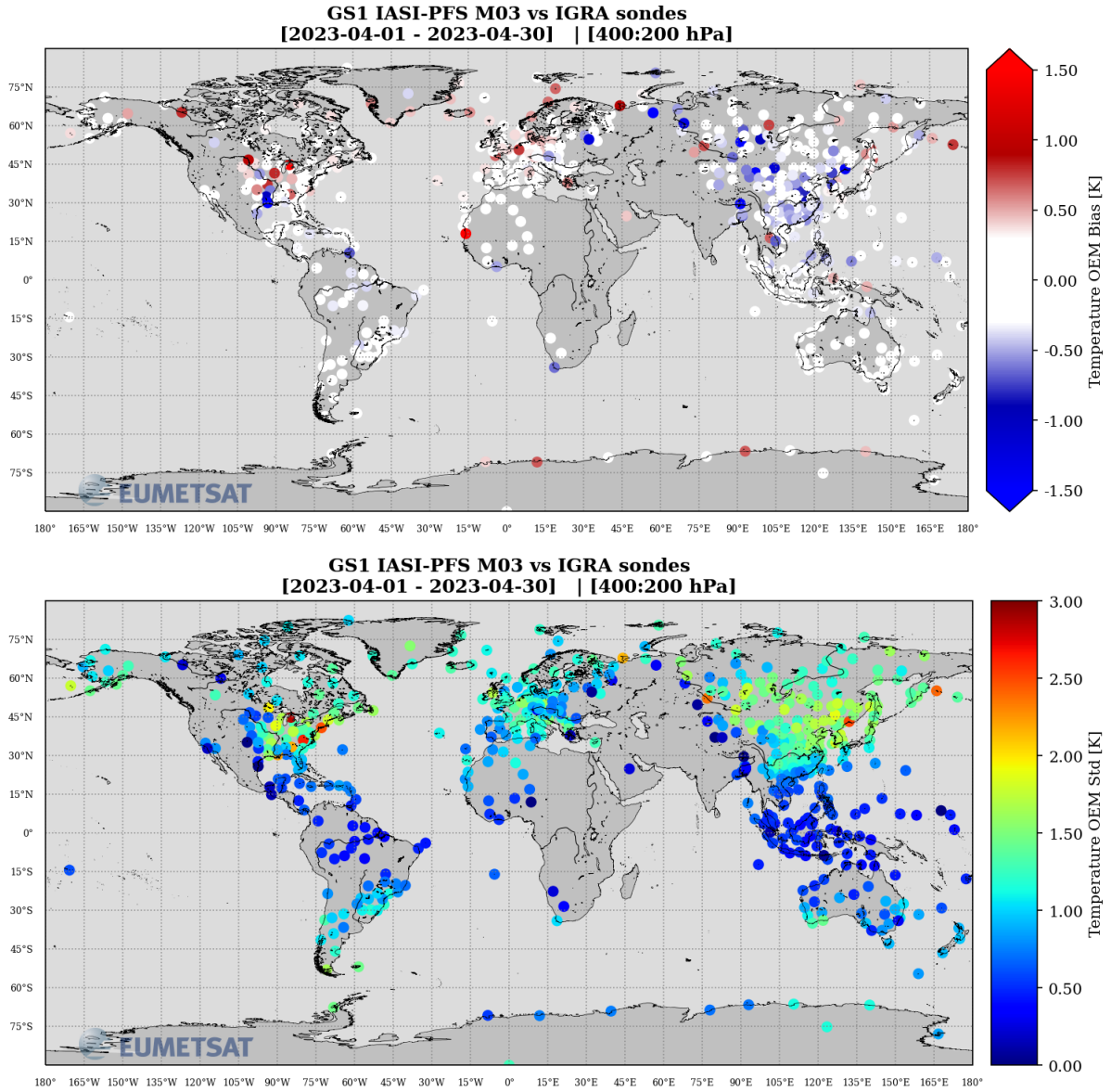

Figure 4.9: Maps of temperature mean (top) differences and standard deviation (bottom) between IASI L2 temperature and sondes in the layer [200-400hPa], with M03 IASI L2 from GS1 for 01-30/04/2023

4.2.4 Layer: 600 - 400 hPa

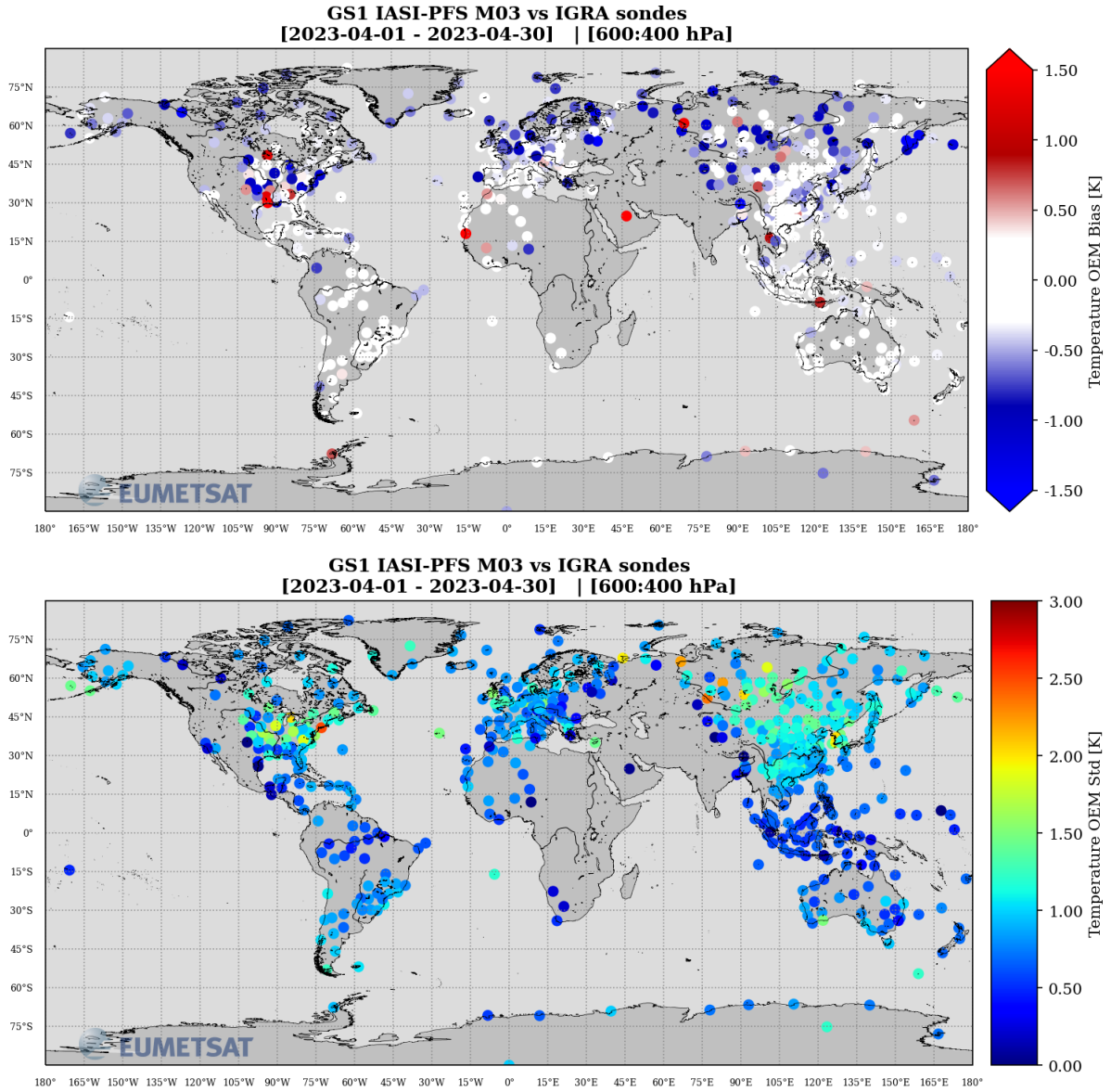

Figure 4.10: Maps of temperature mean (top) differences and standard deviation (bottom) between IASI L2 temperature and sondes in the layer [400-600hPa], with M03 IASI L2 from GS1 for 01-30/04/2023

4.2.5 Layer: 800 - 600 hPa

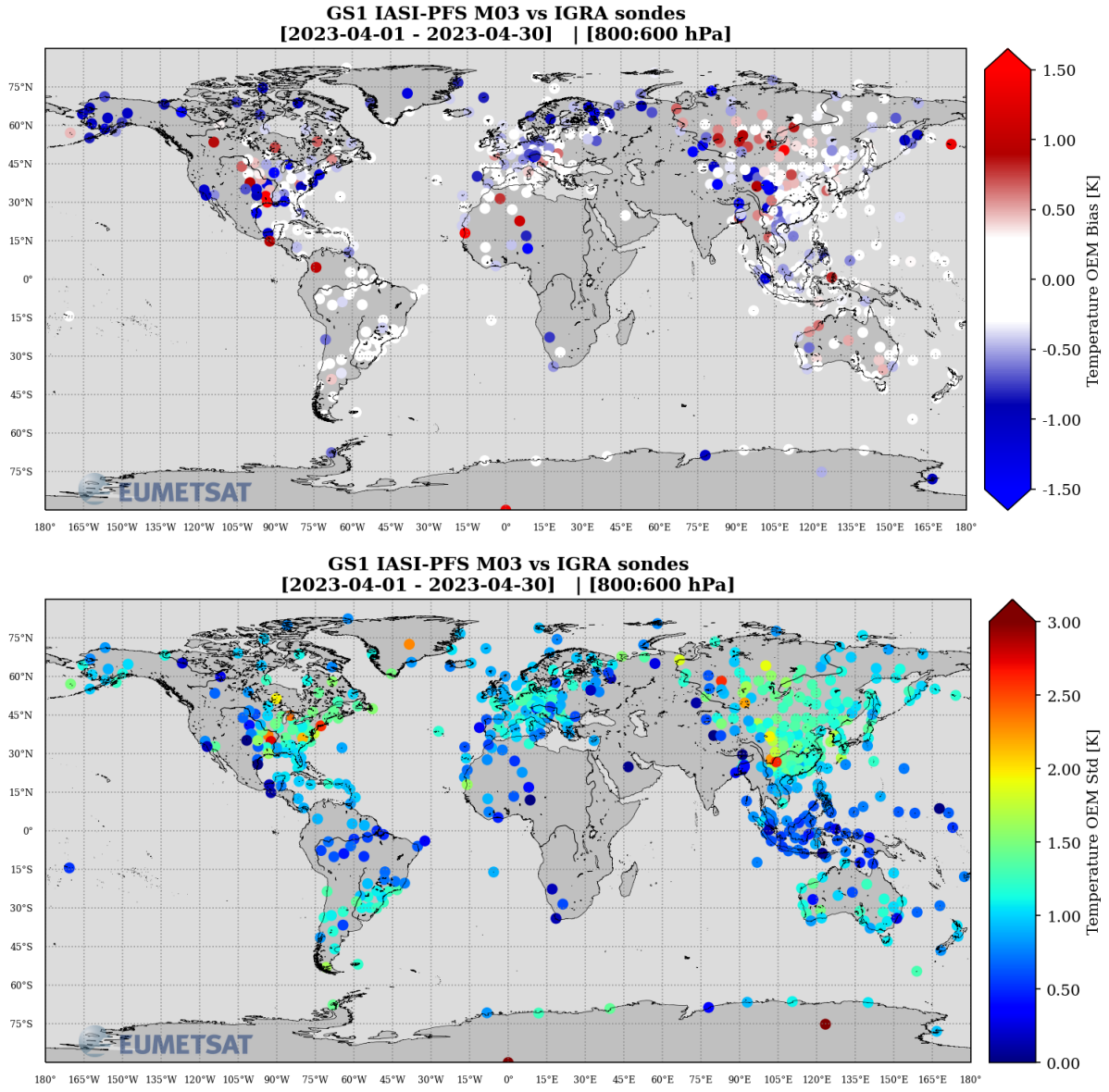

Figure 4.11: Maps of temperature mean (top) differences and standard deviation (bottom) between IASI L2 temperature and sondes in the layer [600-800hPa], with M03 IASI L2 from GS1 for 01-30/04/2023

4.2.6 Layer:1000 - 800 hPa

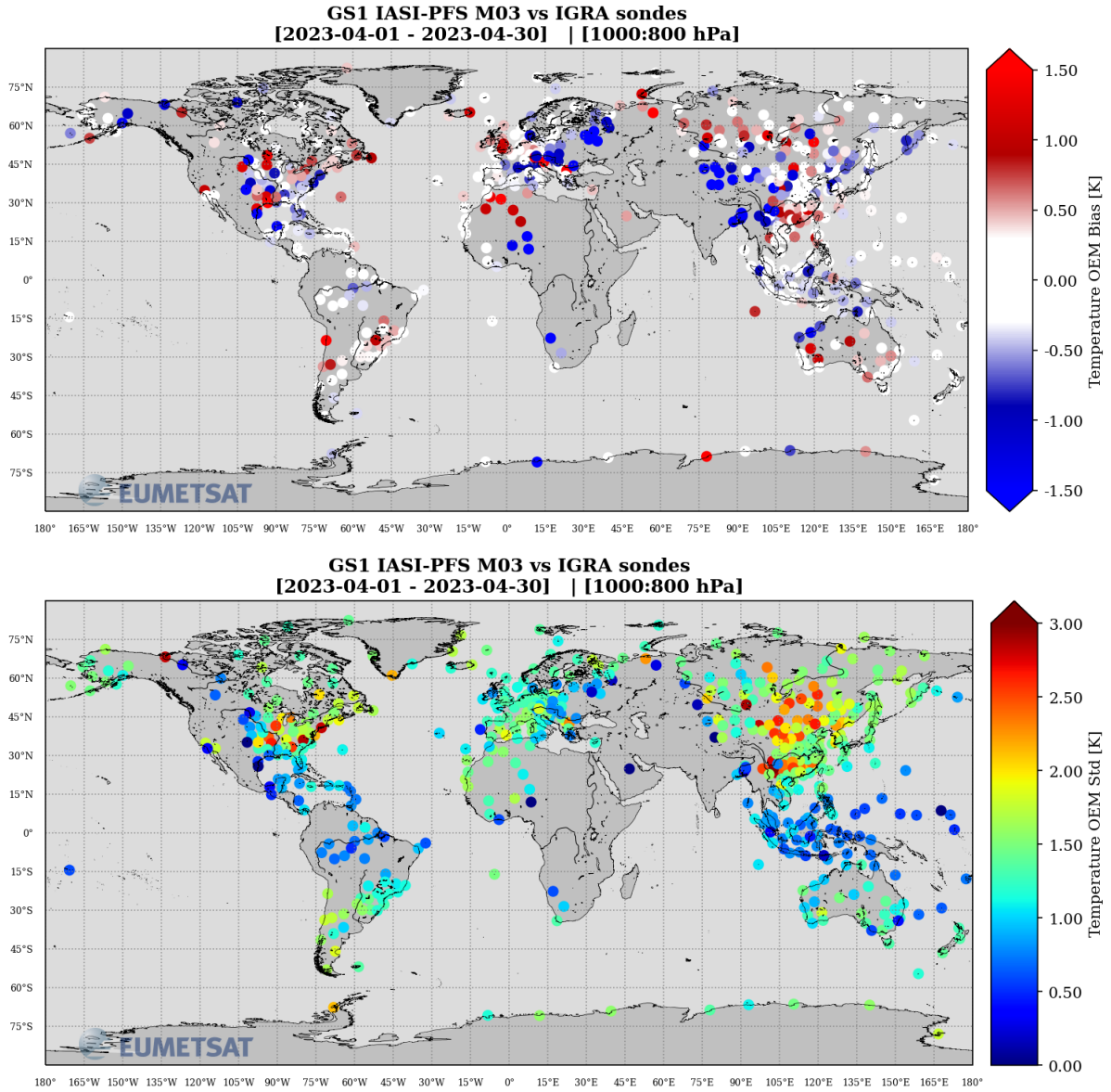

Figure 4.12: Maps of temperature mean (top) differences and standard deviation (bottom) between IASI L2 temperature and sondes in the layer [800-1000hPa], with M03 IASI L2 from GS1 for 01-30/04/2023

4.3 Precipitable Water Maps

4.3.1 Absolute difference

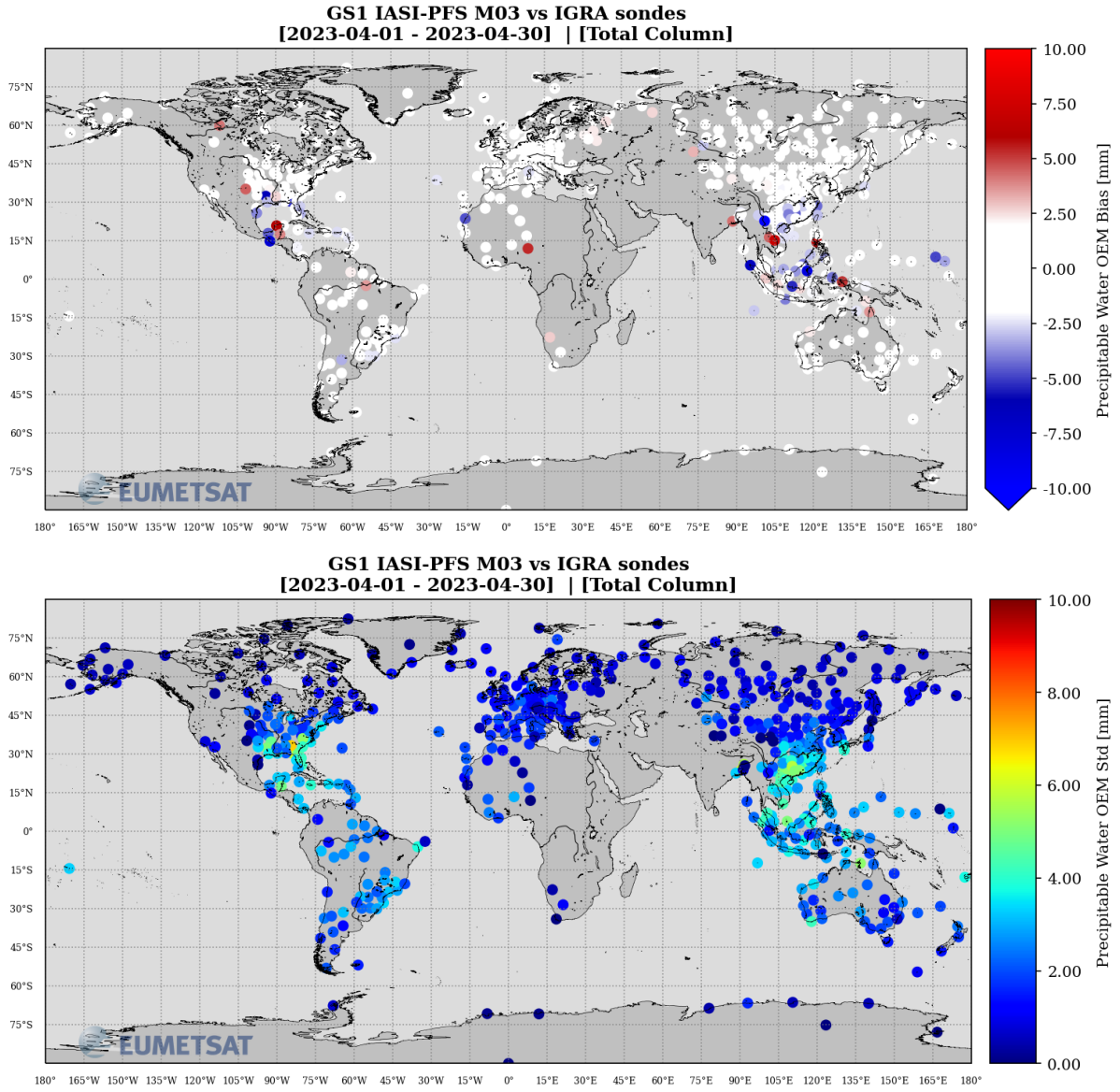

Figure 4.13: Maps of absolute Precipitable Water mean (top) absolute differences and standard deviation (bottom) between IASI L2 and IGRA, with M03 IASI L2 from GS1 for 01-30/04/2023

4.3.2 Relative difference

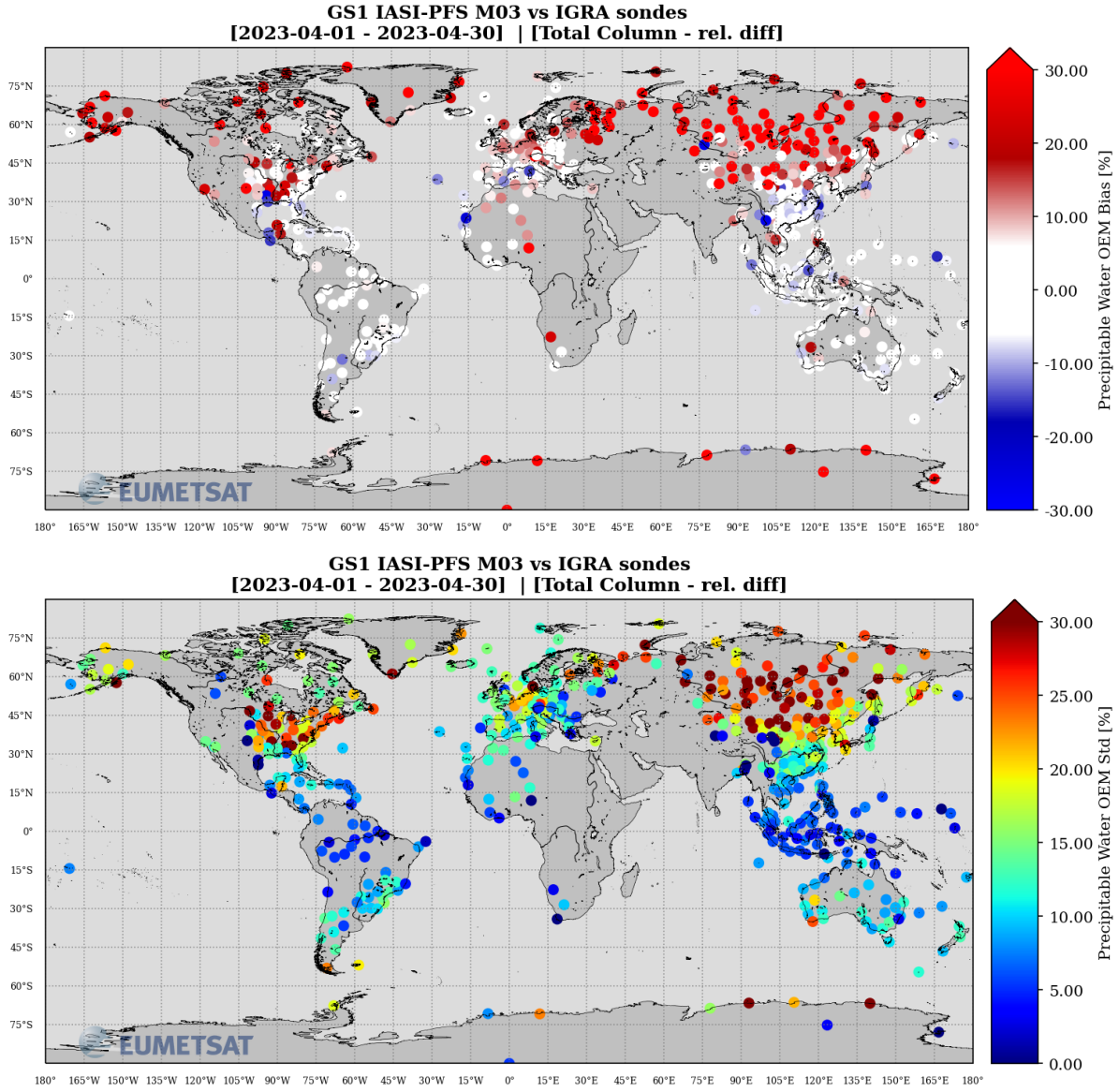

Figure 4.14: Maps of relative Precipitable Water mean (top) relative differences and standard deviation (bottom) between IASI L2 and IGRA, with M03 IASI L2 from GS1 for 01-30/04/2023