E-GVAP 4

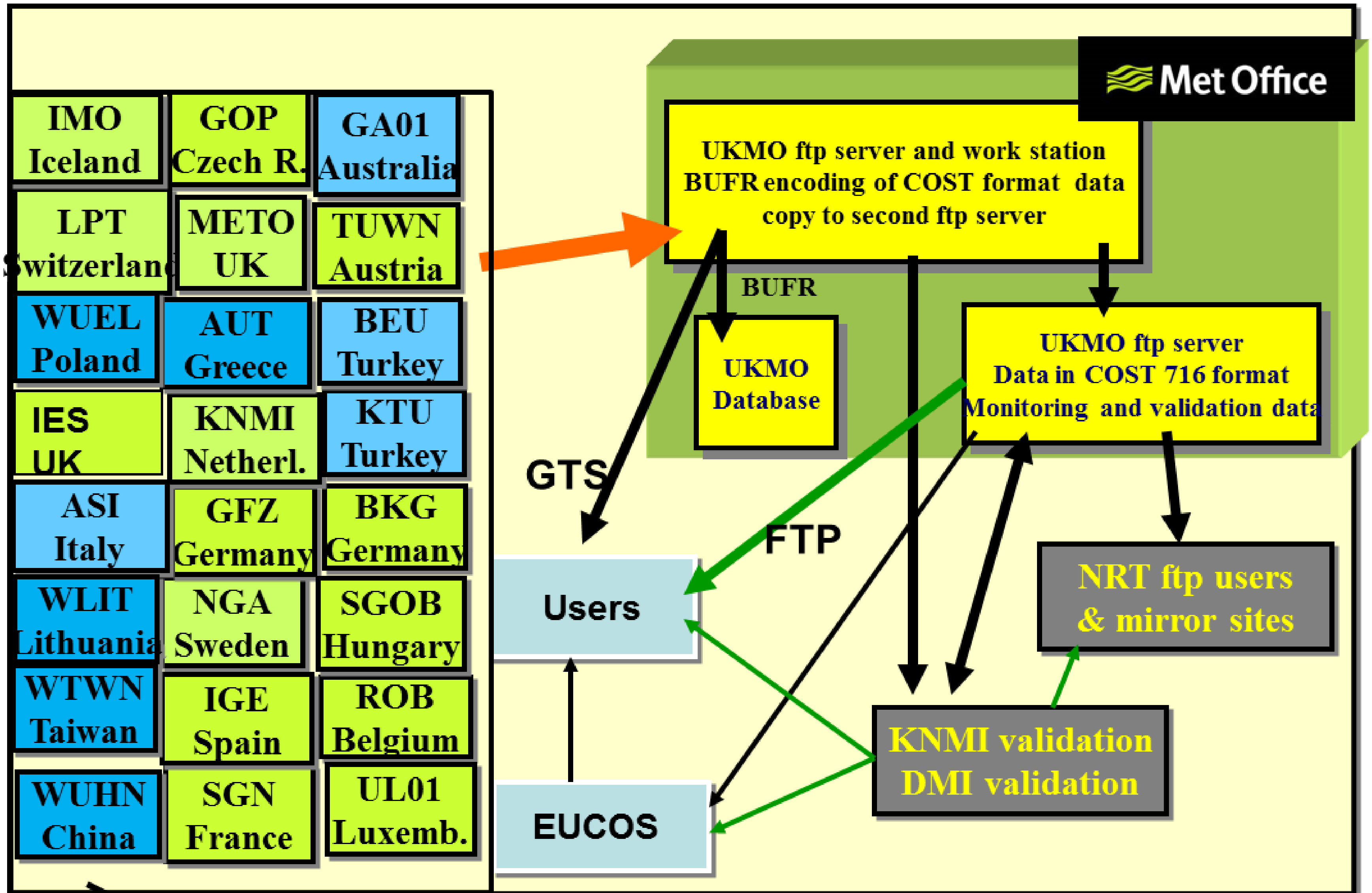
The EIG EUMETNET GNSS Water Vapour Programme, phase 4

Expert teams meeting
November 28-29, 2019, DWD, Offenbach, Germany

E-GVAP status and outlook.

AC	Institution
AUT	Aristotle Univ. of Thessaloniki Analysis Center, Greee.
ASI	e-geos/Telespazio, Italy
BEU	Zonguldak University of Technology, Turkey
BKG	Federal Agency for Cartography and geodesy, Germany
CONH	US data, only available by bilateral agreed ftp download.
GA01	Geoscience Australia
GFZ	Helmholz Centre Potsdam, GFZ German Res. Cen. f Geosciences
GOPE	Geodectic Observatory Pecny, Czech Republic
IES	Inst. of Eng., Surv. And Space Geodesy, Univ of Nottingham, UK
IGE	Instituto Geografica National, Spain
IMO	Icelandic Met Office
KNMI	Royal Meteorological Institute of the Netherlands
KTU	Karadeniz Technival Univ. Analsis Center, Turkey
LPT	SwissTopo, Switzerland
METO	UK Met Office
NGA	Lantmateriet (Swedish Mapping, Cadestre and Land Reg. Authority), Gavle, Sweden
ROB	Royal Observatory of Belgium
SGN	Institut Geographique National, France
SGOB	Satellite Geod. Obs, IGCRS + Technical Univ. Budapest, Hungary
TUWN	Technical University Vienna, Austria
UL01	University of Luxembourg, Fac. Of Science and Communication
WLIT	Lithuania, setup and run by WUEL
WTWN	Taiwan, setup by WUEL, monitored and run in Taiwan. New
WUEL	Wroclaw University + Inst. Of Geodesy and Geoinformatics, Poland
WUHN	GNSS Research Center, Wuhan University, China. New

NRT GNSS ZTD data flow



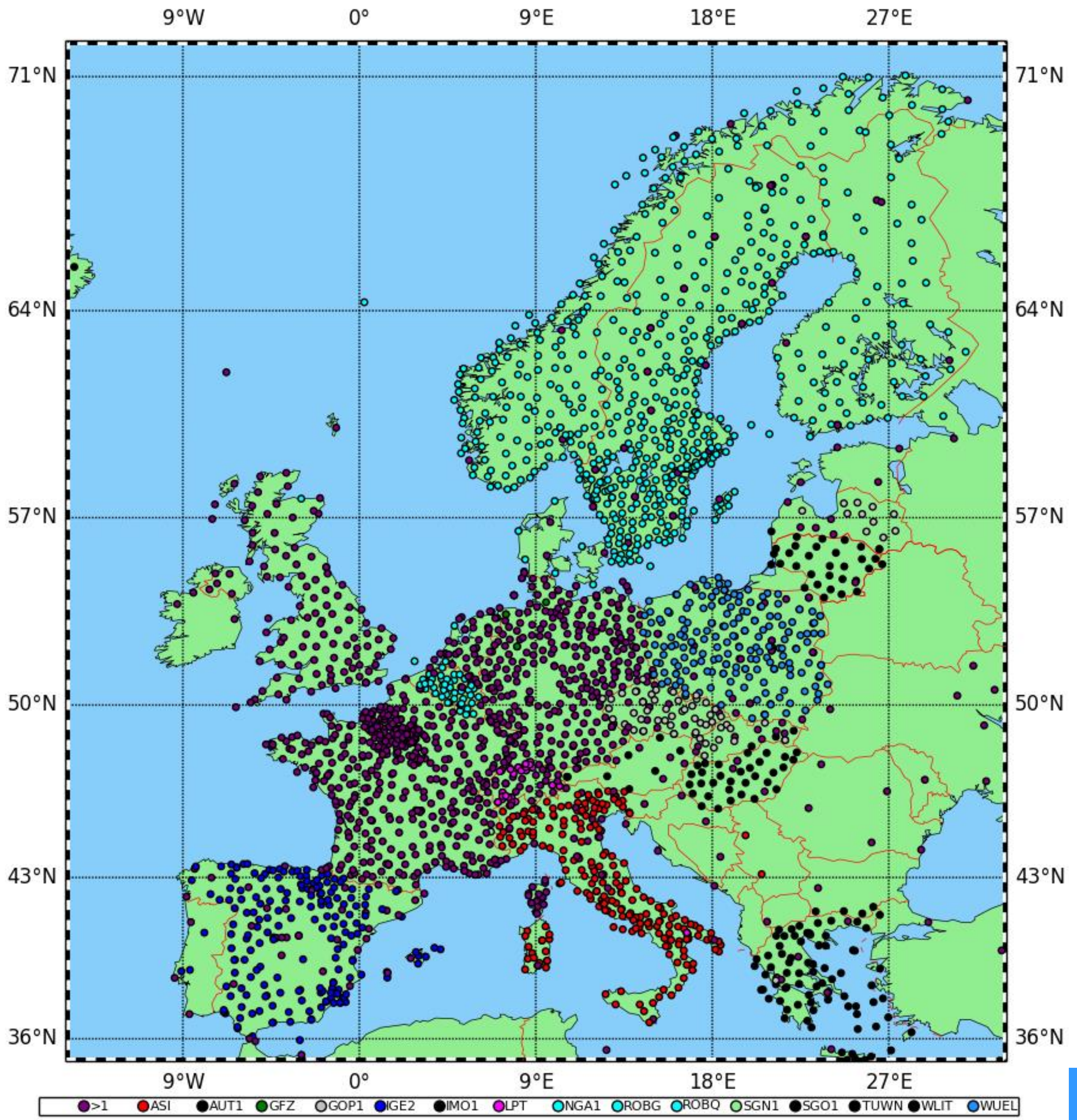
Analysis centres (ACs), each processing raw GNSS data from many sites.
Each AC send data to UKMO. Green countries are members of E-GVAP

EUMETNET
European Meteorological Services Network

E-GVAP members

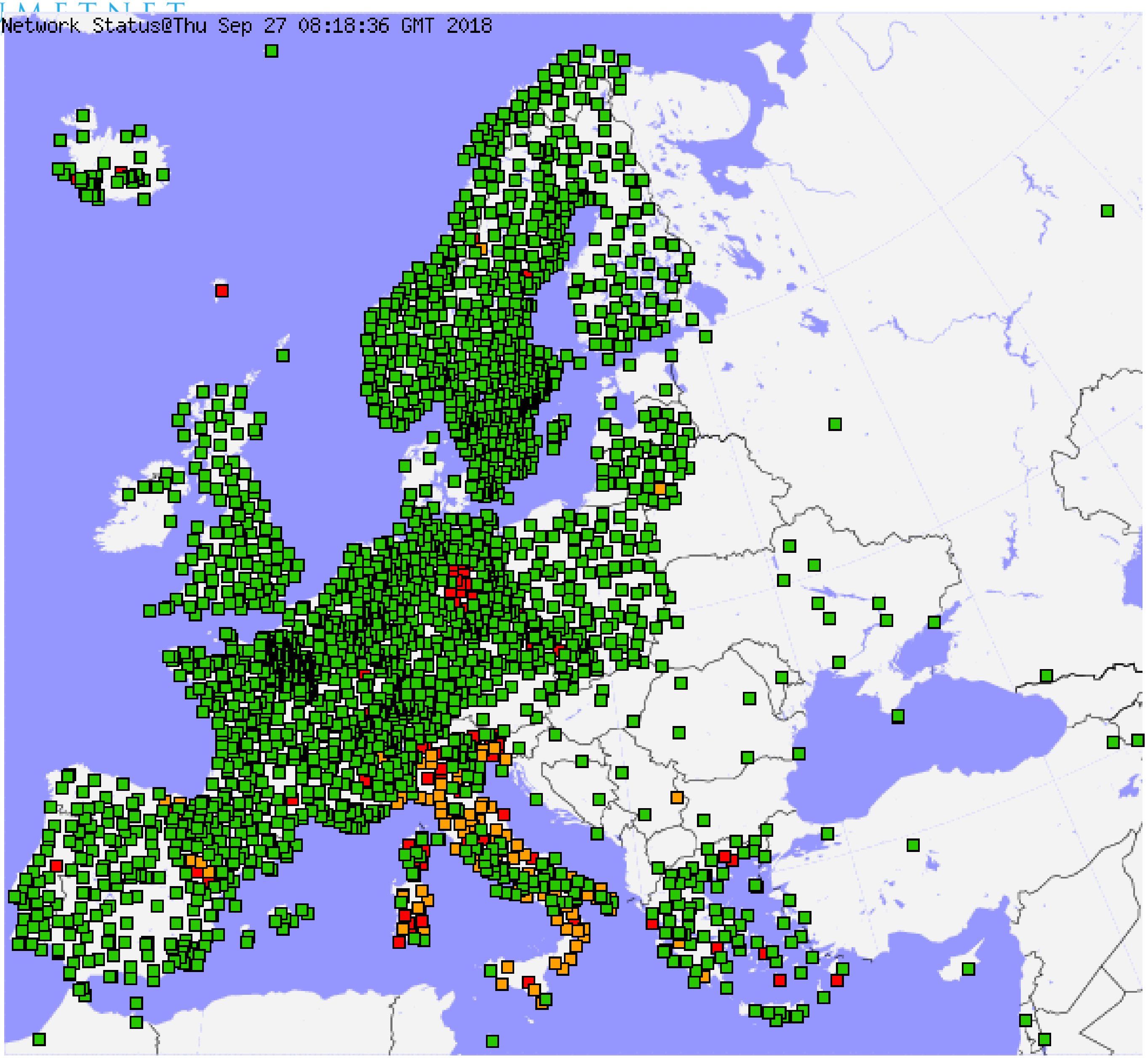
1. ZAMG, Austria
2. RMI, Belgium
3. DHMZ, Croatia
4. CYMET, Cyprus
5. DMI, Denmark
6. FMI, Finland
7. Meteo-France, France
8. DWD, Germany
9. OMSZ, Hungary
10. IMO, Iceland
11. Met Eireann, Ireland
12. LEGMC, Latvia
13. Meteolux, Luxemburg
14. KNMI, Netherlands
15. Met Norway, Norway
16. IPMA, Portugal
17. RHMSS, Serbia
18. SHMI, Slovak Republic
19. ARSO, Slovenia
20. AEMET, Spain
21. SMHI, Sweden
22. MeteoSwiss, Switzerland
23. Met Office, UK

EUME

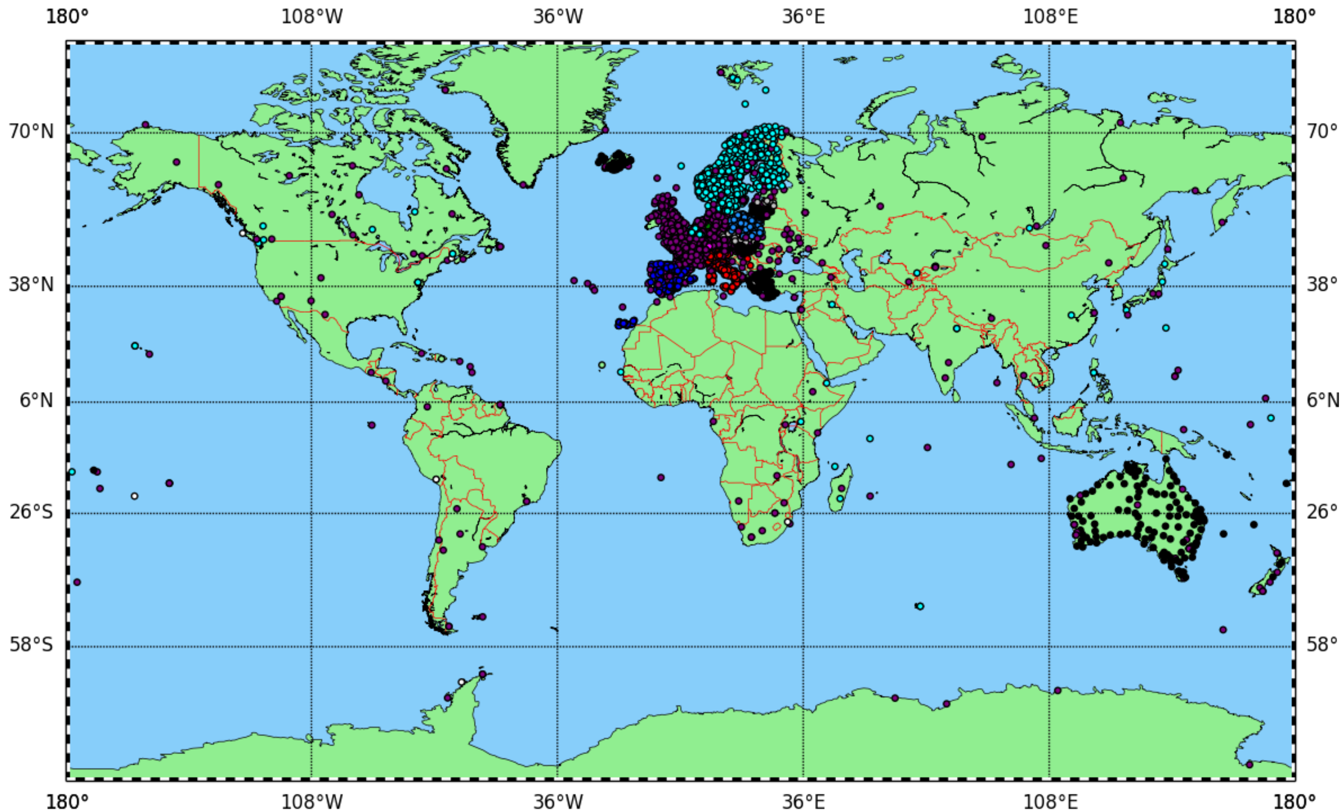


9°W
0°
9°E
18°E
27°E
71°N
64°N
57°N
50°N
43°N
36°N
>1
ASI
AUT1
GFZ
GOP1
IGE2
IMO1
LPT
NGA1
ROBG
ROBQ
SGN1
SGO1
TUWN
WLIT
WUEL

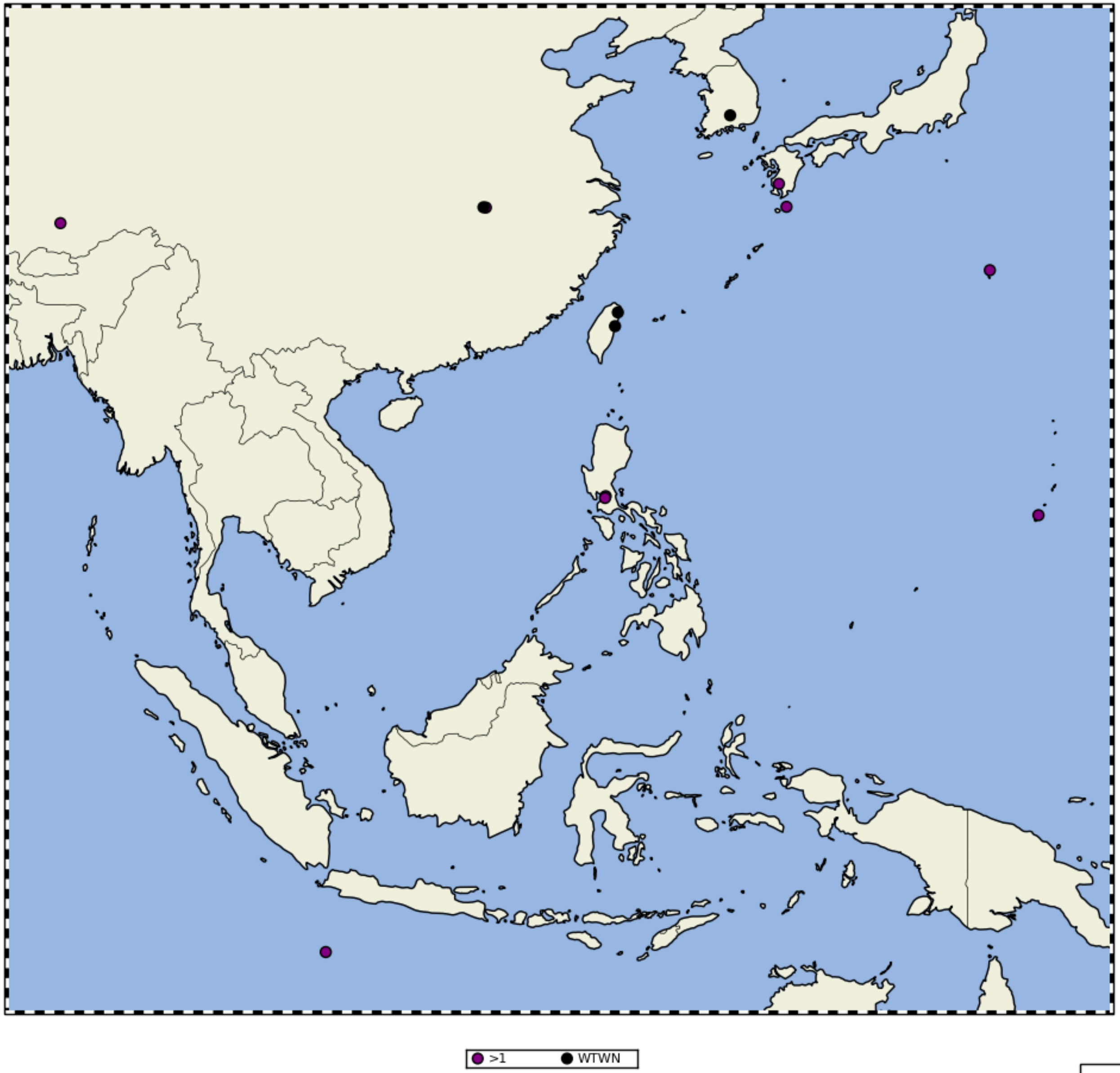
Coverage



Coverage



GNSS stations processed by WTWN (13)

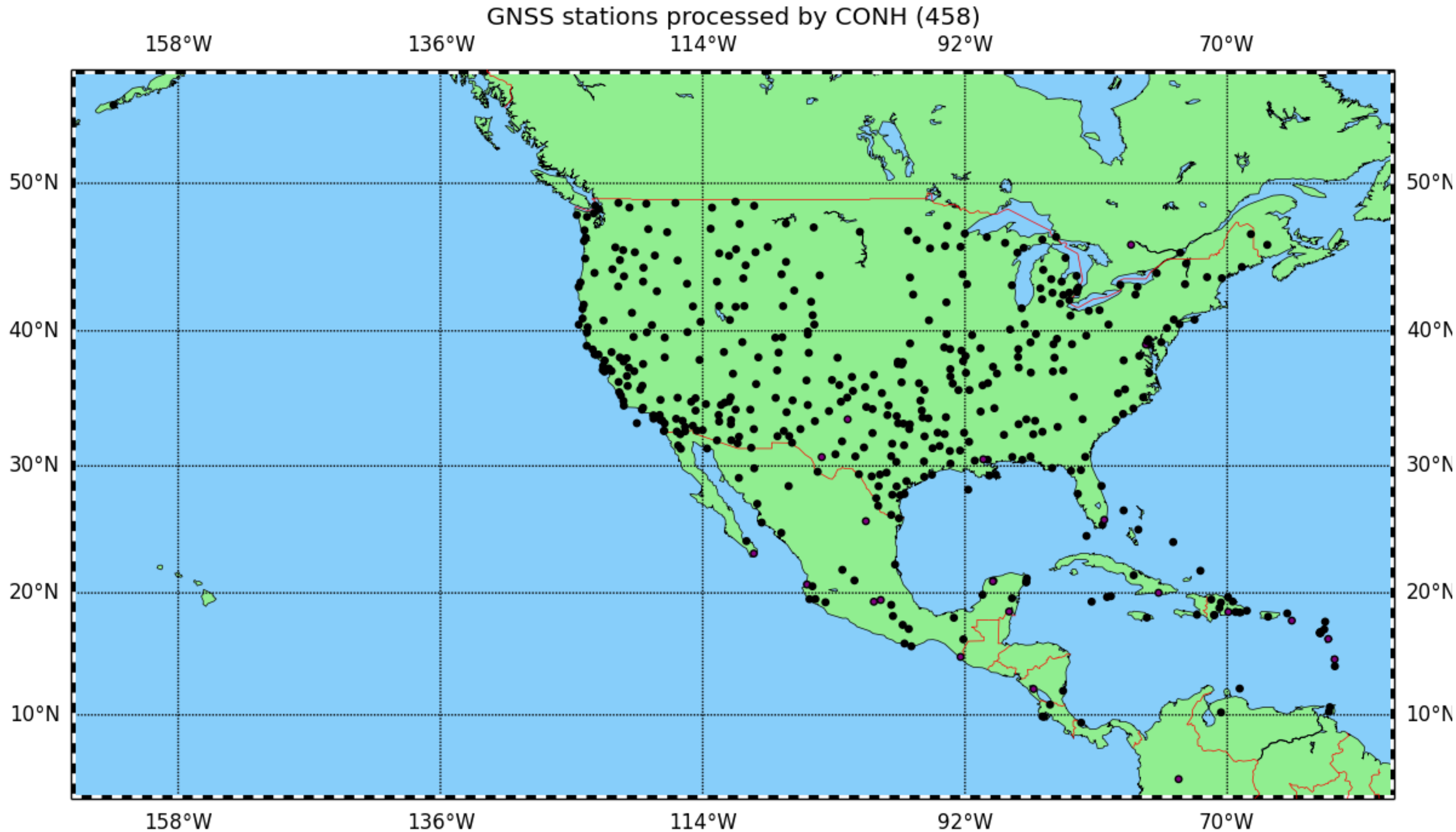


Plotted at 06:43ut 25-Nov-2019

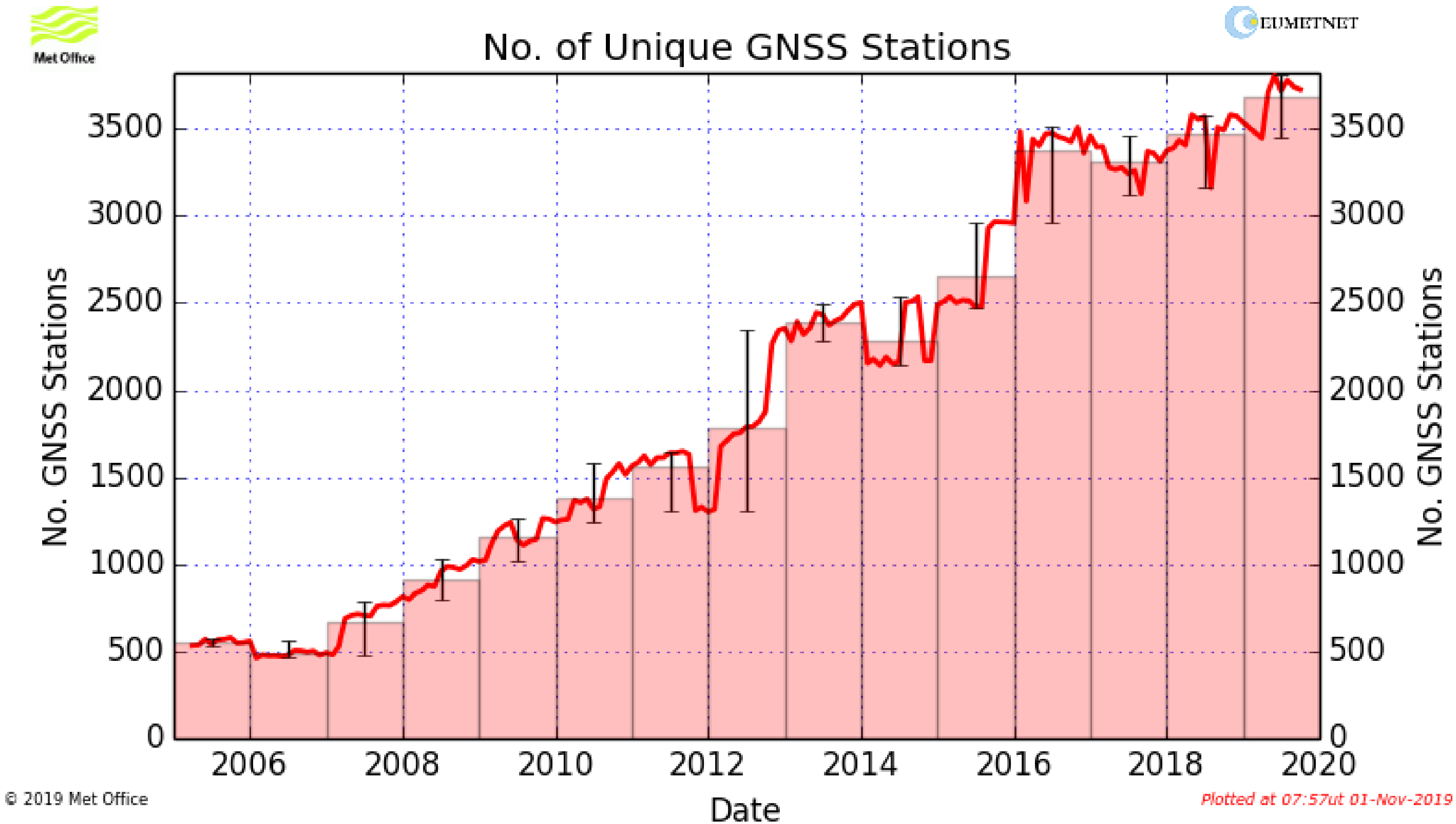
GNSS stations processed by WUHN (124)

Plotted at 06:43ut 25-Nov-2019

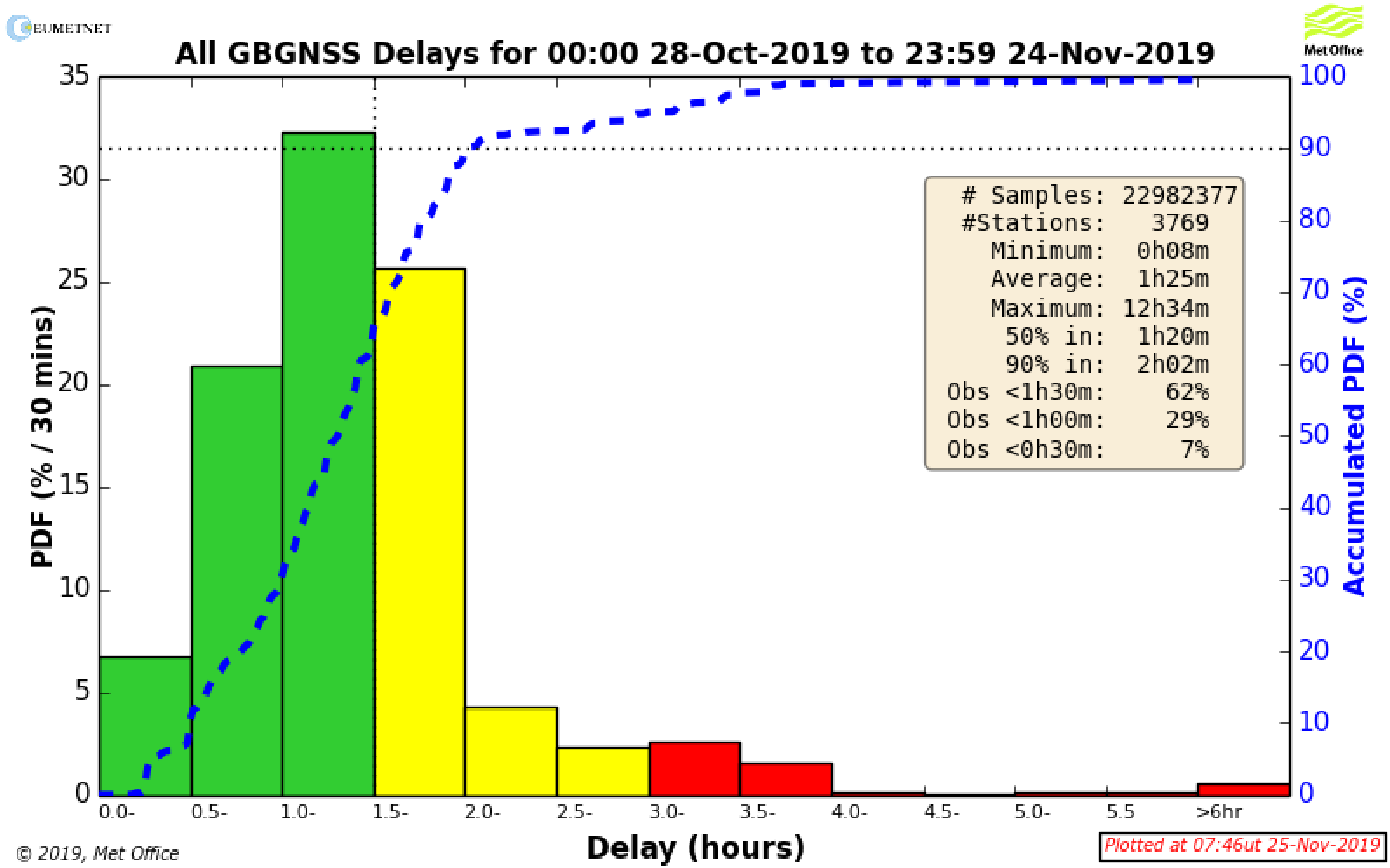
CONH data, an alternative to previous NOAA data

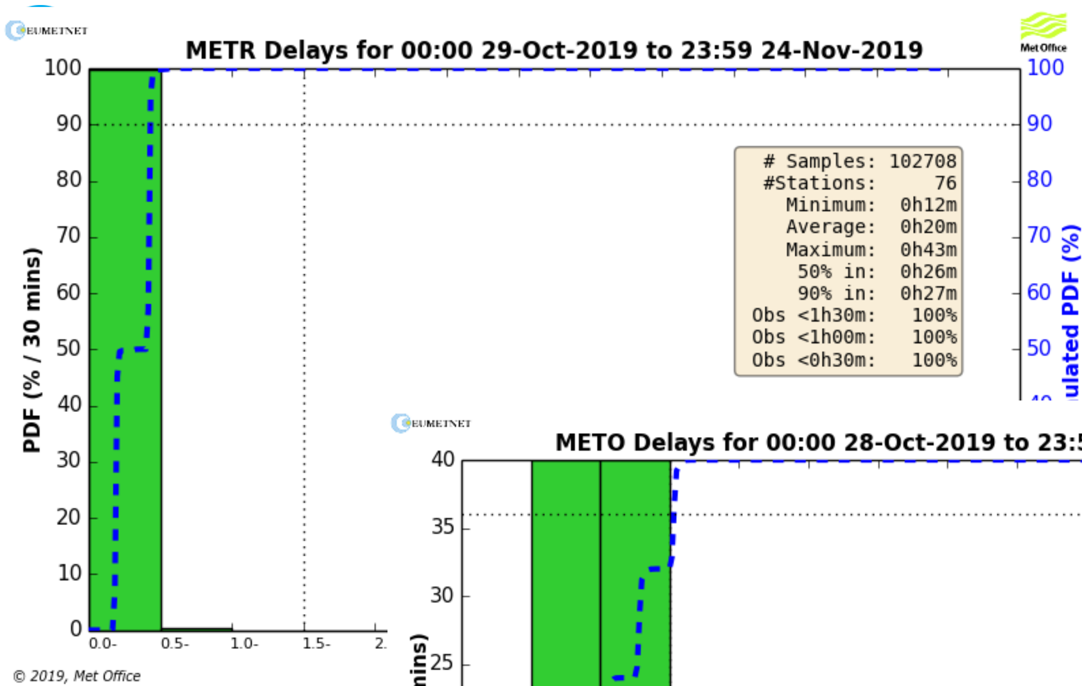


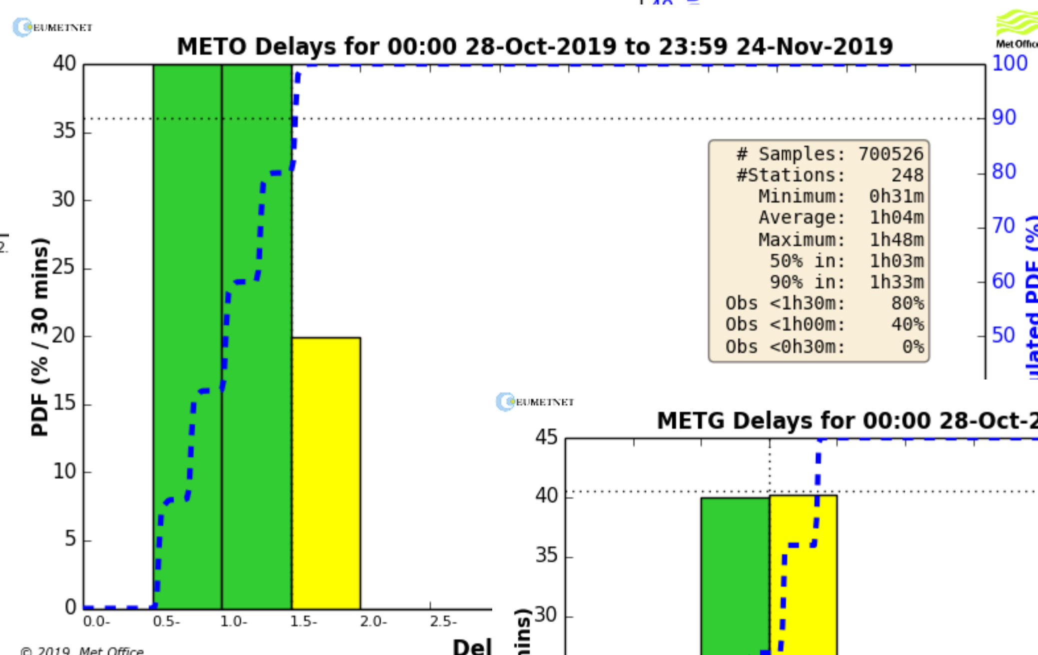
Can only be obtained bilaterally, not via E-GVAP
E-GVAP can provide software converting from CONH format to to E-GVAP cost and BUFR.

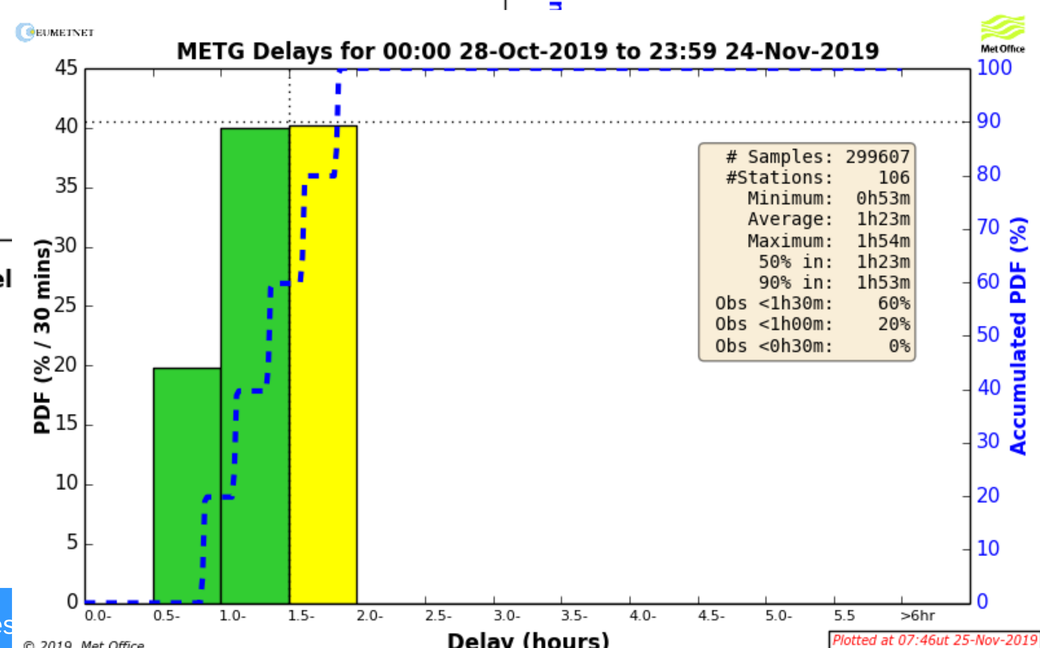


No. of Unique GNSS Stations
Met Office
EUMETNET
No. GNSS Stations
0
500
1000
1500
2000
2500
3000
3500
2006
2008
2010
2012
2014
2016
2018
2020
Date
© 2019 Met Office
Plotted at 07:57ut 01-Nov-2019


EUMETNET
Met Office
All GBGNSS Delays for 00:00 28-Oct-2019 to 23:59 24-Nov-2019
PDF (% / 30 mins)
Accumulated PDF (%)
Samples: 22982377
#Stations: 3769
Minimum: 0h08m
Average: 1h25m
Maximum: 12h34m
50% in: 1h20m
90% in: 2h02m
Obs <1h30m: 62%
Obs <1h00m: 29%
Obs <0h30m: 7%
0.0- 0.5- 1.0- 1.5- 2.0- 2.5- 3.0- 3.5- 4.0- 4.5- 5.0- 5.5 >6hr
Delay (hours)
© 2019, Met Office
Plotted at 07:46ut 25-Nov-2019


EUMETNET
Met Office
METR Delays for 00:00 29-Oct-2019 to 23:59 24-Nov-2019
PDF (% / 30 mins)
Samples: 102708
#Stations: 76
Minimum: 0h12m
Average: 0h20m
Maximum: 0h43m
50% in: 0h26m
90% in: 0h27m
Obs <1h30m: 100%
Obs <1h00m: 100%
Obs <0h30m: 100%
© 2019, Met Office


EUMETNET
Met Office
METO Delays for 00:00 28-Oct-2019 to 23:59 24-Nov-2019
PDF (% / 30 mins)
Samples: 700526
#Stations: 248
Minimum: 0h31m
Average: 1h04m
Maximum: 1h48m
50% in: 1h03m
90% in: 1h33m
Obs <1h30m: 80%
Obs <1h00m: 40%
Obs <0h30m: 0%
© 2019, Met Office


EUMETNET
Met Office
METG Delays for 00:00 28-Oct-2019 to 23:59 24-Nov-2019
PDF (% / 30 mins)
Accumulated PDF (%)
Samples: 299607
#Stations: 106
Minimum: 0h53m
Average: 1h23m
Maximum: 1h54m
50% in: 1h23m
90% in: 1h53m
Obs <1h30m: 60%
Obs <1h00m: 20%
Obs <0h30m: 0%
Delay (hours)
© 2019, Met Office
Plotted at 07:46ut 25-Nov-2019

ObsPMT QMP first quarter

E-GVAP At least one ZTD timely

	Availability	Timeliness HH+90
Target	85.0%	85.0%
13 Supersites	77.8%	97.2%
All sites/ACs	68.3%	74.7%
Operational ACs	74.4%	74.1%
Test ACs	64.4%	75.1%

E-GVAP GNSS sites-AC

Target NRT ZTD accuracy RMS OmB in mm	15.0 mm
Actual super sites only	9.39 mm
Actual sites	9.79 mm

Overview E-GVAP Supersites Q1 2019	Obs. totals	Data availability	Timeliness HH+90 (one ZTD timely)	ZTD accuracy
BRST	119,043	81.7%	95.8%	9.0mm
CABW	40,203	72.8%	94.2%	9.4mm
CAMO	68,014	53.8%	98.5%	9.2mm
GOPE	108,477	81.6%	97.5%	7.2mm
IZAN	79,258	78.0%	97.1%	8.6mm
LDB2	101,153	85.3%	99.1%	6.8mm
M0SE	89,301	79.1%	99.0%	17.3mm
MEDI	99,251	73.5%	96.6%	7.5mm
ONSA	158,842	77.5%	97.4%	8.7mm
PAYE	120,831	80.0%	97.7%	16.7mm
SMNE	116,094	87.0%	97.4%	7.6mm
YEBE	119,291	79.6%	96.7%	7.0mm
ZIMM	129,593	81.6%	97.7%	7.1mm

Overview E-GVAP Operational ACs Q1 2019	Obs. totals	Data availability	Timeliness HH+90 (one ZTD timely)	ZTD accuracy
ASI_	2,603,235	83.1%	61.9%	9.2mm
BKG_	176,995	83.3%	98.9%	6.5mm
GF1G	3,975,853	76.2%	59.1%	6.4mm
GF1R	2,924,937	56.8%	91.8%	6.3mm
GFZ_	1,940,072	83.6%	94.7%	10.3mm
GOP1	130,910	37.5%	55.8%	5.6mm
GOPG	89,414	33.9%	42.3%	8.4mm
KNM3	58,630	53.2%	99.0%	244.5mm
KNM4	46,741	56.1%	100.0%	259.5mm
LPT_	807,456	98.1%	75.8%	10.5mm

EUMETNET
EUROPEAN METEOROLOGICAL SERVICES NETWORK

Operational ACs ...continued	Obs totals	Data availability	Timeliness HH+90 (one ZTD timely)	ZTD accuracy
LPTR	184,539	100.0%	100.0%	21.8mm
METO	2,068,850	84.4%	85.7%	8.2mm
ROBH	5,776,731	94.6%	84.6%	10.6mm
SGN_	3,917,523	94.7%	61.2%	9.1mm
SGN1	3,742,733	81.5%	1.5%	10.0mm

Overview E-GVAP Non-operational ACs Q1 2019	Obs totals	Data availability	Timeliness HH+90 (one ZTD timely)	ZTD accuracy
ASIC	3,548,858	62.2%	0.0%	7.9mm
ASIR	57,941	40.1%	99.8%	15.1mm
ASIS	8,048	18.2%	100.0%	13.1mm
AUT1	162,722	60.3%	92.1%	9.5mm
BKGH	354,795	54.5%	99.8%	7.3mm
SA01	110,044	47.9%	99.1%	24.4mm
ES2	675,516	51.8%	100.0%	8.6mm
GE2	2,692,872	88.1%	84.1%	13.6mm
MO1	0	0.0%	0.0%	8.0mm
METG	924,575	80.7%	71.2%	9.7mm
MTGH	289,591	48.7%	100.0%	10.7mm
MTRH	726,168	49.5%	100.0%	8.7mm
MTRS	241,240	55.9%	0.0%	10.0mm
NGA1	5,117,778	91.8%	66.9%	6.6mm
NGA2	2,517,751	69.5%	100.0%	9.7mm
ROBG	2,347,095	90.7%	70.4%	9.5mm
ROBQ	2,845,716	92.9%	99.2%	7.8mm
ROBT	2,672,850	58.1%	99.1%	10.0mm
SGN2	3,693,285	80.8%	1.4%	8.4mm
SGNC	191,165	85.6%	68.7%	20.9mm
SGNR	226,625	76.0%	76.1%	31.3mm
TUWN	47,651	67.7%	97.6%	7.5mm
WLIT	40,827	100.0%	78.9%	8.7mm
WUEL	601,141	76.9%	98.7%	7.1mm

ObsPMT QMP second quarter

E-GVAP

2019 Q2 GNSS sites-AC	Accuracy
Target NRT ZTD accuracy RMS OmB	15.0 mm
Actual super sites only	15.2
Actual sites	11.4

At least one ZTD timely	Data availability	Timeliness HH+90
Target	85.0%	85.0%
13 Supersites	55.9%	97.4%
All sites/ACs	82.4%	57.5%
Operational ACs	81.8%	63.0%
Test ACs	83.2%	51.7%

Overview E-GVAP Supersites 2019 Q2	Obs. totals	Data availability	Timeliness HH+90 (one ZTD timely)	ZTD accuracy (mm)
BRST	79,342	94.3%	96.5%	14.3
CABW	11,047	45.1%	98.6%	7.0
CAMO	14,499	35.7%	99.5%	8.9
GOPE	26,160	68.0%	98.7%	8.4
IZAN	19,024	88.1%	98.7%	56.7
LDB2	27,569	89.1%	98.7%	8.2
M0SE	22,441	69.9%	98.5%	25.7
MEDI	34,330	88.3%	96.8%	22.4
ONSA	31,373	56.4%	98.6%	12.6
PAYE	34,700	67.0%	98.7%	8.3
SMNE	35,285	90.2%	98.5%	8.3
YEBE	34,553	71.8%	97.2%	8.6
ZIMM	36,450	74.5%	95.7%	8.7

Overview E-GVAP Operational ACs 2019 Q2	Obs. totals	Data availability	Timeliness HH+90 (one ZTD timely)	ZTD accuracy
ASI_	2572384	82.9%	53.9%	12.3
BKG_	190617	90.3%	99.3%	8.9
GF1G	4266609	80.2%	30.9%	8.0
GF1R	3166469	59.7%	84.8%	7.7
GFZ_	1692607	80.9%	93.4%	10.2
GOP1	303164	88.8%	43.1%	8.9
GOPG	271754	88.8%	42.7%	10.3
LPT_	845844	98.5%	49.8%	10.2
METO	2055224	83.9%	80.0%	8.2
ROBH	5725294	90.9%	79.2%	11.2
SGN_	4003150	94.4%	52.4%	10.1
SGN1	2501951	72.0%	51.5%	10.4

Overview E-GVAP Non-operational ACs 2019 Q2	Obs. totals	Data availability	Timeliness HH+90 (one ZTD timely)	ZTD accuracy
ASIC	0	0.0%		9.2
IGE2	486136	67.6%	99.5%	15.2
LPTX	91252	97.2%	99.3%	13.5
METG	193299	79.7%	100.0%	9.9
NGA1	1279196	91.3%	98.9%	8.5
ROBG	465370	78.7%	99.3%	10.9
ROBQ	371687	78.1%	99.3%	9.2
SGN2	485318	60.8%	97.4%	10.9
SGN3	374933	70.4%	99.0%	11.8
SGN4	375151	70.4%	99.0%	11.6
SGNC	45914	71.6%	93.5%	28.6
SGNR	37269	54.5%	83.3%	27.3
WLIT	13797	90.2%	96.5%	10.8
WUEL	237980	50.9%	97.7%	9.5

Hickups

There has in the last year been more mishaps due to computer problems than average. This has hit areas such as,

- **BUFR encoding and distribution**
- **Access to the ftp-server for download**
- **Transfer of OmB from UKMO Global model to the ftp-server.**

If you find something does not function don´t hesitate to email us at egvap@dmi.dk. It speeds up discovery at our end and solution.

Monthly OmB statistics per AC, January, February, March

bias [mm]	std. dev. [mm]	#site	AC
-0.0	7.0	618	ASIC
0.3	16.2	35	ASIR
-5.3	9.3	15	ASIS
1.3	7.4	345	ASI_
6.2	7.5	114	AUT1
1.9	6.6	112	BKGH
2.7	5.5	96	BKG_
-0.9	8.8	402	CONW
4.2	28.5	161	GA01
1.4	6.3	618	GF1G
1.5	6.2	565	GF1R
8.4	5.3	267	GFZ_
2.8	4.2	106	GOP1
-3.4	7.8	218	IES2
1.7	15.3	357	IGE2
52.8	274.9	37	KNM3
47.5	275.2	28	KNM4
-17.6	17.1	43	-LPTR
5.5	11.6	42	LPTX
0.4	9.7	205	LPT_
-0.4	9.9	122	METG
-2.6	8.1	238	METO
-4.1	10.8	51	METR
3.1	10.0	119	MTGH
-1.2	8.7	237	MTRH
-5.0	8.5	144	MTRS
1.3	6.2	647	NGA1
1.4	9.3	375	NGA2
2.8	9.2	284	ROBG
0.5	12.1	633	ROBH
-0.3	7.5	220	ROBQ
0.5	10.6	718	ROBT
-3.4	8.6	504	SGN1
1.6	7.5	504	SGN2
8.2	17.3	22	SGNC
9.1	30.6	32	SGNR
-1.5	8.7	445	SGN_
2.5	12.3	59	SGO1
3.7	6.0	30	TUWN
6.3	7.1	7	WLIT
5.2	17.2	20	WTWN
5.0	5.8	278	WUEL

bias [mm]	std. dev. [mm]	#site	AC
-1.6	7.7	606	ASIC
-0.8	19.3	30	ASIR
-5.9	11.0	15	ASIS
-1.0	8.6	349	ASI_
5.5	7.5	116	AUT1
1.4	7.3	110	BKGH
2.1	6.2	98	BKG_
-0.2	9.0	420	CONW
5.2	31.1	162	GA01
0.0	6.7	625	GF1G
0.2	6.6	575	GF1R
7.0	5.9	270	GFZ_
0.8	5.8	107	GOP1
-4.0	8.6	213	IES2
1.6	25.5	345	IGE2
-4.4	20.1	42	LPTX
-3.7	11.9	205	LPT_
-0.7	9.7	114	METG
-3.3	8.5	240	METO
-4.0	12.1	52	METR
2.2	9.8	114	MTGH
-1.4	9.1	236	MTRH
-1.5	7.0	646	NGA1
-1.5	9.4	375	NGA2
2.7	9.2	279	ROBG
-1.2	9.7	645	ROBH
0.2	7.9	219	ROBQ
-1.1	9.3	733	ROBT
-5.1	9.7	513	SGN1
0.9	8.7	513	SGN2
8.8	17.9	23	SGNC
3.9	30.2	36	SGNR
-2.7	9.7	443	SGN_
-7.5	11.2	54	SGO1
2.3	7.0	31	TUWN
0.5	9.0	7	WLIT
5.7	13.4	20	WTWN
-0.6	6.6	236	WUEL

bias [mm]	std. dev. [mm]	#site	AC
-0.4	7.7	610	ASIC
2.7	16.4	24	ASIR
-3.8	12.6	13	ASIS
-0.9	8.6	346	ASI_
6.0	8.2	120	AUT1
1.8	7.2	109	BKGH
1.9	6.1	98	BKG_
0.6	9.6	456	CONW
5.3	29.1	160	GA01
-0.2	6.6	626	GF1G
0.6	6.4	560	GF1R
6.6	6.2	270	GFZ_
1.0	6.2	99	GOP1
-0.0	9.4	97	GOPG
-2.4	7.8	208	IES2
2.2	20.0	344	IGE2
-0.9	16.3	43	LPTX
-1.2	10.0	208	LPT_
0.5	9.8	114	METG
-0.8	7.9	234	METO
-0.9	11.1	40	METR
2.9	9.5	110	MTGH
0.5	8.5	235	MTRH
-0.9	7.1	644	NGA1
0.5	12.4	375	NGA2
3.3	9.3	276	ROBG
0.6	13.5	647	ROBH
0.9	8.1	220	ROBQ
-0.1	12.4	737	ROBT
-3.7	8.9	516	SGN1
1.7	9.0	516	SGN2
8.5	17.5	24	SGNC
3.9	30.3	33	SGNR
-1.9	9.2	444	SGN_
-3.4	12.2	57	SGO1
2.0	7.5	31	TUWN
1.4	8.4	7	WLIT
6.0	13.8	18	WTWN

April, May, June

bias [mm]	std. dev. [mm]	#site	AC
1.0	7.5	604	ASIC
-2.9	145.0	21	ASIR
10.0	25.9	13	ASIS
2.0	8.8	333	ASI_
6.3	9.6	119	AUT1
2.0	8.9	110	BKGH
1.8	6.8	97	BKG_
0.2	11.0	449	CONH
5.4	39.8	159	GA01
0.0	7.1	625	GF1G
0.4	6.9	622	GF1R
6.1	6.6	268	GFZ_
0.9	6.9	100	GOP1
-0.5	10.2	91	GOPG
-0.2	7.5	202	IES2
5.5	20.5	336	IGE2
6.2	9.9	43	LPTX
2.4	7.6	208	LPT_
0.5	9.8	110	METG
0.6	7.3	218	METO
-1.6	10.7	44	METR
3.2	9.8	110	MTGH
2.4	7.7	237	MTRH
-3.7	8.1	642	NGA1
-1.9	9.6	372	NGA2
3.4	9.7	276	ROBG
1.7	12.8	653	ROBH
0.7	7.7	220	ROBQ
2.1	12.8	744	ROBT
0.6	9.5	521	SGN1
4.3	9.1	521	SGN2
0.7	15.5	242	SGN3
1.2	11.8	242	SGN4
6.7	21.8	28	SGNC
-0.7	30.4	36	SGNR
-0.8	10.3	448	SGN_
-3.1	11.9	55	SGO1
3.4	7.5	30	TUWN
0.9	8.9	7	WLIT
7.5	17.8	16	WTWN
-1.8	8.2	184	WUEL

bias [mm]	std. dev. [mm]	#site	AC
0.7	8.2	607	ASIC
7.2	125.9	31	ASIR
-9.3	20.5	14	ASIS
2.1	9.3	348	ASI_
6.6	11.5	118	AUT1
2.5	8.6	107	BKGH
1.7	7.8	97	BKG_
0.9	13.0	456	CONH
8.2	20.5	154	GA01
1.0	7.4	617	GF1G
0.9	7.2	567	GF1R
4.9	7.0	224	GFZ_
2.3	7.9	92	GOP1
-0.2	10.5	88	GOPG
0.4	8.1	200	IES2
-0.7	14.3	341	IGE2
5.0	10.4	43	LPTX
2.1	8.4	209	LPT_
0.2	9.7	116	METG
1.1	7.9	235	METO
1.5	11.1	42	METR
3.4	10.0	112	MTGH
1.4	8.6	237	MTRH
0.9	7.4	639	NGA1
0.1	10.1	367	NGA2
3.1	10.2	280	ROBG
1.3	9.6	647	ROBH
0.9	9.5	220	ROBQ
1.9	9.1	742	ROBT
-1.2	9.9	283	SGN1
2.8	10.2	283	SGN2
-3.6	8.8	243	SGN3
3.4	9.9	243	SGN4
12.3	24.3	30	SGNC
13.8	23.4	31	SGNR
-2.3	9.3	446	SGN_
-0.9	13.5	57	SGO1
3.8	7.7	29	TUWN
1.9	10.9	7	WLIT
4.7	17.2	17	WTWN
0.9	9.0	234	WUEL
5.0	11.4	148	WUHN

bias [mm]	std. dev. [mm]	#site	AC
-0.1	11.2	611	ASIC
-16.4	156.0	29	-ASIR
-23.9	16.4	15	-ASIS
-1.7	16.2	344	ASI_
8.3	14.0	120	AUT1
1.0	11.3	105	BKGH
1.0	11.5	96	BKG_
0.1	14.7	452	CONH
5.6	15.2	158	GA01
-1.2	10.1	621	GF1G
-1.4	9.9	564	GF1R
2.4	10.1	223	GFZ_
0.6	11.5	105	GOP1
-0.6	11.0	101	GOPG
-1.2	10.2	199	IES2
-1.6	16.4	348	IGE2
0.2	20.2	43	LPTX
-0.9	14.8	208	LPT_
-0.6	10.7	113	METG
-0.5	10.4	233	METO
-2.6	12.3	41	METR
2.4	11.1	109	MTGH
-0.4	10.6	234	MTRH
-1.7	10.1	637	NGA1
1.2	14.5	366	NGA2
2.7	11.8	277	ROBG
0.4	12.5	648	ROBH
1.1	10.8	214	ROBQ
0.8	12.4	743	ROBT
-1.2	12.1	288	SGN1
1.4	13.2	288	SGN2
-4.3	12.9	245	SGN3
1.3	13.4	244	SGN4
13.2	27.0	30	SGNC
12.3	24.0	29	SGNR
-1.9	12.5	445	SGN_
-4.3	21.6	62	SGO1
1.2	13.4	28	TUWN
-0.5	14.1	7	WLIT
-2.0	36.4	16	WTWN
-2.7	11.5	185	WUEL
1.4	35.4	305	WUHN

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July, August, September

bias [mm]	std. dev. [mm]	#site	AC
0.5	11.3	602	ASIC
-1.7	14.5	340	ASI_
7.5	14.7	117	AUT1
2.1	11.9	107	BKGH
1.5	10.7	96	BKG_
-0.4	15.5	455	CONH
5.6	13.4	159	GA01
-0.0	9.8	605	GF1G
-0.1	9.6	600	GF1R
4.4	9.1	218	GFZ_
-1.7	11.7	99	GOPG
-1.9	10.7	204	IES2
-3.2	18.6	354	IGE2
1.7	17.5	43	LPTX
-0.6	13.4	205	LPT_
-0.8	11.1	114	METG
-0.8	10.8	237	METO
-3.7	13.9	39	METR
3.0	11.1	111	MTGH
-0.8	11.2	233	MTRH
-1.0	9.8	636	NGA1
0.2	12.1	365	NGA2
2.5	11.8	276	ROBG
1.2	13.0	645	ROBH
0.2	12.1	215	ROBQ
1.1	13.1	750	ROBT
0.3	12.7	288	SGN1
2.5	13.4	288	SGN2
-2.9	15.2	247	SGN3
3.5	13.2	247	SGN4
14.8	23.9	28	SGNC
13.9	21.6	30	SGNR
-1.2	13.8	446	SGN_
-4.7	21.6	62	SGO1
1.0	12.6	29	TUWN
4.5	11.8	7	WLIT
4.9	20.6	14	WTWN
2.2	11.0	179	WUEL
0.2	25.3	347	WUHN

bias [mm]	std. dev. [mm]	#site	AC
1.5	11.8	600	ASIC
-3.2	15.0	333	ASI_
6.3	13.6	121	AUT1
1.8	12.2	107	BKGH
1.3	11.5	96	BKG_
-0.0	15.5	451	CONH
6.0	16.2	161	GA01
-1.0	10.8	603	GF1G
-0.8	10.4	608	GF1R
2.6	10.9	217	GFZ_
0.9	12.9	117	GOP1
-1.0	11.5	104	GOPG
-1.8	11.5	209	IES2
0.6	22.2	362	IGE2
2.2	18.0	43	LPTX
-1.4	14.1	206	LPT_
-0.7	11.7	108	METG
-1.0	11.6	229	METO
-2.0	13.6	25	METR
2.9	11.2	104	MTGH
-1.0	10.5	225	MTRH
-1.9	10.0	633	NGA1
-0.8	12.9	363	NGA2
2.5	12.0	277	ROBG
-0.2	15.4	627	ROBH
-1.4	13.1	214	ROBQ
-0.8	14.3	731	ROBT
2.0	13.1	287	SGN1
-0.8	14.2	287	SGN2
3.2	14.6	246	SGN3
-0.4	14.2	247	SGN4
11.5	24.9	35	SGNC
12.2	21.0	30	SGNR
2.5	13.9	445	SGN_
-6.7	17.9	60	SGO1
1.1	13.2	29	TUWN
0.5	13.5	7	WLIT
1.9	20.3	14	WTWN
-0.3	11.7	177	WUEL
-0.8	18.6	329	WUHN

bias [mm]	std. dev. [mm]	#site	AC
0.9	10.0	601	ASIC
-1.4	12.2	319	ASI_
4.7	13.0	119	AUT1
2.3	10.6	107	BKGH
1.5	9.2	96	BKG_
-0.8	13.9	450	CONH
4.2	23.1	160	GA01
-0.8	8.4	625	GF1G
-0.8	8.3	586	GF1R
5.9	8.2	272	GFZ_
2.5	10.6	116	GOP1
-0.3	10.6	103	GOPG
-2.4	10.1	193	IES2
0.7	14.2	358	IGE2
2.5	17.4	43	LPTX
-0.0	12.1	206	LPT_
-0.7	10.4	108	METG
-1.9	10.0	235	METO
-0.2	15.4	15	METR
-1.4	7.9	632	NGA1
-0.2	10.1	362	NGA2
2.6	11.5	274	ROBG
-0.5	13.8	617	ROBH
-1.1	11.3	214	ROBQ
-0.3	11.9	731	ROBT
1.7	11.7	284	SGN1
-0.1	12.8	284	SGN2
1.5	11.5	249	SGN3
0.8	12.5	249	SGN4
14.0	25.4	35	SGNC
16.9	21.3	30	SGNR
2.2	12.1	445	SGN_
-4.7	16.5	60	SGO1
3.2	11.4	29	TUWN
0.9	11.8	7	WLIT
2.3	19.4	13	WTWN
0.9	9.1	167	WUEL
1.3	14.1	287	WUHN

October and November

bias [mm]	std. dev. [mm]	#site	AC
1.1	9.7	606	ASIC
-1.8	11.3	316	ASI_
4.0	11.7	124	AUT1
2.0	8.9	106	BKGH
1.6	8.0	96	BKG_
-0.4	11.4	435	CONH
4.2	20.6	160	GA01
-0.6	7.6	611	GF1G
-0.6	7.4	562	GF1R
6.6	7.4	269	GFZ_
1.8	9.0	115	GOP1
-0.8	9.8	101	GOPG
-2.0	9.4	193	IES2
1.3	12.6	354	IGE2
2.1	18.3	42	LPTX
-0.9	12.4	207	LPT_
-0.5	10.5	110	METG
-0.9	9.2	249	METO
-5.2	10.3	30	METR
-0.4	6.3	633	NGA1
-0.4	8.6	367	NGA2
2.6	10.1	271	ROBG
0.1	11.2	615	ROBH
-1.4	10.6	212	ROBQ
0.4	11.0	735	ROBT
3.0	12.0	284	SGN1
1.5	13.2	284	SGN2
1.2	12.1	243	SGN3
-0.3	12.9	243	SGN4
14.4	23.6	29	SGNC
11.9	23.0	30	SGNR
2.2	11.9	446	SGN_
-4.4	13.3	59	SGO1
3.0	9.5	29	TUWN
4.1	9.5	7	WLIT
2.5	18.3	14	WTWN
1.5	8.3	191	WUEL
-0.4	13.8	308	WUHN

bias [mm]	std. dev. [mm]	#site	AC
2.5	8.3	596	ASIC
1.9	9.2	313	ASI_
4.9	11.9	122	AUT1
1.7	7.9	106	BKGH
2.4	6.7	95	BKG_
-0.1	9.7	437	CONH
4.2	18.0	156	GA01
1.5	6.4	614	GF1G
1.2	6.5	615	GF1R
8.1	6.0	265	GFZ_
1.8	7.8	113	GOP1
-0.1	9.5	98	GOPG
1.0	7.6	190	IES2
5.1	10.7	343	IGE2
7.2	9.8	42	LPTX
2.8	8.1	205	LPT_
0.4	10.0	103	METG
2.0	7.5	243	METO
-0.0	9.2	49	METR
-0.1	6.5	632	NGA1
0.4	8.2	367	NGA2
3.3	9.6	269	ROBG
1.4	10.8	610	ROBH
0.6	8.8	212	ROBQ
1.4	10.8	728	ROBT
2.3	9.6	278	SGN1
4.3	10.9	278	SGN2
3.5	9.8	242	SGN3
4.3	10.1	242	SGN4
14.8	21.0	27	SGNC
13.1	29.8	29	SGNR
3.7	9.9	443	SGN_
-3.5	15.4	62	SGO1
6.9	8.4	29	TUWN
3.6	8.4	7	WLIT
1.4	15.8	13	WTWN
2.7	7.0	233	WUEL
-1.3	12.9	307	WUHN

Similar, but for per site and AC.

For individual sites, the variation can be quite large, indicating O-B based white/black listing is still important.

Also statistics per site, over all Acs Is made.

bias [mm]	std. dev. [mm]	rms [mm]	#OmBs	site-AC
-0.9	6.1	6.1	1546	PAUO-NGA1
-1.3	8.6	8.7	3334	PAUO-NGA2
1.9	7.9	8.2	1800	PAYE-ASIC
-0.6	8.0	8.0	1550	PAYE-ASI_
1.8	8.2	8.4	1462	PAYE-GF1G
-1.0	8.6	8.7	1715	PAYE-IES2
0.3	9.2	9.2	790	PAYE-IGE2
4.7	8.6	9.8	4790	PAYE-LPTX
1.4	8.6	8.7	838	PAYE-LPT_
-0.5	8.8	8.9	1805	PAYE-METO
2.9	9.1	9.5	1745	PAYE-ROBG
1.4	9.2	9.3	1840	PAYE-ROBH
1.5	9.5	9.6	1806	PAYE-ROBT
4.1	8.9	9.8	1900	PAYE-SGN3
1.7	9.2	9.4	1909	PAYE-SGN4
4.9	9.4	10.6	1874	PAYE-SGN_
-0.4	10.2	10.2	1285	PAYR-ASIC
0.6	12.5	12.5	465	PAYR-IGE2
-1.2	10.9	10.9	1392	PAYR-ROBH
-0.6	11.1	11.1	1327	PAYR-ROBT
1.2	10.8	10.9	1981	PAYR-SGN3
-1.2	10.7	10.7	1973	PAYR-SGN4
6.2	12.0	13.5	1502	PAYR-SGN_
-0.5	21.2	21.2	608	PBCH-CONH

^

Data formats

- **BUFR to be updated**
  - **WIGOS identifiers**
  - **Handling of slants**
- **SINEXTRO to substitute the COST format**
- **DWD GFZ lead discussion.**

OSCAR data base

- **Meta data for meteorological observations sites.**
- **Presently not clear whether to and how to handle E-GVAP meta data in OSCAR**

IPR (intelectual property rights)

Update of Product Requirements Doc?

Requirements for quality and quantity for nowcasting? (Jana)

Timeliness criteria from new E-GVAP requirements

An essential aim in the next phase is improved timeliness, to fulfill requirements from local, rapid refresh NWP and nowcasting (see the approved E-GVAP requirements for details). The criteria to be used for timeliness are,

Level	Hourly ZTD estimation	Percentage	Sub-hourly ZTD estimation	Percentage
Threshold	120 min	-	30 min	90 %
Target	90 min	90 %	15 min	75 %
Goal	60 min	75 %	5 min	-

Table 1, timeliness criteria for the ZTD timeliness monitoring.

This discriminates be between two types of products, ZTDs produced by *hourly* versus *sub-hourly* processing. Remember, they also have different quality, but both in general meet the 15 mm std. dev. against NWP criteria.

In the next phase the time resolution of the timeliness monitoring will be enhanced to 5 min.

Site names

Lists with ”occupied” and sitenames. 3 lists:

1. **Active sites,**
2. **Sites for which we have ZTDs, but they have become inactive.**
3. **Reserved names (if you have a prefered name for at receiver you plan to install).**

Plan to install Dave Offilers interactive name checking tool, but software on current homepage server not sufficient. Will in the meantime provide regular upload of the ”name files” to the E-GVAP homepage and EUREF. The files are available at the E-GVAP ftpserver for download, and updated daily.

Email lists

- Currently they do not function properly when used from outside DMI. This is due to mailserver changes at DMI, introduced on ministerial request. Expect this can be cured, but it will take a bit of time.

- Important to inform Henrik when personal responsible for E-GVAP contacts or work is changed!

- A yearly test – direct mail instead of via mail list.

Log changes

The latest version is egvap_cost_v22a.pdf. It is available both at the E-GVAP homepage (under ”support”) and from the download ftp-server at UKMO.

Notice that it is possible to write a few words in the top of the COST 716 file, enabling users (and one self) to follow/remember changes done to the processing, providing a contact point if questions arise, etc.

Expert team on data processing

The primary contact point between the meteorological and geodetic side.

Team involves both the real processing experts, and people from institutes starting to process GNSS data for delivery to E-GVAP.

Rosa Pacione, e-geos, Italy
Jan Dousa, GOP, Czeck Republic.
Elmar Brockmann, Swisstopo, Switzerland
Galina Dick, GFZ, Germany
Tong Ning, Swedish Mapping Agency (Lantmaeteriet)
Jose Antonio Sánchez Sobrino, IGE/IGN, Spain
Lila Jean-Louis, SGN/IGN, France.
Eric Pottiaux/Carine Bruyninx, ROB, Belgium
Wolfang Soehne/Yuksel Altiner, BKG, Germany
Ambrus Kenyeres, SGOB, Hungary
Norman Terfele, UL01, University of Luxemburg, Luxemburg
Jan Kaplon, WUEL, Poland

Jonathan Jones, Siebren de Haan, Henrik Vedel.
Responsible person: Jonathan Jones.

Expert team on GNSS observation usage

Purpose: To further the use of gb GNSS data in NWP and now-casting through sharing of results and expertise, to provide guidance material for others, and to provide feedback to processing centres.

Owen Lewis, UK Metoffice and E-GVAP
Jana Sanchez Arriola, AEMET, Spain
Patrick Moll, Meteo-France.
Klaus Stephan/Michael Bender, DWD.
Henrik Vedel, DMI and E-GVAP
Jonathan Jones, UK Met Office and E-GVAP
Siebren de Haan, KNMI and E-GVAP.

Other?
The experts should cover the ”big nwp consortia” and be people active in using ground-based GNSS data in NWP and/or forecasting.

Who has IWV or ZTD based nowcasting expertise?

Responsible person: Henrik Vedel.

O-B and other NWP data for statistics (E-GVAP), and for use in realtime positioning experiments (post GNSS4SWEC).

- **Currently O-B from UK Metoffice global model as regards EUCOS QMP, and from KNMI HIRLAM regarding the E-GVAP validation page.**
- **Need global coverage.**

  Need also European coverage with higher resolution models.
  - **For E-GVAP O-B.**
  - **For post GNSS4SWEC need ZTD, surface pressure, T2m and <T>?**
  - **For gradient validation, need gradient OmB**
  - **For STD validation, need STD OmB**

High resolution radiosonde data

- In meteorology one has decided to move from short radiosonde reports in an ascii format to long radiosonde reports in BUFR format.
- In practice this is a gradual process. At the time some NMS send both formats, some only one of them. As usual errors are made when changing to someting new = the new BUFR format data are better in most cases, but not always.
- The old and ongoing radiosonde extractions done for E-GVAP are based on the old format.
- Software has been made for extraction of the new BUFR data, which contain many more levels. It corrects some of the errors in some of the current BUFR data.
- The old software for calculation of ZTD etc. based on RS data has been changed. It can now handle both the old profiles and the new, longer profiles.
- The extracted BUFR data will be added to the RS data provided by E-GVAP. It will be a separate set of data, at least initially.
- They will appear before X-mas. Besides daily extractions a dataset running 201801 to present will be made available.

Main characteristics of phase 4:

- **Continuation of ZTD provision and quality control.**
- **Improving timeliness, through sub-hourly processing and data distribution of zenith total delays (ZTDs).**
- **Enabling distribution and validation of slant total delays (STDs).**
- **Update of data formats, both the ASCII based format used for uploads and internally in geodesy, and the BUFR format used for GTS distribution.**
- **Provide IWV fields as numbers (grib format) for members include in own software for display to forecasters.**
- **Provide guidance for members to estimate themselves IWV based on GNSS ZTD and auxiliary information from SYNOP and/or NWP.**

Slants total delays and ZTD gradients

- **ZTD gradients and STDs can be derived from the same original data used to derive ZTD.**
- **They contain information on atmospheric inhomogeneity in the area around a GNSS site. They also contain noise.**
- **As the number of GNSS satellites increases (GPS, GLONAS, Galileo, Beidou), S/N of ZTD gradients improves.**
- **Some European NWP consortia are preparing for assimilation of slants (e.g. DWD/ICON and KNMI/Arome-Harmonie).**
- **E-GVAP AC GFZ is testing STD estimation.**
- **Several E-GVAP ACs do ZTD gradient estimation.**
- **Both gradients and slants can be distributed using current E-GVAP file formats, but proper handling of slants requires format updates.**

Main focus areas in the year ahead

- **More GNSS sites.**
  - **Specifically attempt to obtain ZTD data from Morocco**
- **Improve timeliness through more sub-hourly uploads.**
- **Improve timeliness monitoring to 5 min. resolution.**
- **Provide monthly OmB statistics at homepage for all ACs**
- **Introduce standard rules for warning times to users when ACs do changes to the GNSS data processing.**
- **Provide regular uploads of “occupied” site names to homepage and EUREF.**
- **Provide also the high resolution radiosonde reports, in addition to the current reports.**
- **Provision of IWV 2D grided data in grib format, for members to show with own display software.**
- **Provision of information how to derive IWV from ZTD, for members to do their own conversion.**
- **Active quality control, AQC.**

Next meeting?

Any other matter?

FIN

Contact Details

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