

1 **Characterizations of Europe's integrated water vapor and**
2 **assessments of atmospheric reanalyses using more than two**
3 **decades of ground-based GPS**

4 Peng Yuan¹, Roeland Van Malderen², Xungang Yin³, Hannes Vogelmann⁴, Joseph Awange⁵,
5 Bernhard Heck¹, Hansjörg Kutterer¹

6 ¹Geodetic Institute, Karlsruhe Institute of Technology, Karlsruhe, 76131, Germany

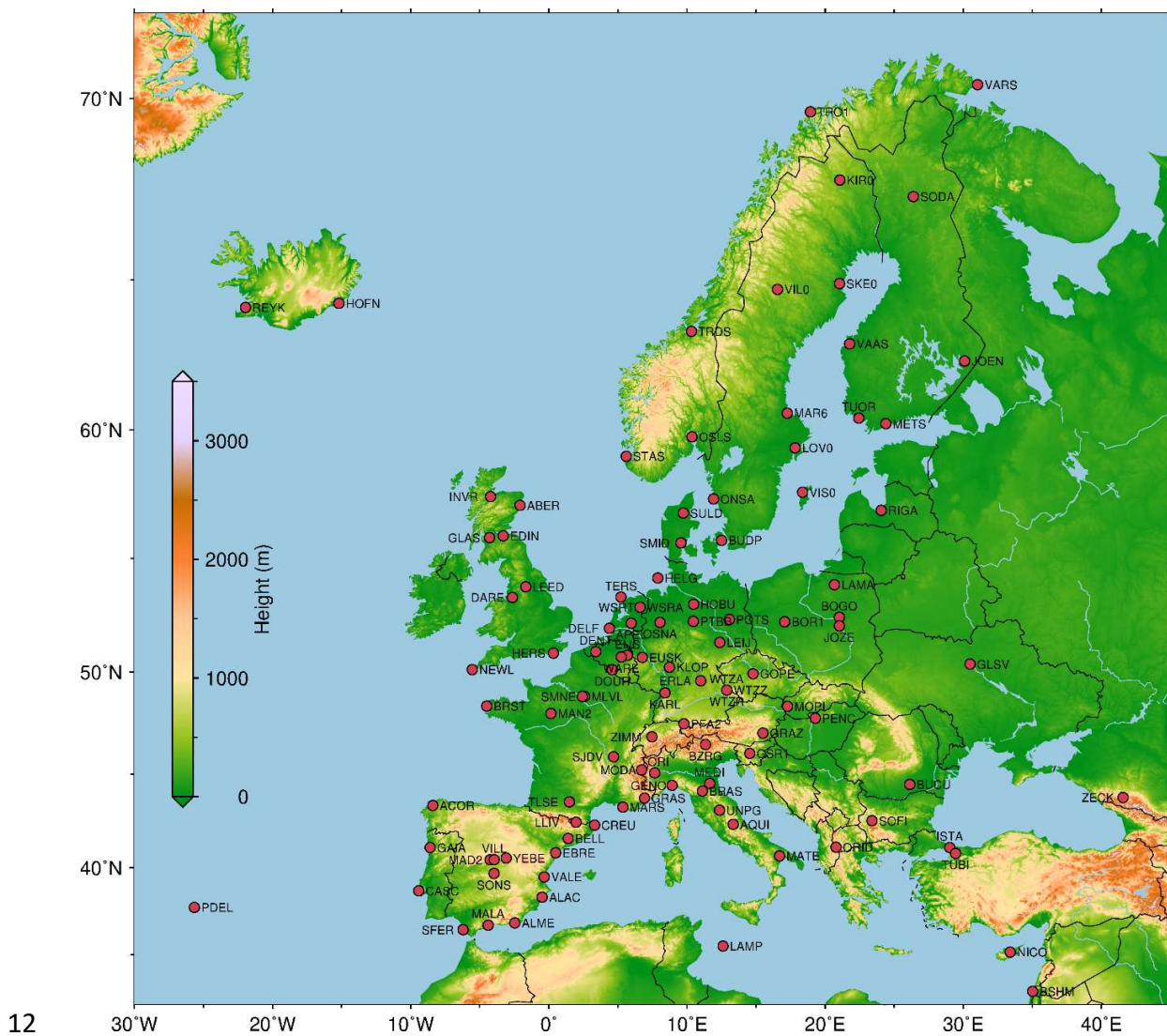
7 ²KMI-IRM, Royal Meteorological Institute of Belgium, Brussels, B-1180, Belgium

8 ³Riverside Technology Inc, Asheville, NC 28801, USA

9 ⁴Karlsruhe Institute of Technology, IMK-IFU, Garmisch-Partenkirchen, 82467, Germany

10 ⁵Curtin University, School of Earth and Planetary Sciences, Perth, WA 6845, Australia

11 *Correspondence to:* Peng Yuan (peng.yuan@kit.edu)



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 13 **Figure S1.** Geographical distribution of the 108 GPS stations. This is an enlarged version of Fig. 1 with station
 14 names. The coordinates of the stations and their time lengths are provided in Table S1.

15 **Table S1.** Time period, number of years (Num. of Y.), number of daily observations (Num. of O.), and integration
 16 rate (I-rate) of the GPS IWV time series. The height denotes orthometric height.

Station	Lat. (°)	Lon. (°)	Height (m)	Begin date	End date	Num. of Y.	Num. of O.	I-rate (%)
ABER	57.14	357.92	3.1	1998-09-18	2018-12-31	20.3	6415	86.6
ACOR	43.36	351.60	11.9	2003-11-14	2018-12-31	15.1	5291	95.7
ALAC	38.34	359.52	9.9	1998-03-07	2018-12-31	20.8	7165	94.2
ALME	36.85	357.54	77.1	1999-12-04	2018-12-31	19.1	6682	95.9
APEL	52.21	5.96	72.4	2000-10-24	2018-12-31	18.2	6477	97.5
AQUI	42.37	13.35	664.1	1999-06-15	2018-12-31	19.5	6710	94.0
BELL	41.60	1.40	802.9	1998-12-16	2018-12-31	20.0	7118	97.2
BOGO	52.48	21.04	118.8	1996-07-01	2018-12-29	22.5	7749	94.3
BOR1	52.28	17.07	88.8	1994-09-28	2018-12-31	24.3	8642	97.5
BRAS	44.12	11.11	857.5	2000-05-27	2018-12-31	18.6	6545	96.3
BRST	48.38	355.50	14.3	1998-11-01	2018-12-31	20.2	6506	88.3
BSHM	32.78	35.02	204.3	1998-09-02	2018-12-29	20.3	6722	90.5
BUCU	44.46	26.13	107.7	1999-02-09	2018-12-31	19.9	7062	97.2
BUDP	55.74	12.50	57.7	2001-01-01	2018-12-31	18.0	6406	97.4
BZRG	46.50	11.34	279.0	2002-07-12	2018-12-31	16.5	5853	97.3
CASC	38.69	350.58	22.2	1999-09-28	2018-12-31	19.3	6706	95.3
CREU	42.32	3.32	83.6	2003-07-31	2018-12-31	15.4	5465	97.0
DARE	53.34	357.36	36.2	2000-07-09	2018-12-31	18.5	6236	92.4
DELf	51.99	4.39	30.7	1996-08-08	2018-12-31	22.4	8012	97.9
DENT	50.93	3.40	19.2	1996-01-02	2018-12-31	23.0	8077	96.2
DOUR	50.09	4.60	236.4	1996-01-02	2018-12-31	23.0	8052	95.9
EBRE	40.82	0.49	57.6	1997-04-16	2018-12-31	21.7	7588	95.7
EDIN	55.92	356.71	65.8	2000-04-10	2018-12-31	18.7	6357	92.9
EIJS	50.76	5.68	57.6	1996-08-30	2018-12-31	22.3	7925	97.1
ERLA	49.59	11.00	291.0	1997-08-03	2018-12-31	21.4	7484	95.7
EUSK	50.67	6.76	198.1	1998-04-04	2018-12-31	20.7	7351	97.0
GAIA	41.11	351.41	232.1	2000-01-02	2018-12-31	19.0	6435	92.7
GENO	44.42	8.92	110.0	1998-07-23	2018-12-31	20.4	7044	94.3
GLAS	55.85	355.70	16.9	2000-03-16	2018-12-31	18.8	6467	94.2
GLSV	50.36	30.50	200.8	1997-12-09	2018-12-31	21.1	7464	97.0
GOPE	49.91	14.79	547.6	2001-12-22	2018-12-31	17.0	6058	97.4
GRAS	43.75	6.92	1268.2	1995-02-22	2018-12-31	23.9	8013	92.0
GRAZ	47.07	15.49	490.8	1994-01-02	2018-12-31	25.0	8678	95.0
GSRI	46.05	14.54	304.8	2001-12-23	2018-12-31	17.0	5958	95.8
HELG	54.17	7.89	9.0	1999-11-09	2018-12-31	19.1	6747	96.5
HERS	50.87	0.34	31.4	2001-09-14	2018-12-31	17.3	6170	97.7
HOBu	53.05	10.48	111.3	2002-06-21	2018-12-31	16.5	5828	96.5
HOFN	64.27	344.80	17.4	1997-06-29	2018-12-31	21.5	7413	94.4

INVR	57.49	355.78	12.8	2000-01-02	2018-05-08	18.3	6099	91.0
ISTA	41.10	29.02	109.9	1999-12-11	2018-12-31	19.1	6325	90.9
JOEN	62.39	30.10	96.4	1996-10-26	2018-12-31	22.2	7593	93.7
JOZE	52.10	21.03	110.0	1995-02-07	2018-12-31	23.9	8359	95.8
KARL	49.01	8.41	134.7	1997-06-29	2018-12-31	21.5	7469	95.1
KIR0	67.88	21.06	469.3	1996-11-05	2018-12-31	22.2	7794	96.3
KLOP	50.22	8.73	174.4	1997-06-30	2018-12-31	21.5	7461	95.0
LAMA	53.89	20.67	157.6	1994-12-22	2018-12-30	24.0	8180	93.2
LAMP	35.50	12.61	19.6	1999-03-26	2018-12-31	19.8	6341	87.8
LEED	53.80	358.34	165.3	2000-01-02	2018-12-31	19.0	6482	93.4
LEIJ	51.35	12.37	134.2	1997-06-30	2018-12-31	21.5	7414	94.4
LLIV	42.48	1.97	1414.3	1999-05-14	2018-12-31	19.6	6917	96.4
LOV0	59.34	17.83	56.1	1995-08-01	2018-12-31	23.4	8156	95.3
MAD2	40.43	355.75	776.4	1997-07-07	2018-12-31	21.5	7355	93.7
MALA	36.73	355.61	71.2	2000-05-05	2018-12-31	18.7	6652	97.6
MAN2	48.02	0.16	120.9	1998-04-05	2018-12-31	20.7	7126	94.1
MAR6	60.60	17.26	50.6	1996-10-26	2018-12-31	22.2	7926	97.8
MARS	43.28	5.35	12.2	1998-07-17	2018-12-31	20.5	7030	94.1
MATE	40.65	16.70	490.2	1994-01-02	2018-12-31	25.0	8788	96.3
MEDI	44.52	11.65	10.2	1995-07-28	2018-12-31	23.4	8005	93.5
METS	60.22	24.40	75.7	1994-01-02	2018-12-31	25.0	8361	91.6
MLVL	48.84	2.59	115.9	1998-03-20	2018-12-31	20.8	7047	92.8
MODA	45.21	6.71	1127.9	1998-10-17	2018-12-31	20.2	6412	86.9
MOPI	48.37	17.27	535.3	1998-05-27	2018-12-31	20.6	6923	92.0
NEWL	50.10	354.46	11.0	1998-09-30	2018-12-10	20.2	6685	90.6
NICO	35.14	33.40	161.9	1997-05-15	2018-12-31	21.6	6745	85.4
ONSA	57.40	11.93	8.9	1994-01-02	2018-12-31	25.0	8699	95.3
ORID	41.13	20.79	730.8	2000-07-13	2018-12-31	18.5	6262	92.8
OSLS	59.74	10.37	181.5	2000-10-30	2018-12-31	18.2	6430	96.9
OSNA	52.25	8.05	105.5	2000-01-01	2018-12-31	19.0	6528	94.1
PDEL	37.75	334.34	53.5	2000-02-01	2018-12-31	18.9	6433	93.1
PENC	47.79	19.28	248.3	1996-03-03	2018-12-31	22.8	8033	96.3
PFA2	47.52	9.78	1042.9	1997-04-12	2018-12-31	21.7	7543	95.1
POTS	52.38	13.07	104.0	1995-10-04	2018-12-31	23.2	8135	95.8
PTBB	52.30	10.46	87.2	2000-03-30	2018-12-31	18.8	6629	96.8
REYK	64.14	338.04	26.6	1996-01-02	2018-12-31	23.0	7813	93.0
RIGA	56.95	24.06	13.6	1996-10-26	2018-12-31	22.2	7649	94.4
SFER	36.46	353.79	39.2	1998-06-03	2018-12-28	20.6	7007	93.3
SJDV	45.88	4.68	382.1	1999-03-12	2018-12-31	19.8	6320	87.4
SKE0	64.88	21.05	59.0	1996-11-02	2018-12-31	22.2	7912	97.7
SMID	55.64	9.56	82.5	2001-01-01	2018-12-31	18.0	6396	97.3
SMNE	48.84	2.43	81.6	2000-10-30	2018-12-31	18.2	6414	96.6

SODA	67.42	26.39	279.0	1996-10-26	2018-12-31	22.2	7192	88.8
SOFI	42.56	23.39	1074.5	1997-06-04	2018-12-31	21.6	7227	91.7
SONS	39.68	356.04	755.3	2000-11-25	2018-12-31	18.1	6460	97.7
STAS	59.02	5.60	60.8	2000-10-30	2018-12-31	18.2	6340	95.5
SULD	56.84	9.74	82.0	2001-01-01	2018-12-31	18.0	6386	97.1
TERS	53.36	5.22	14.4	1996-10-31	2018-12-31	22.2	7924	97.9
TLSE	43.56	1.48	157.7	2001-01-06	2018-12-31	18.0	6391	97.3
TORI	45.06	7.66	261.2	1998-07-15	2018-12-31	20.5	6917	92.5
TRDS	63.37	10.32	277.7	2000-10-30	2018-12-31	18.2	6380	96.1
TROI	69.66	18.94	106.6	2000-06-19	2018-12-31	18.5	6518	96.3
TUBI	40.79	29.45	184.3	2002-01-01	2018-12-31	17.0	6020	97.0
TUOR	60.42	22.44	41.0	1997-01-01	2016-11-05	19.8	6911	95.3
UNPG	43.12	12.36	303.5	1997-10-15	2018-11-20	21.1	6976	90.5
VAAS	62.96	21.77	40.1	1996-10-26	2018-12-31	22.2	7623	94.1
VALE	39.48	359.66	27.0	2000-01-10	2018-12-31	19.0	6425	92.7
VARS	70.34	31.03	156.1	2000-10-30	2018-12-31	18.2	6343	95.6
VIL0	64.70	16.56	420.1	1996-10-29	2018-12-31	22.2	7853	97.0
VILL	40.44	356.05	595.4	1994-11-29	2018-12-31	24.1	8327	94.6
VIS0	57.65	18.37	54.7	1996-11-05	2018-12-31	22.2	7855	97.1
WARE	50.69	5.25	141.6	1996-01-02	2018-12-31	23.0	7924	94.3
WSRA	52.91	6.60	40.5	1997-05-17	2018-12-31	21.6	7709	97.6
WSRT	52.91	6.60	40.5	1997-06-26	2018-12-31	21.5	7653	97.4
WTZA	49.14	12.88	619.1	1997-11-26	2018-12-31	21.1	7301	94.7
WTZR	49.14	12.88	619.2	1995-12-31	2018-12-31	23.0	8217	97.8
WTZZ	49.14	12.88	619.1	1999-02-05	2018-12-31	19.9	7015	96.5
YEBE	40.52	356.91	920.3	1999-05-19	2018-12-31	19.6	6829	95.3
ZECK	43.79	41.57	1143.4	1997-07-06	2018-12-31	21.5	7092	90.4
ZIMM	46.88	7.47	906.7	1994-01-02	2018-12-31	25.0	8781	96.2