Statistics Report

EMADDC ©KNMI
(Dated: May 12, 2020)

Contents

I. General

This is the daily auto generated quality report (based on input quality control) for the EMADDC TEST processing system at KNMI.

Due to the COVID-19 situation all operational and test data streams of the European Meteorological Aircraft Derived Data Centre (EMADDC) are being processed on the TEST system and the derived upper air observations for wind direction, wind speed and air temperature will be made available via KNMI FTP (and under investigation to the GTS).

This is a temporarily measure as long as the COVID-19 situation lasts based upon agreement with the current aircraft data suppliers.

The TEST system uses the most recent developed correction algorithms for heading and temperature correction as presented at the EUMETNET/ECWMF ABO workshop in February 2020 in Reading.

The heading correction algorithm assesses the magnetic declination table used on board at each individual aircraft and is geographical independent, thus enabling processing data from every geographical location.

The temperature correction algorithm recalculates the Mach number based on IAS and pressure, after which Temperature is derived from Mach and TAS. The derived Temperature is averaged by using five calculated derived Temperatures of this specific aircraft in a small time window. Averaging between aircraft is not performed at this stage, this is only applicable when vertical profiles are being generated.

Wind direction, wind speed and air temperature are resp. reported in meter per second (m/s), degree (deg) and degree Kelvin (K). The aircraft-ID are anonymized on request of data stream suppliers, although discussions are ongoing to make aircraft-ID available in the future. An observation is characterized uniquely based on location and time measured. The observation frequency may differ per radar and consequently per source.

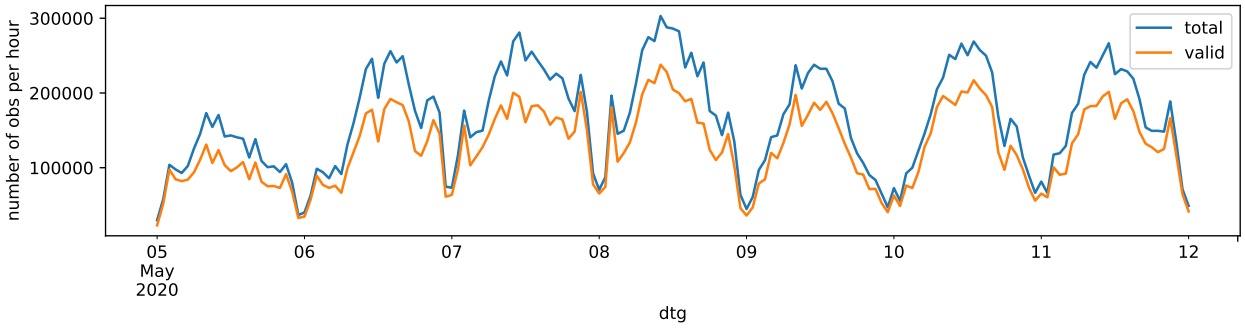
Black listing of aircraft and active quality control is not performed at this stage and is foreseen to be implemented in one of the next versions.

A. 7 Days statistics and yesterdays coverage

Data used is displayed in the next table.

Time period	05 May 2020 to 12 May 2020
Platform	TEST
Stream	all
Reference	ecmwf
version	2.0beta1

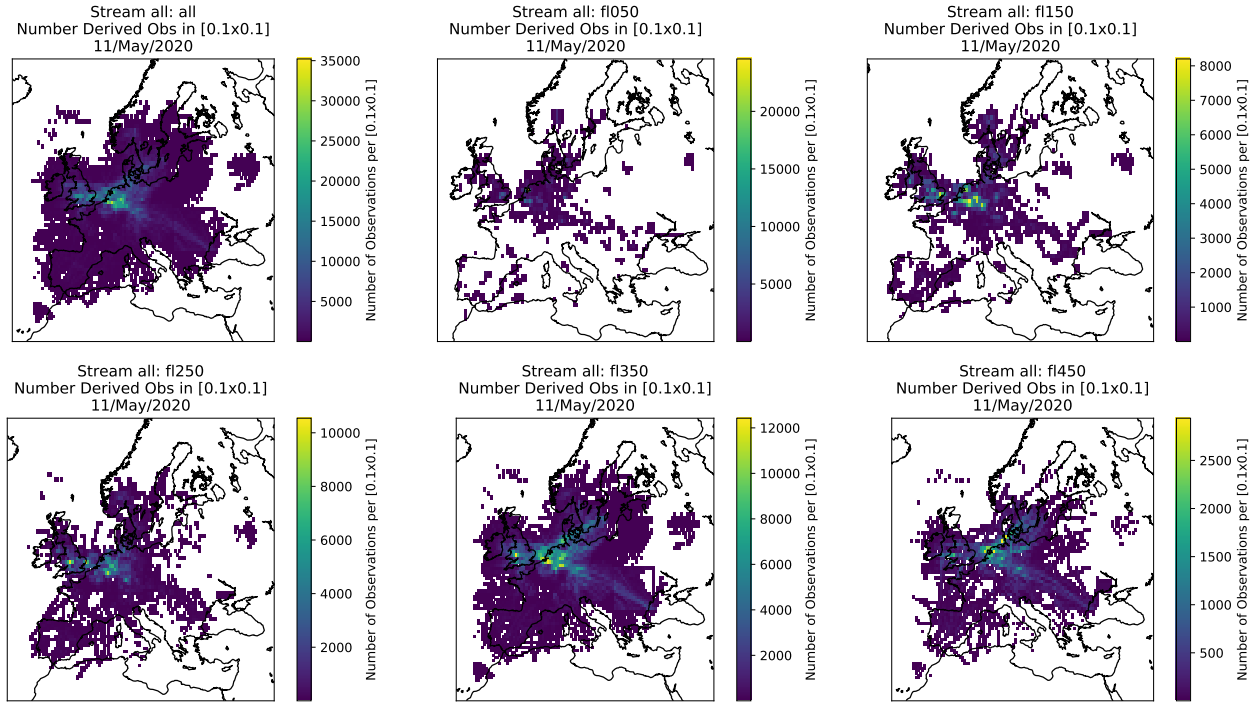
The number of input and output data per hour



The observation minus model forecast (OmF) for wind and temperature for all data streams together, and for different flight level bins.

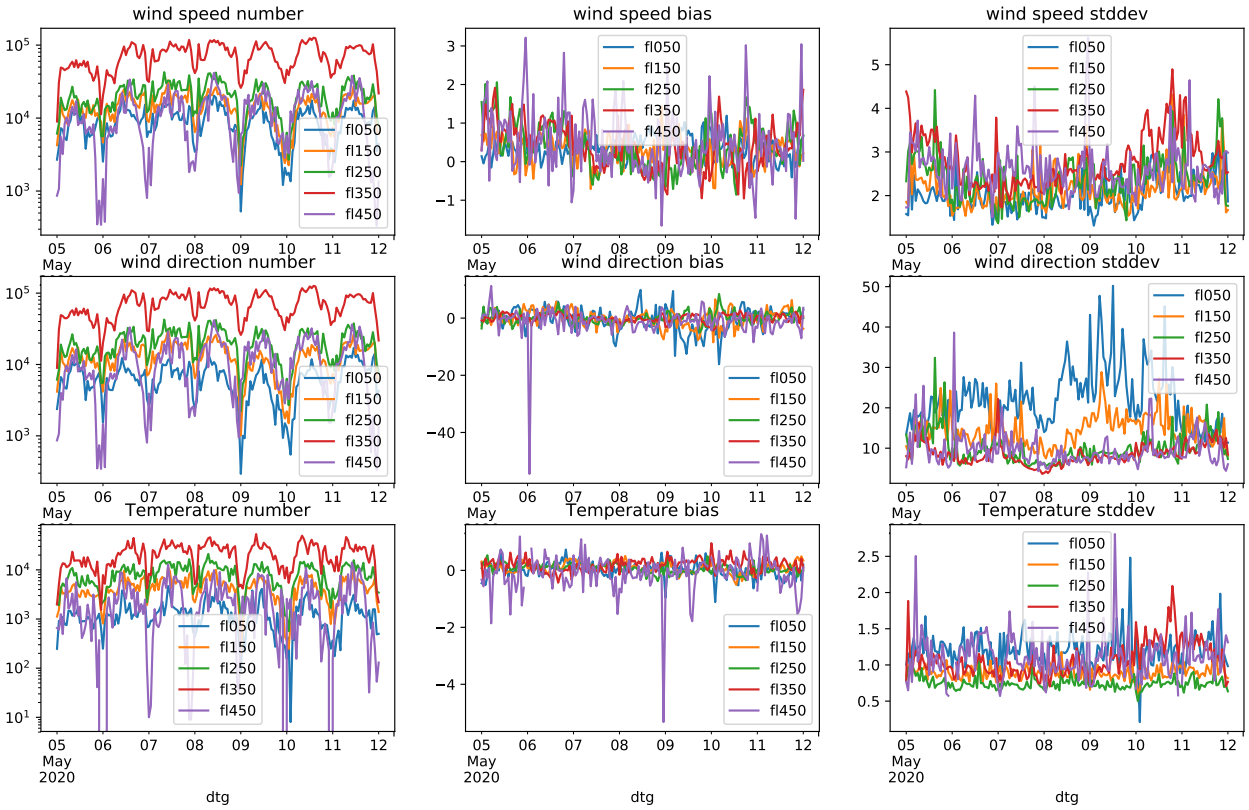
parameter	wind speed				wind dir			temperature				
level	obs in	obs out	bias	s.d.	obs(>4m/s)	bias	s.d.	obs in	obs out	bias	s.d.	Aircraft
all	28,003,743	21,869,496	0.34	2.67	21,051,726	0.10	11.18	25,908,885	6,595,720	0.12	1.06	4,489
fl-50	284	271	0.46	1.24	81	2.98	18.99	203	0	nan	nan	-
fl050	2,146,202	1,571,348	0.38	2.12	1,113,892	-0.30	22.87	1,927,422	229,539	0.04	1.25	-
fl150	3,174,130	2,479,851	0.32	2.22	2,269,825	0.27	14.86	2,990,204	760,995	0.09	0.92	-
fl250	4,529,302	3,555,883	0.34	2.48	3,519,107	0.22	10.50	4,256,606	1,410,423	0.06	0.77	-
fl350	15,333,815	12,167,745	0.33	2.87	12,075,844	0.22	8.76	14,172,033	3,714,130	0.18	1.13	-
fl450	2,820,010	2,094,398	0.38	2.68	2,072,977	-0.76	10.51	2,562,417	480,633	-0.02	1.27	-

Coverage plots of all streams for all flight levels, and 5 different flight levels; data from yesterday



B. Trend

Statistics of hourly data for different flight levels, wind speed, wind direction and temperature.



C. Profiles

Profiles of wind and temperature are created, when within a range 50km from an airport (or radiosonde site) in a 15 minute window at least 10 data points are found, with the lowest below FL100 and the highest above FL200. Table shows the number of profiles in a 3h. window for data from yesterday.

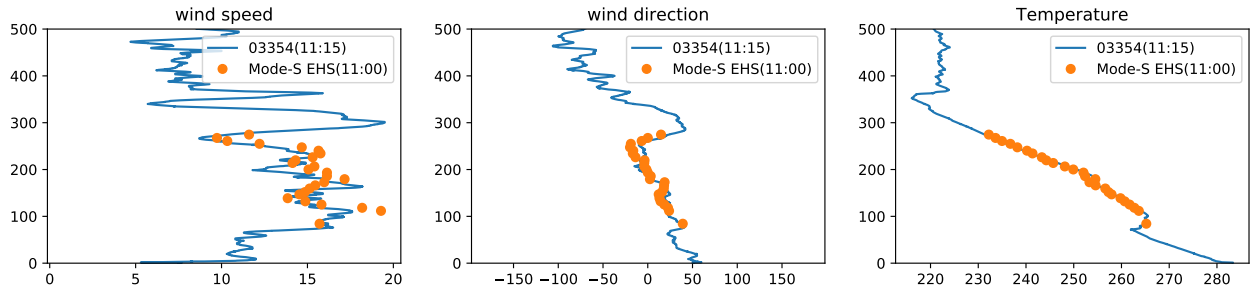
a. Near airports

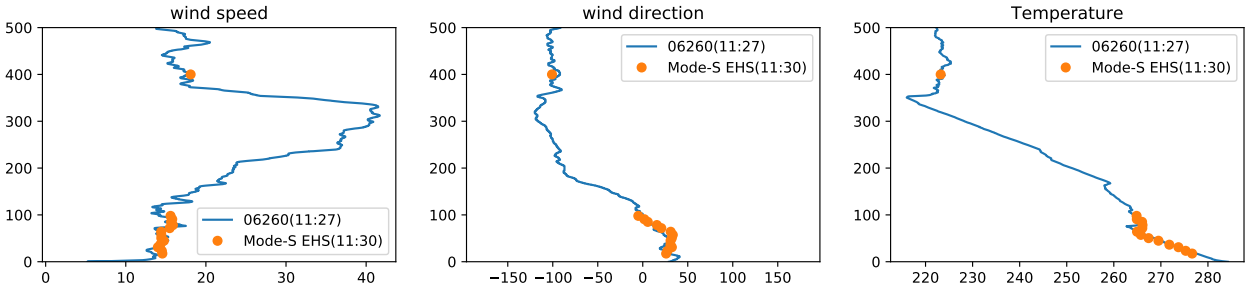
airport	00-03	03-06	06-09	09-12	12-15	15-18	18-21	21-24	11 May 2020
EBBR				3	2	2	5	2	Brussels Airport
EBCI			1	1	1		1	1	Brussels South Charleroi Airport
EBLG	1		1	1		2	1	7	Lige Airport
EDDB				1					Berlin-Schnefeld Airport
EDDF		2	2	3	2	4			Frankfurt am Main Airport
EDDH			1		2				Hamburg Airport
EDDK	1	2	3		5	1	1	1	Cologne Bonn Airport
EDDL		2	4	1	5	1			Dsseldorf Airport
EDDM				2					Munich Airport
EDDP								1	Leipzig/Halle Airport
EDDT				1					Berlin-Tegel Airport
EDDW				1					Bremen Airport
EDLW		1	1	2	2				Dortmund Airport
EGCC			1				3		Manchester Airport
EGGP			1						Liverpool John Lennon Airport
EGGW			1	3	1		2	1	London Luton Airport
EGKK				1	5	1			London Gatwick Airport
EGLL			1	1	3				London Heathrow Airport
EGNX				2			1		East Midlands Airport
EGSS			2	5	3	1	1		London Stansted Airport
EGUN								1	RAF Mildenhall
EHAM		1	4	5	3	2	1		Amsterdam Airport Schiphol
EHEH			1		1				Eindhoven Airport
EIDW					1				Dublin Airport
EKCH			1	1		1	1	1	Copenhagen Kastrup Airport
ELLX								1	Luxembourg-Findel International Airport
ESMS				1			2	1	Malm Sturup Airport

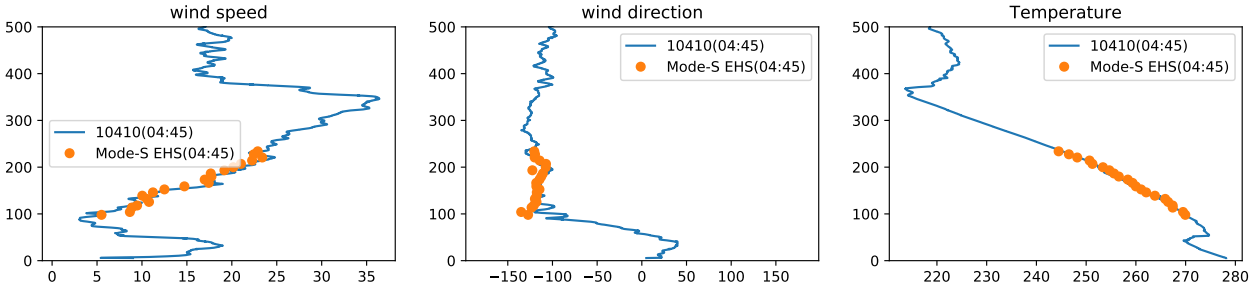
b. Near radiosonde launch sites

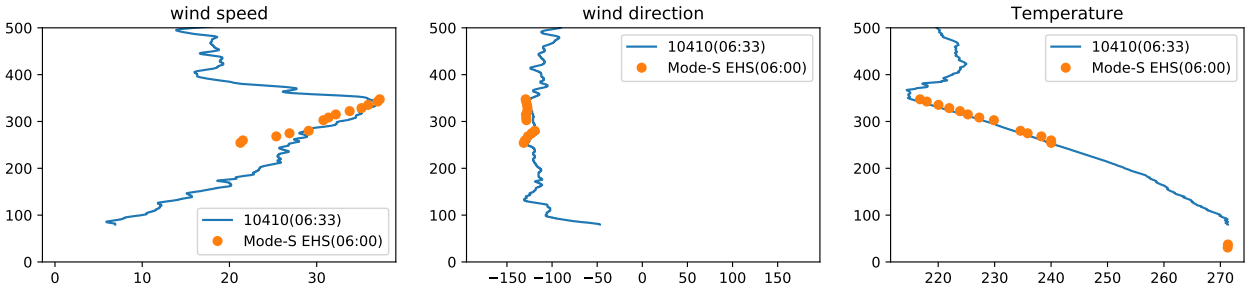
radiosonde	00-03	03-06	06-09	09-12	12-15	15-18	18-21	21-24
03354				2				
03743		1						
06260	1	1	8	3	2		2	
06458	1		1	2	3	1	4	3
10410		2	3	2	5	2		
10618				1				
10868				2				

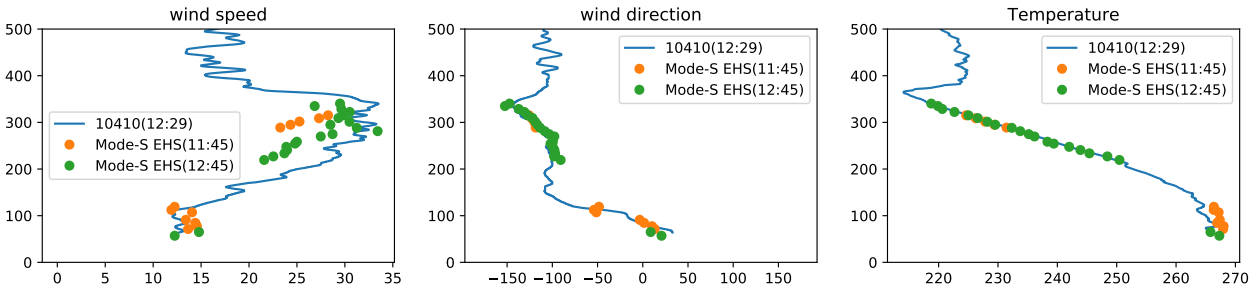
c. Collocation with radiosonde observations




wind speed
06260(11:27)
Mode-S EHS(11:30)
wind direction
06260(11:27)
Mode-S EHS(11:30)
Temperature
06260(11:27)
Mode-S EHS(11:30)


wind speed
10410(04:45)
Mode-S EHS(04:45)
wind direction
10410(04:45)
Mode-S EHS(04:45)
Temperature
10410(04:45)
Mode-S EHS(04:45)

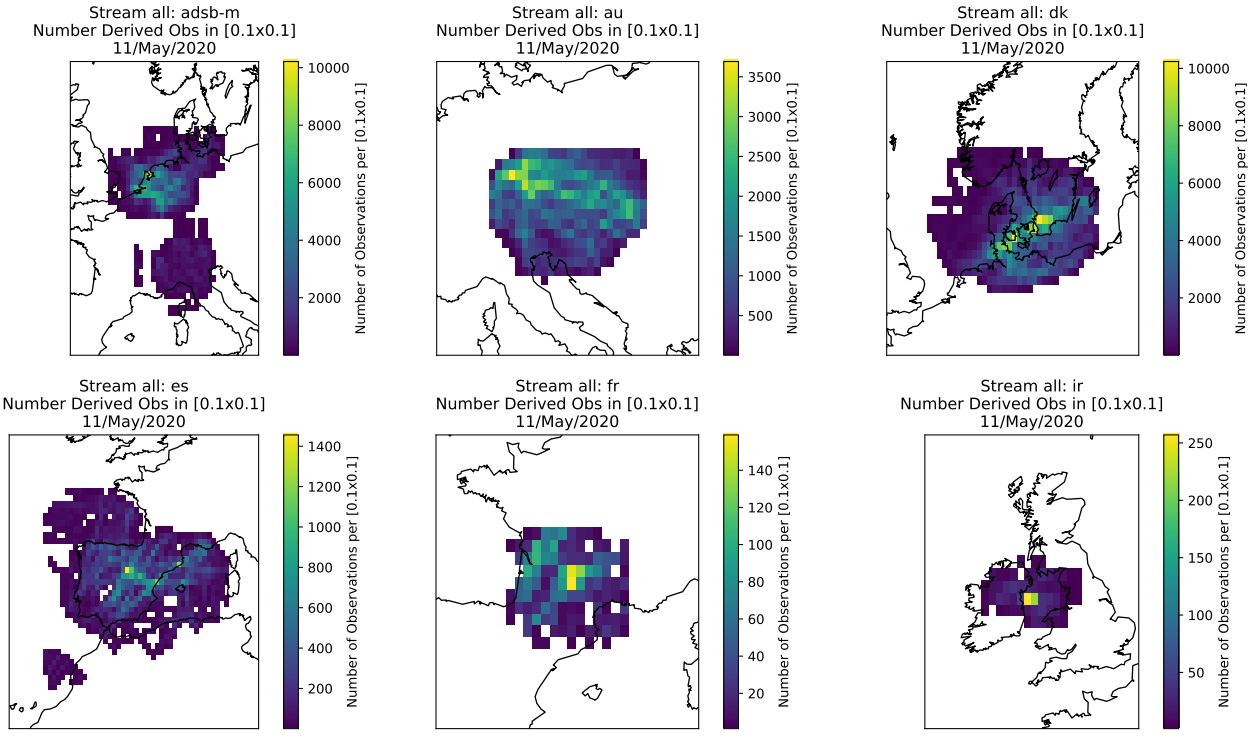

wind speed
10410(06:33)
Mode-S EHS(06:00)
wind direction
10410(06:33)
Mode-S EHS(06:00)
Temperature
10410(06:33)
Mode-S EHS(06:00)

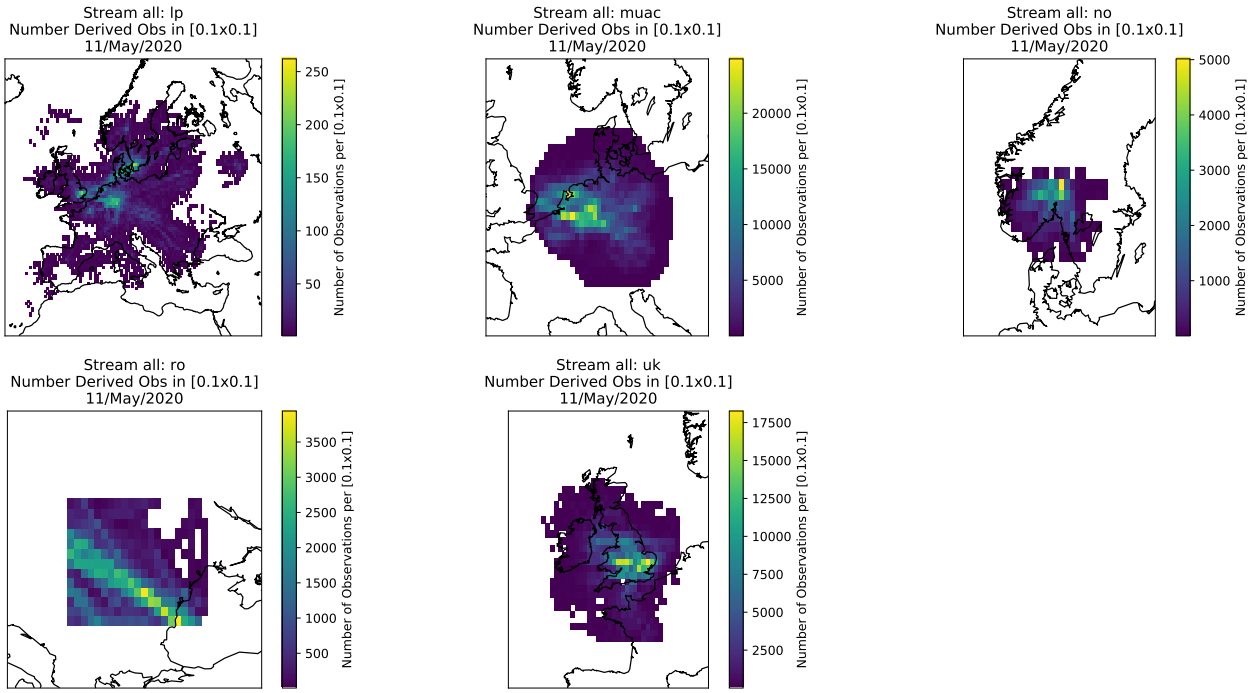

wind speed
10410(12:29)
Mode-S EHS(11:45)
Mode-S EHS(12:45)
wind direction
10410(12:29)
Mode-S EHS(11:45)
Mode-S EHS(12:45)
Temperature
10410(12:29)
Mode-S EHS(11:45)
Mode-S EHS(12:45)

a. Aircraft data stream providers

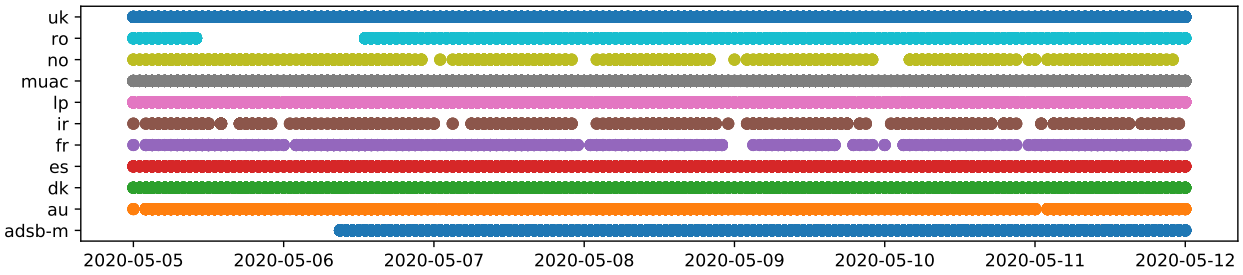
EMADDC code	Provider	Geographical area
muac	EUROCONTROL MUAC	Benelux/Germany
adsb-m	AIR SUPPORT A/S Denmark	Hamburg
au	Austro Control	Austria
dk	DMI	Denmark
es	ENAIRE / AEMET	Spain
fr	Meteo France	France
ir	Met Eireann	Ireland
lp	AIR SUPPORT A/S Denmark	Europe
no	METNO	Norway
ro	Romatsa	Romania
uk	Met Office	Great Britain

b. Coverage plots per data stream.





c. Data presence last 7 days

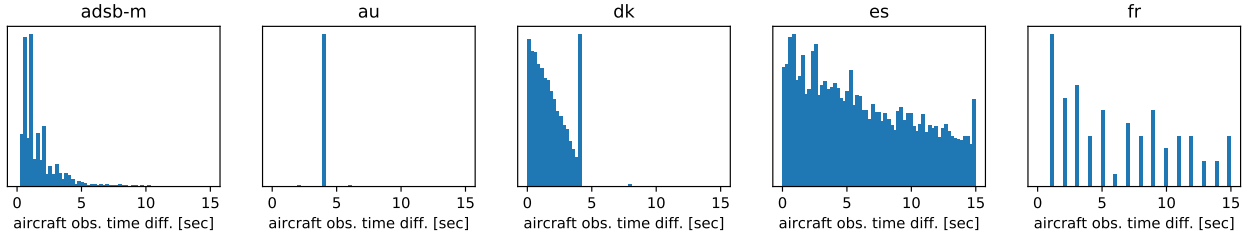


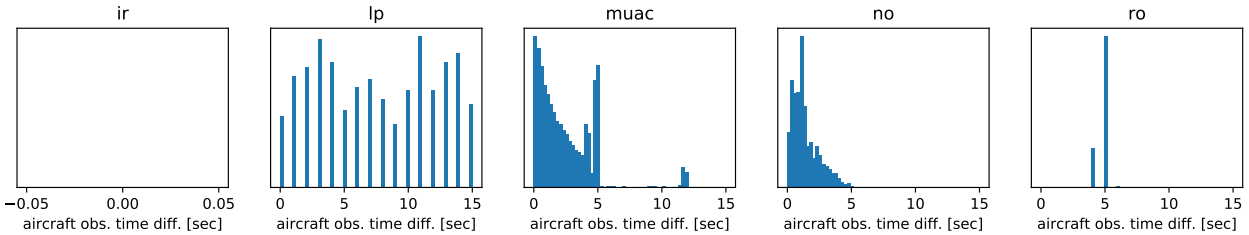
d. The OmF statistics for all streams

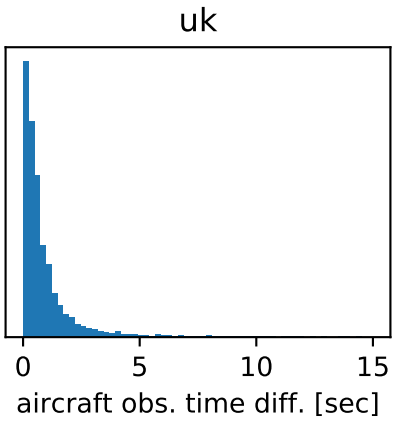
parameter	wind speed				wind dir			temperature				
level	obs in	obs out	bias	s.d.	obs(>4m/s)	bias	s.d.	obs in	obs out	bias	s.d.	Aircraft
adsb-m	3,959,834	3,124,558	0.25	2.70	3,008,230	-0.02	10.11	3,807,199	1,121,666	0.11	1.17	1,422
au	1,956,553	1,670,022	0.55	2.95	1,653,983	0.16	9.06	1,885,111	570,329	0.14	1.10	1,373
dk	3,617,160	2,650,580	0.25	2.45	2,640,617	-0.15	8.46	3,449,267	633,864	0.09	1.01	1,343
es	639,655	519,876	0.50	3.18	512,117	0.08	11.68	157,707	35,093	0.12	1.10	950
fr	22,394	15,554	0.39	3.22	15,223	0.29	11.59	1,620	207	0.01	1.19	387
ir	8,247	6,643	1.28	3.11	6,254	-0.03	18.18	1,413	331	0.22	1.18	363
lp	264,938	207,545	0.29	3.33	202,289	-1.89	13.92	15,293	3,961	0.03	1.07	2,908
muac	10,573,186	8,079,097	0.36	2.66	7,666,375	0.27	12.17	10,166,714	2,480,882	0.12	1.01	3,095
no	440,958	410,456	0.55	2.28	406,452	-0.46	8.36	418,202	127,559	-0.13	0.93	226
ro	1,282,363	1,044,142	0.44	2.72	1,034,426	-0.52	9.98	1,200,798	230,818	0.37	1.21	933
uk	5,238,455	4,141,023	0.27	2.60	3,905,760	0.34	12.55	4,805,561	1,391,010	0.13	1.03	1,323

e. Some detailed info per stream

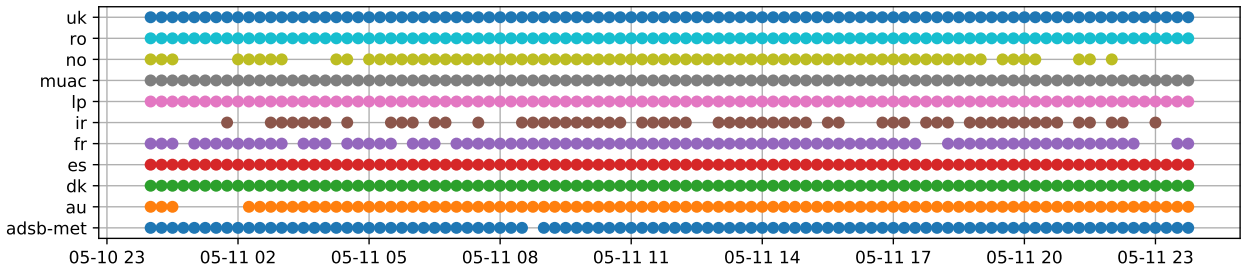
Distribution plots of time difference between consecutive observations per aircraft.







Yesterday's input data presence of streams in 15 minutes intervals



f. Input quality control

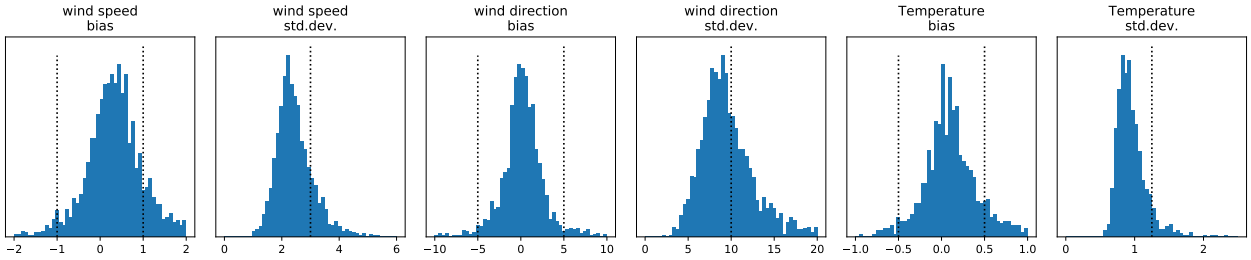
source	no-qc	ok	total	flag0	flag2	flag3	flag4	flag5	flag6	flag9	flag11	flag12	flag13
adsb-m	0	406142 (88%)	460745	4%	2%	-	0%	-	-	-	-	4%	4%
au	0	278393 (92%)	300676	4%	0%	-	0%	-	0%	0%	0%	2%	3%
dk	0	655329 (94%)	695614	4%	-	-	0%	-	0%	-	0%	1%	2%
es	0	125882 (92%)	135378	5%	-	0%	0%	-	0%	-	0%	0%	0%
fr	0	3676 (93%)	3915	5%	-	-	-	-	-	-	-	1%	1%
ir	1047	594 (30%)	1961	3%	-	-	0%	-	-	-	0%	14%	7%
lp	0	44246 (63%)	69718	5%	0%	-	0%	-	-	-	-	17%	30%
muac	0	1575600 (90%)	1738056	7%	-	0%	0%	0%	0%	-	0%	2%	2%
no	0	69152 (97%)	70749	1%	0%	-	-	-	-	-	-	0%	0%
ro	0	213591 (97%)	219520	-	0%	-	1%	-	0%	-	0%	0%	0%
uk	0	821056 (94%)	864486	3%	0%	-	-	-	-	-	0%	1%	0%

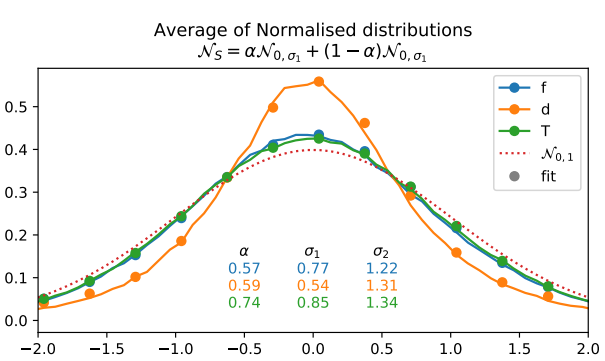
	description
0	abs(ran) > 2.5
1	t_44 > 373.15
2	abs(tta - mhdg) > 45
3	tas > 570
4	tas < 100,
5	gspd > 850,
6	gspd < 50,
7	mach < 0.001,
8	fl==0,
9	gspd == 0,
10	mhdg == -1
11	(gspd < 100) & (abs(tas - ias) > 20)
12	heading consistency
13	track angle consistency

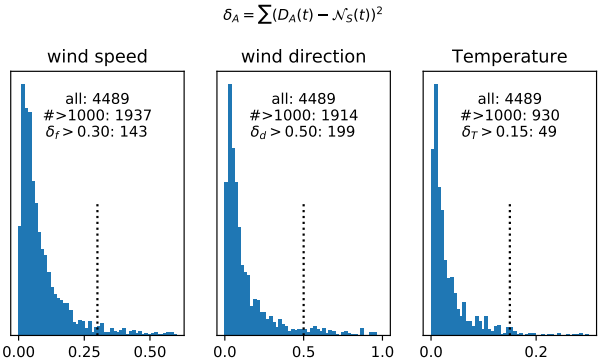
III. Appendix

A. OmF distributions of wind and temperature

The distributions of each aircraft and each of three parameters is normalized using the corresponding standard deviation and mean. Subsequently these distributions are scaled by the standard deviation.

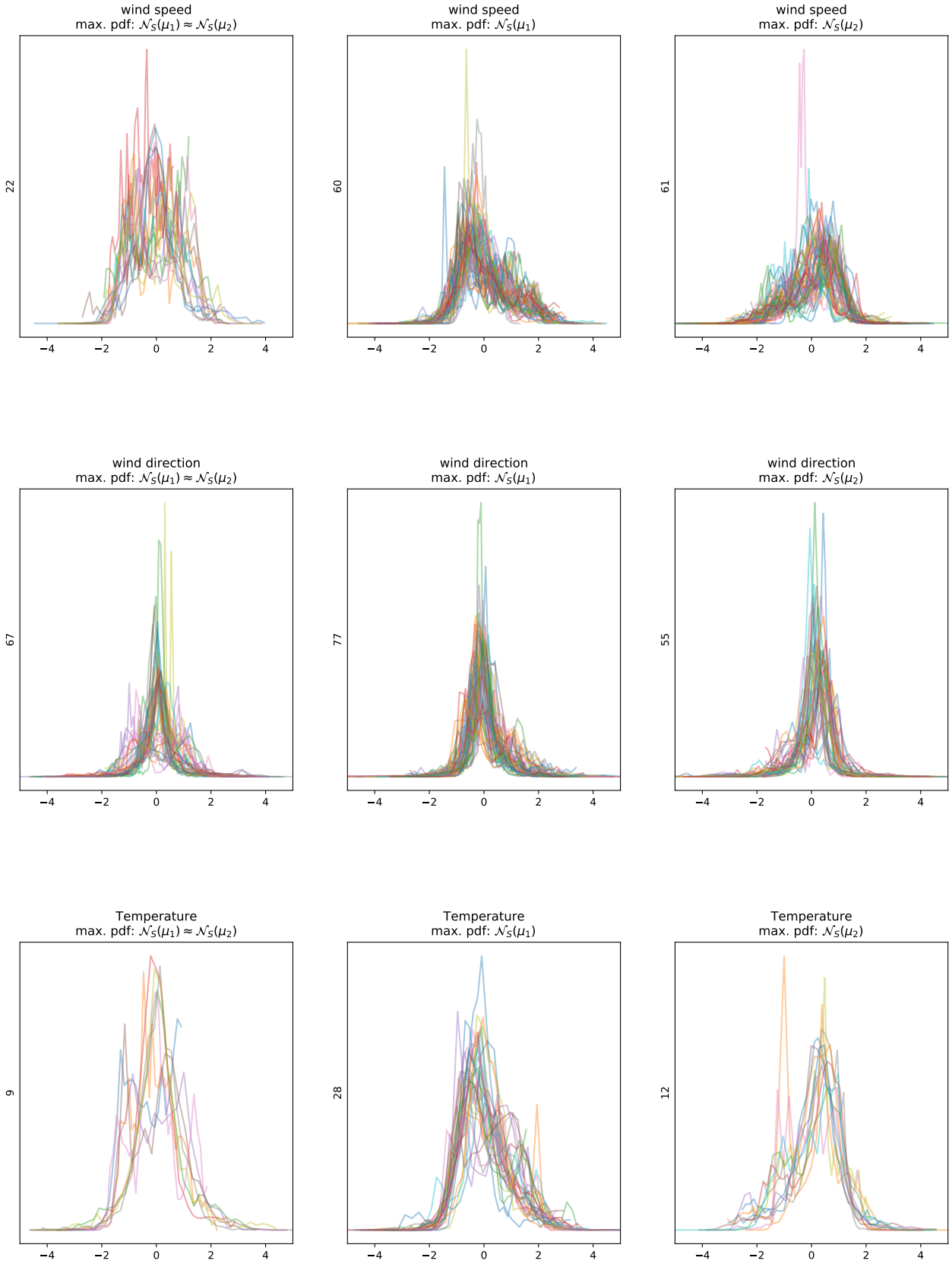






B. Outliers

Three types of Obs-NWP distributions are distinguished: 1. $D_T \approx \mathcal{N}_{\mu,\sigma}$ 1. $D_T \approx \alpha\mathcal{N}_{\mu_1,\sigma_1} + (1-\alpha)\mathcal{N}_{\mu_2,\sigma_2}$, with $0 < \alpha \leq \frac{1}{2}$ 1. $\sigma_1 < \sigma_2$ 1. $\sigma_1 > \sigma_2$



C. Releases

version	date	comment
2.0beta0	2020/04/08 00:00	first version
2.0beta1	2020/04/18 18:30	correct mhdg for fr-stream