



Emergency Management

July 2021 floods: EFAS performance

Dr Jan Verkade (DISS)

Also based on METEO, HYDRO, COMP contributions

Thursday, October 28, 2021





This presentation: report of on-going effort

- Some meteorological and hydrological characteristics
- What was the EFAS performance during the July floods?
 - quality of model simulations and forecasts
 - quality of the service

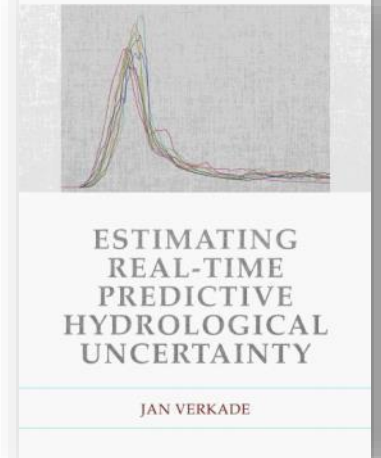
Please note:

this assessment is a work in progress. Analysis materials will be fine-tuned. Findings may change. Conclusions need to be drawn.



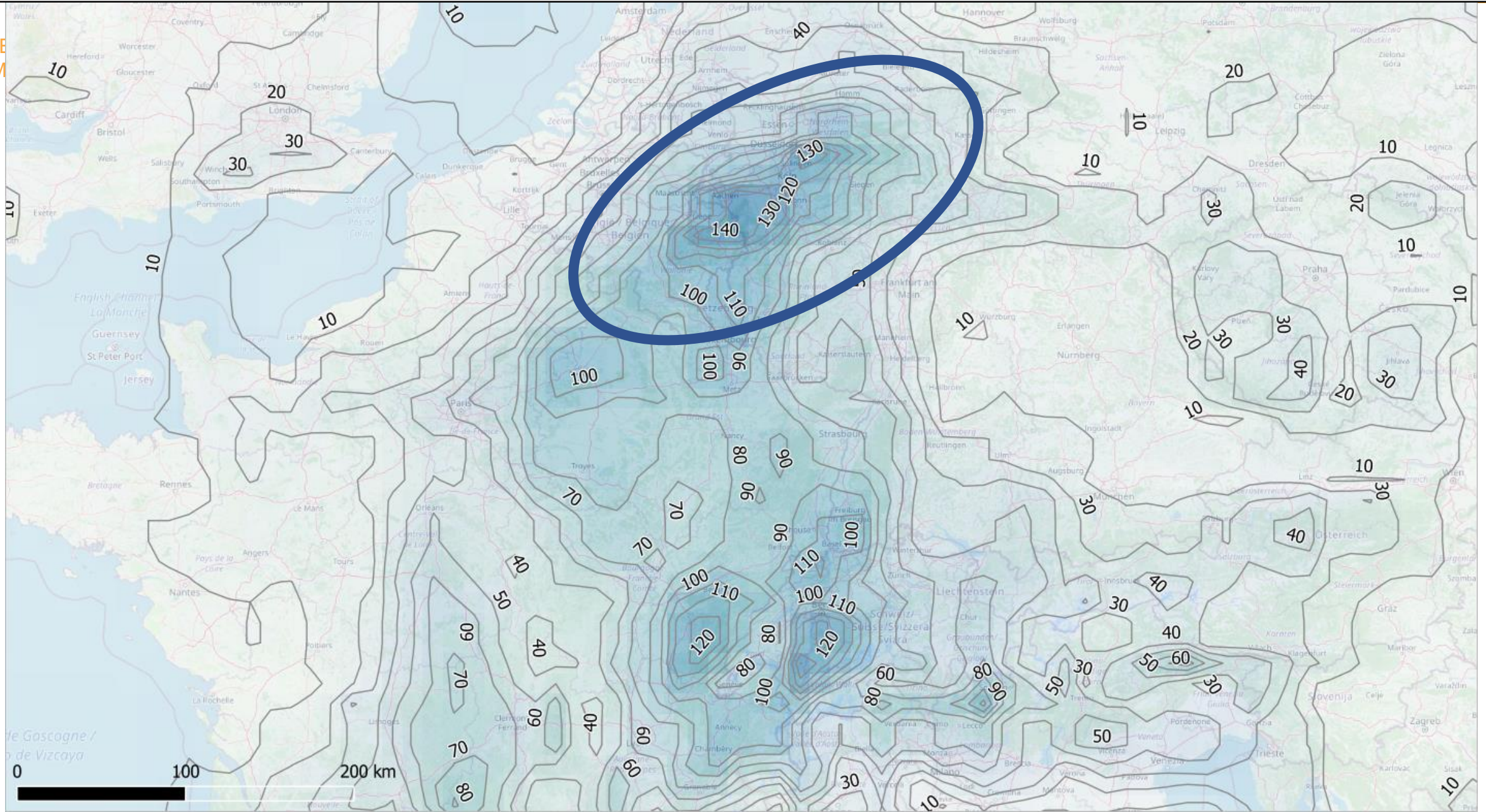
Brief introduction: Dr Jan Verkade

- Hydrometeorologist @ Deltares
- Member of the Rijkswaterstaat River Forecasting Service
 - During July floods, Rijkswaterstaat flood duty officer for Meuse
 - “EFAS forecaster” at DISS, currently tasked with leading the EFAS Detailed Assessment Report



Storm Bernd

ERA5 estimated, 96h accumulated precip until Friday, July 16, 00Z



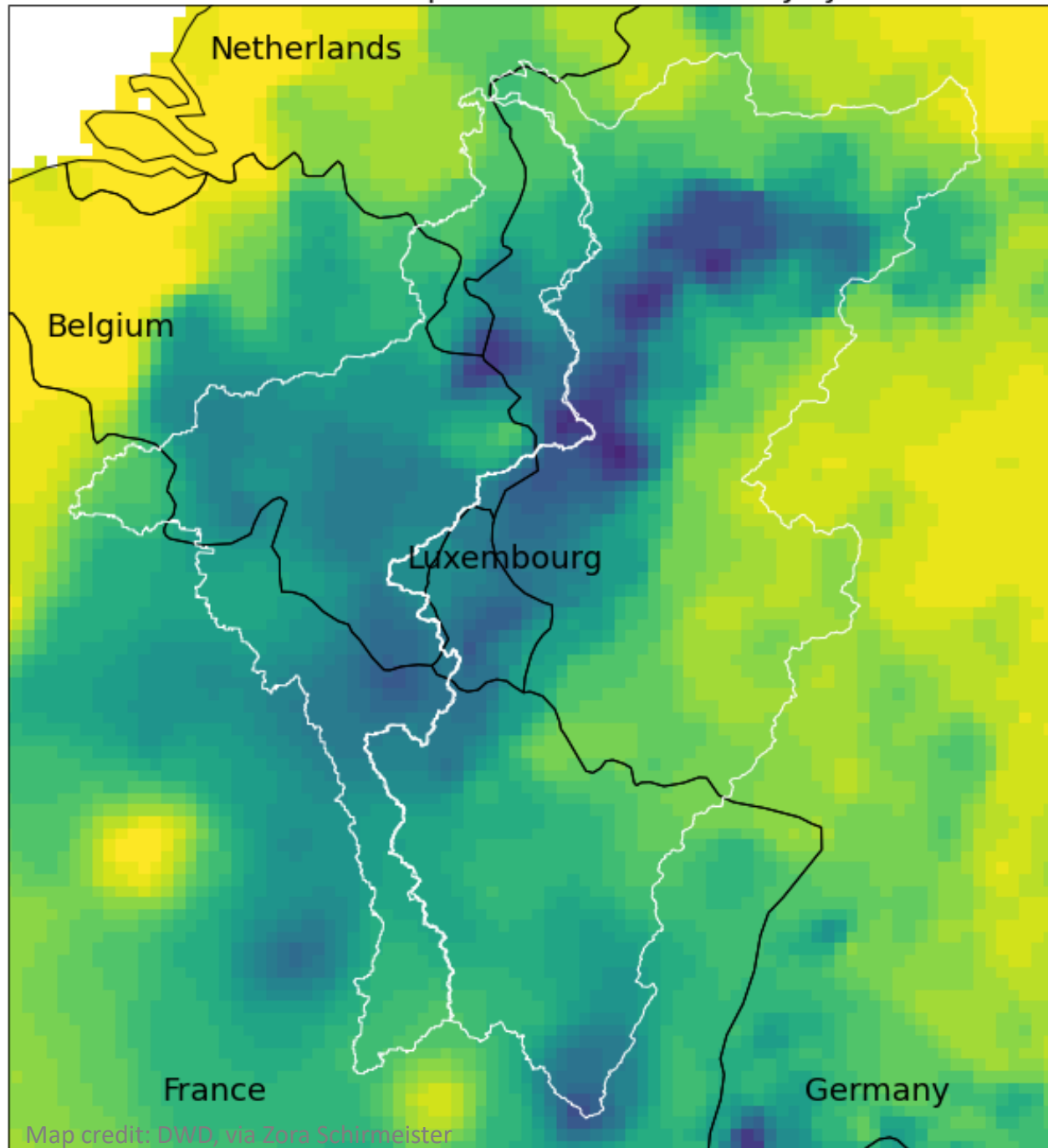
Study area

- Meuse basin until ~Nijmegen
- Various Rhine tributary basins including Moselle, Erft, Ruhr, Wupper, Sieg, Ahr, Lippe

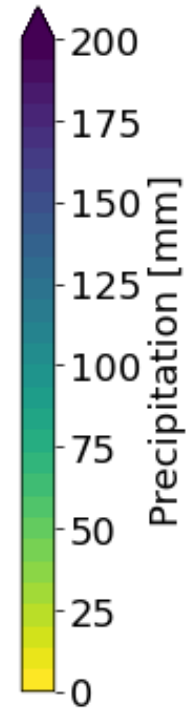
Accumulated Precipitation from 12 to 15 July 2021



Emergency
Management



Map credit: DWD, via Zora Schirmeister





Hydrology: records broken

Basin	River	EFASID	Station Name	Catchment area (km ²)	Hist. Max. D (m ³ /s)	July 12	July 13	July 14	July 15	July 16	July 17	Days>Hist. Max. D	
Rhine	Rhine	153	Lobith	160,800	12,280	Not provided	3,319	3,565	3,951	5,080	6,319	6,680	0
Rhine	Rhine	48	Rees	159,683	12,200	Not provided	3,530	3,780	4,210	5,480	6,680	6,960	0
Rhine	Rhine	58	Düsseldorf	147,680	10,900	Not provided	3,800	3,880	4,700	6,030	6,580	6,710	0
Rhine	Rhine	57	Andernach	139,549	11,100	Not provided	3,780	3,840	4,170	5,850	6,520	6,440	0
Rhine	Rhine	36	Kaub	103,488	7,200	Not provided	3,580	3,580	3,560	3,700	3,970	4,090	0
Rhine	Rhine	49	Mainz	98,206	7,000	Not provided	3,570	3,570	3,520	3,700	3,930	4,040	0
Rhine	Moselle	32	Perl	11,522	2,290	Not provided	164	158	477	663	862	894	0
Rhine	Moselle	3107	La Moselle à Uckange	10,770	2,360	Not provided	99	124	412	648	859	875	0
Rhine	Moselle	3105	La Moselle à Hagondange et à Hau	9,387	2,080	Not provided	101	135	346	547	697	741	0
Rhine	Saar	60	Fremersdorf	6,983	1,420	Not provided	63	166	333	358	251	184	0
Rhine	Moselle	3102	La Moselle à Custines	6,830	2,000	Not provided	77	130	312	612	769	720	0
Rhine	Ruhr	934	Hattingen	4,118	907	Not provided	53	75	970	1,450	819		2
Rhine	Saar	51	St.Arnual	3,945	964	Not provided	44	125	197	199	159	132	0
Rhine	Moselle	3100	La Moselle à Toul	3,338	1,190	Not provided	44	133	175	456	529	409	0
Rhine	Saar	109	Bollendorf	3,222	895	Not provided	20	46	517	913	801	385	1
Rhine	Nahe	110	Boos	2,832	835	Not provided	23	51	79	83	65	65	0
Rhine	Meurthe	3101	La Meurthe à Laneuveville	2,780	779	Not provided	30	85	161	307	390	323	0
Rhine	Moselle	3099	La Moselle à Saint-Mard	1,976	827	Not provided	43	150	156	344	350	280	0
Rhine	Nahe	113	Martinstein	1,468	582	Not provided	15	38	50	63	37	26	0
Rhine	Seille	3104	La Seille à Metz	1,280	174	Not provided	4	4	15	30	30	27	0
Rhine	Orne	3106	L'Orne à Rosselange	1,226	318	Not provided	2	5	35	92	131	113	0
Rhine	Glan	114	Odenbach	1,086	332	Not provided	8	29	30	22	38	36	0
Rhine	Seille	3103	La Seille à Nomeny	925	125	Not provided	5	4	9	28	28	27	0
Meuse	Meuse	953	St. Pieter Noord	21,100	3,062	1993-12-22	299	283	1,767	3,263	3,254	2,155	2
Meuse	Meuse	1357	Amay	16,416	1,867	2003-01-04	114	137	684	1,639	1,933	1,128	1
Meuse	Meuse	1356	Chooz	10,120	1,560	1995-01-30	82	86	365	656	732	579	0
Meuse	Meuse	3112	La Meuse à Stenay	3,904	533	Not provided	29	56	75	143	143	110	0
Meuse	Ourthe	1359	Angleur	3,607	829	1993-12-02	33	35	505	1,396	739	429	1
Meuse	Sambre	1360	Salzannes-Ronet	2,841	314	2011-01-07	21	33	123	220	313	177	0
Meuse	Meuse	3111	La Meuse à Saint-Mihiel	2,540	658	Not provided	13	12	15	43	66	73	0
Meuse	Meuse	3110	La Meuse à Commercy	2,290	598	Not provided	18	72	91	97	89	83	0
Meuse	Meuse	3109	La Meuse à Domrémy-la-Pucelle	1,031	562	Not provided	5	5	17	72	178	167	0

Table credit: Junta de Analucia, via Maria Márquez Arroyo and Irene Carpintero



Emergency
Management

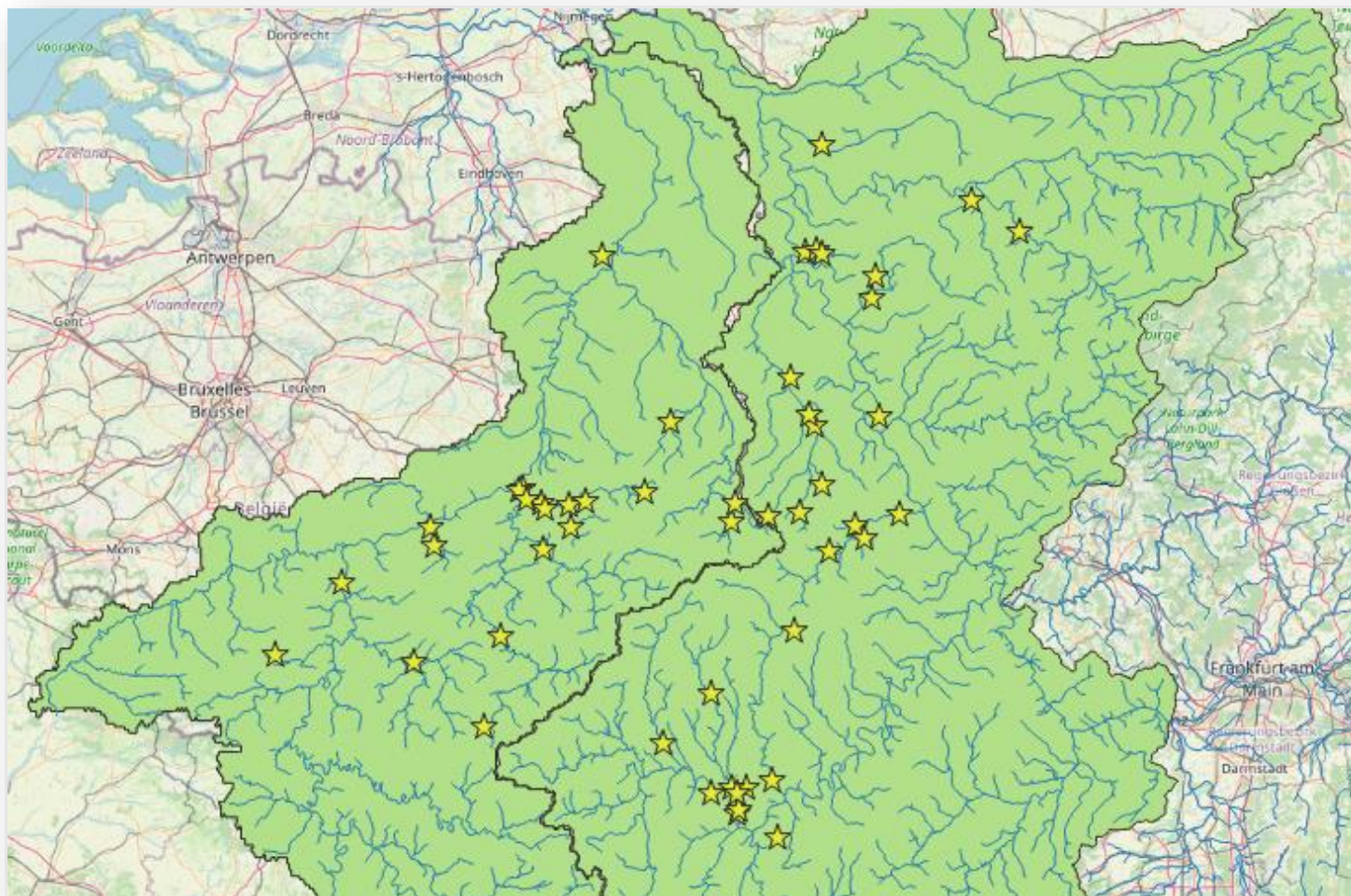
Hydrology: threshold exceedences

Station Name	River	Basin	Catchment area (km ²)	TL1(D)	TL2(D)	TL3(D)	TL4(D)	12J	13J	14J	15J	16J	17J	18J	19J	20J	21J	22J	Days>TL1	Days>TL2	Days>TL3	Days>TL4
Lobith	Rhine	Rhine	160800	7960	10464	12676	15000	3319	3565	3951	5080	6319	6680	6697	6458	5952	5469	5012	0	0	0	0
Ruhrort	Rhine	Rhine	153176	5580				3810	3970	4940	6850	7100	7130	6980	6320	5800	5150	4880	5	0	0	0
Mainz	Rhine	Rhine	98206	4110				3570	3570	3520	3700	3930	4040	4140	4140	3970	3800	3670	2	0	0	0
Bollendorf	Sauer	Rhine	3222	437	569	750	869	20	46	517	913	801	385	187	112	79	55	51	1	0	1	1
Boos	Nahe	Rhine	2832	392	522	697	804	23	51	79	83	65	65	37	28	21	18	15	0	0	0	0
Martinstein	Nahe	Rhine	1468	267	360	497	589	15	38	50	63	37	26	21	16	13	11	9	0	0	0	0
Odenbach	Glan	Rhine	1086	134	182	249	292	8	29	30	22	38	36	16	10	7	6	5	0	0	0	0
St. Pieter Noord	Meuse	Meuse	21100	1500	1750	2000	2850	299	283	1767	3263	3254	2155	1372	980	795	661	578	0	1	1	2

Table credit: Junta de Analucia, via Maria Márquez Arroyo and Irene Carpintero



Reported floods



- Source: various floodlist.com articles including [this one](#) and [this one](#)
- Manual data extraction, assumptions had to be made (notably with respect to timing – not shown)



July 2021 floods are SUMMER floods

- In this area, *previous* records were set during winter floods
- July floods took many by surprise (me included!)
- Then again...
 - 2002 Elbe/Danube floods were summer floods
 - So where the 2007 England floods
 - And the 2013 Elbe floods
 - (and quite a few more)
- Raises some questions about our (my) understanding of when floods occur
- (Questions that this Assessment will not explore, btw)



EFAS performance

Main question, present Assessment study: how did EFAS perform?

- Quality of the model simulations and forecasts
- Quality of the EFAS service

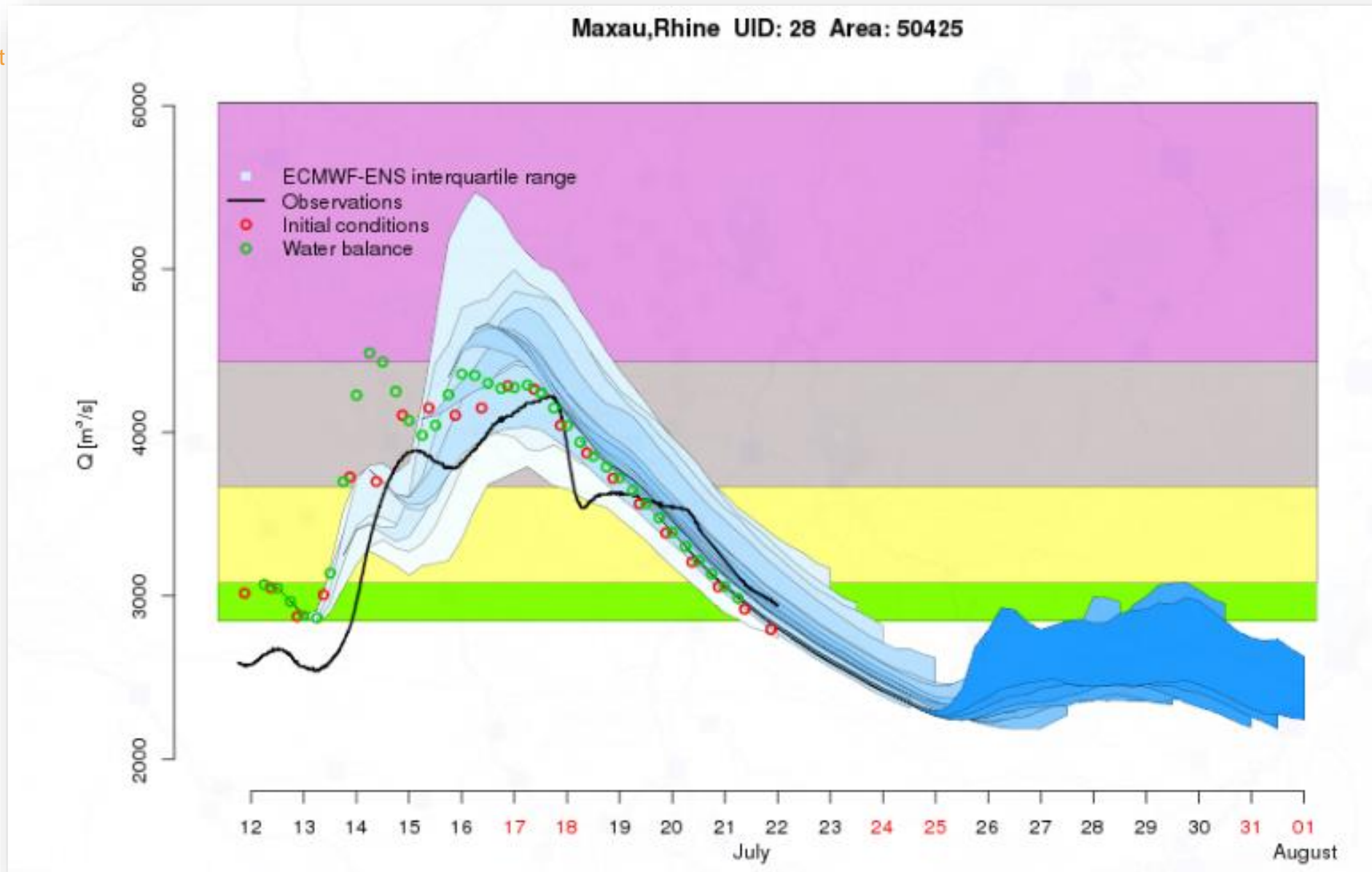


Quality of model simulations and forecasts

- Event evaluation rather than a full-blown verification study
 - anecdotal rather than statistical
 - puts limits to general applicability of findings
(for example, think of balance between false alarms and misses)
- Verification to be done
 - Streamflow forecasts v streamflow simulations (“EFAS truth”)
 - Streamflow simulations v real world observations
 - (Precipitation forecasts v gauge-based precipitation fields)

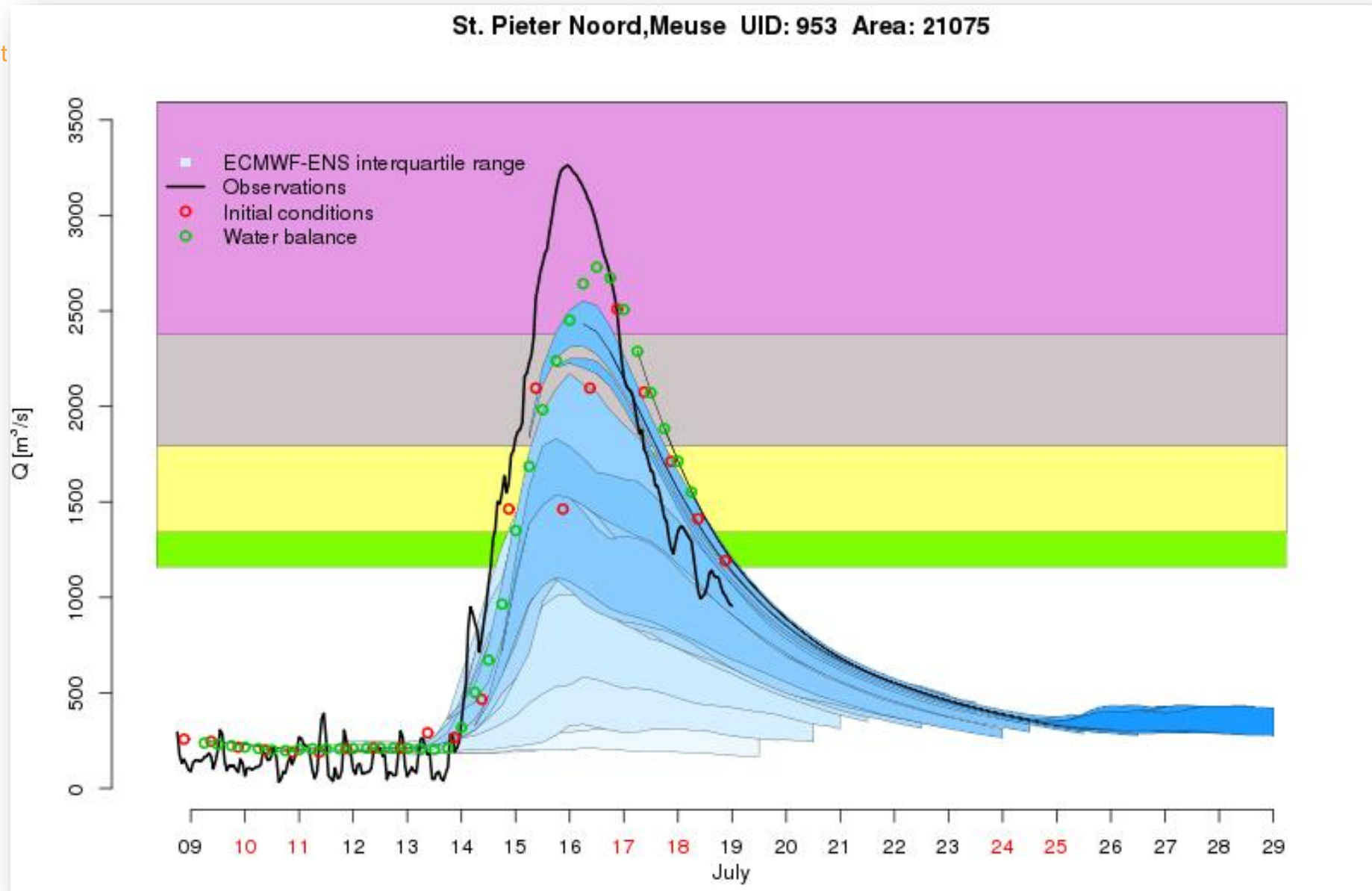


First indications: 'water balance plots'





First indications: 'water balance plots'





Emergency
Management

EFAS performance

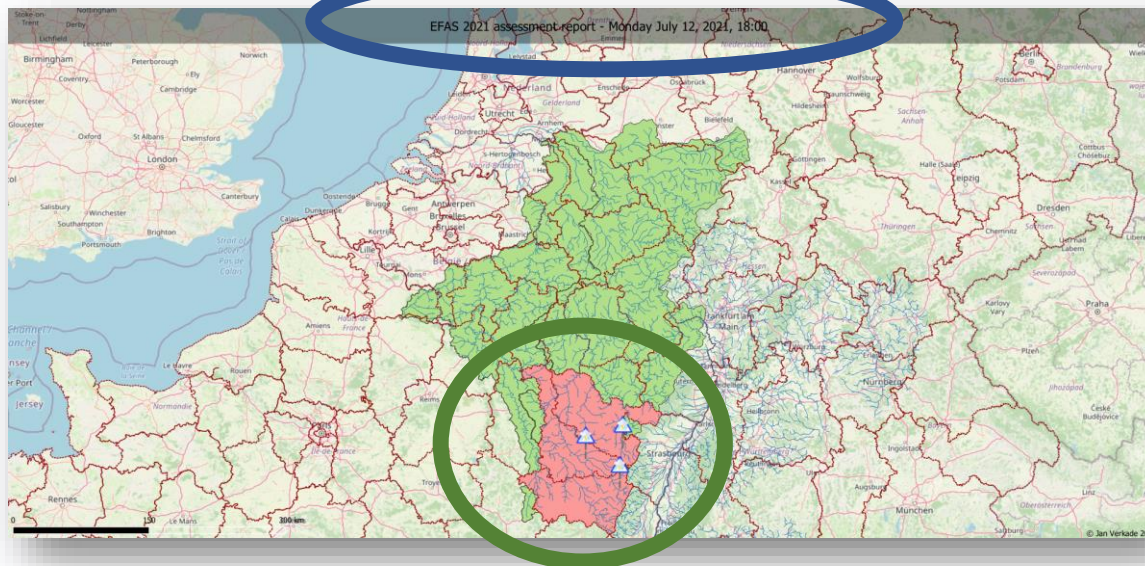
Main question, present Assessment study: how did EFAS perform?

- Quality of the model simulations and forecasts
- Quality of the EFAS service



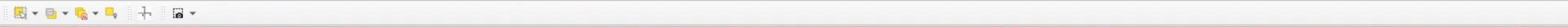
EFAS Flash Flood notifications – animated map

- Green: study area
- Time progresses with 3-hour increments
- Pink: 'Regions' for which a notification was in force at that time
 - Notification issue times are based on time of receipt of notification email
 - Deactivation times are taken from the EFAS portal (Cart/Deactivated notifications)

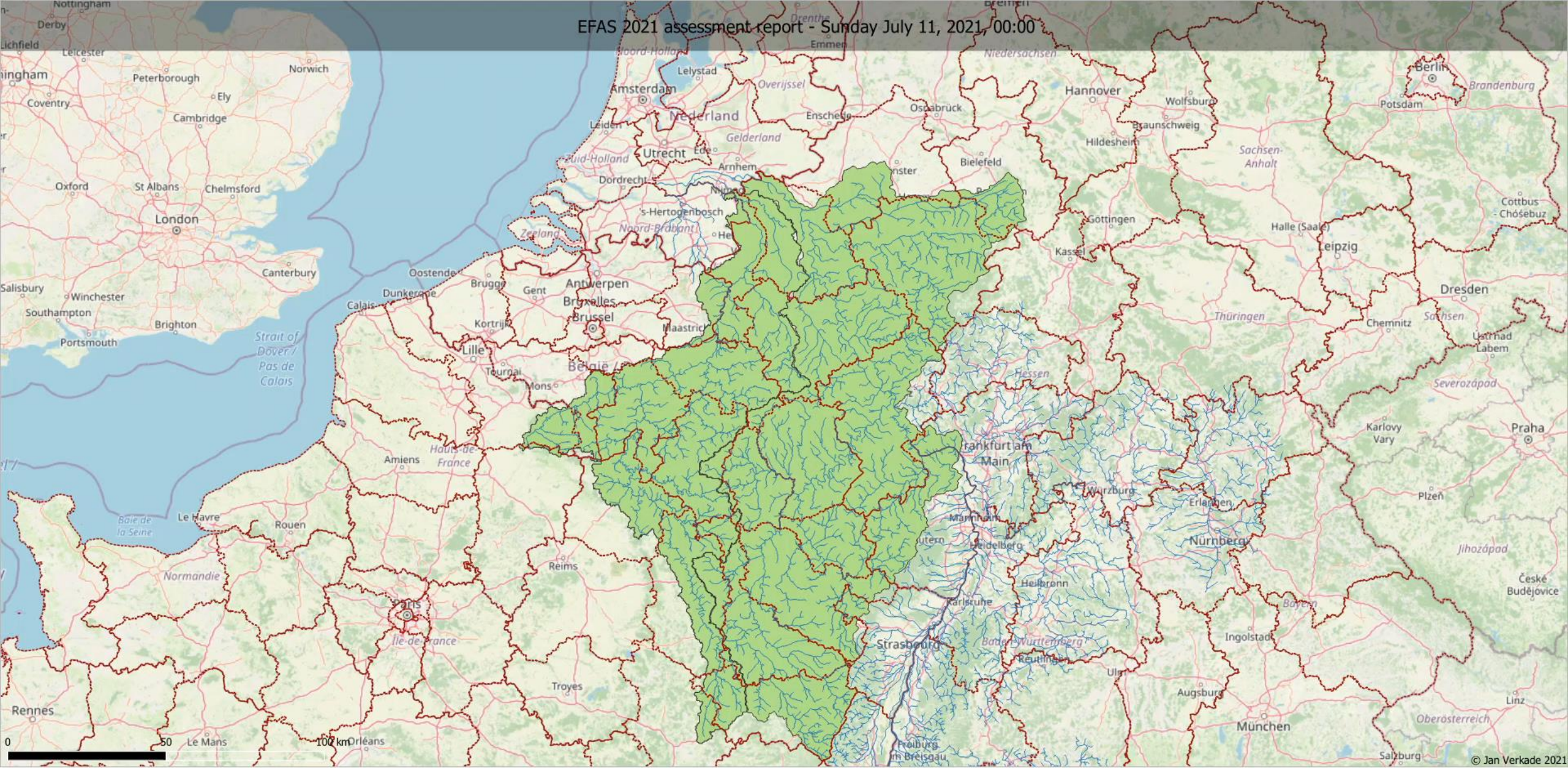


Time

Location of original ERIC reporting point and region it pertains to



EFAS 2021 assessment report - Sunday July 11, 2021, 00:00





Questions to be explored include

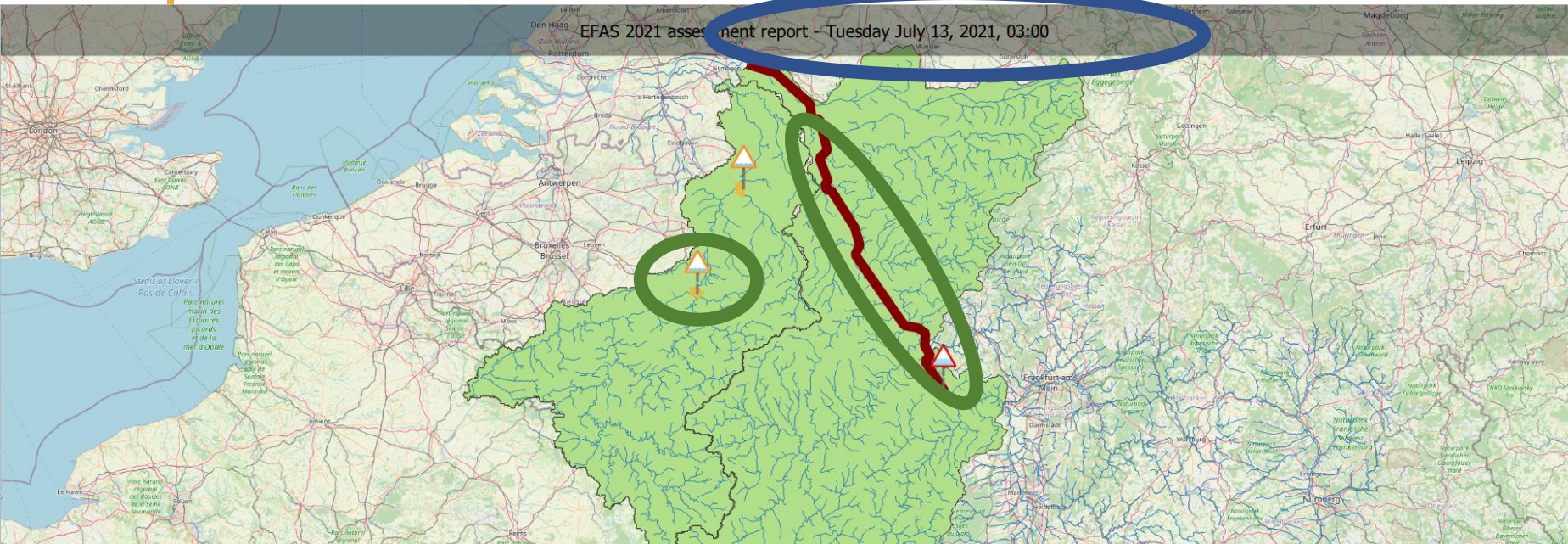
- Were notifications issued in time and as per EFAS/DISS procedures?
- Did flash floods indeed occur?
(Tricky to assess, as these may well occur elsewhere in the 'Region')



Emergency
Management

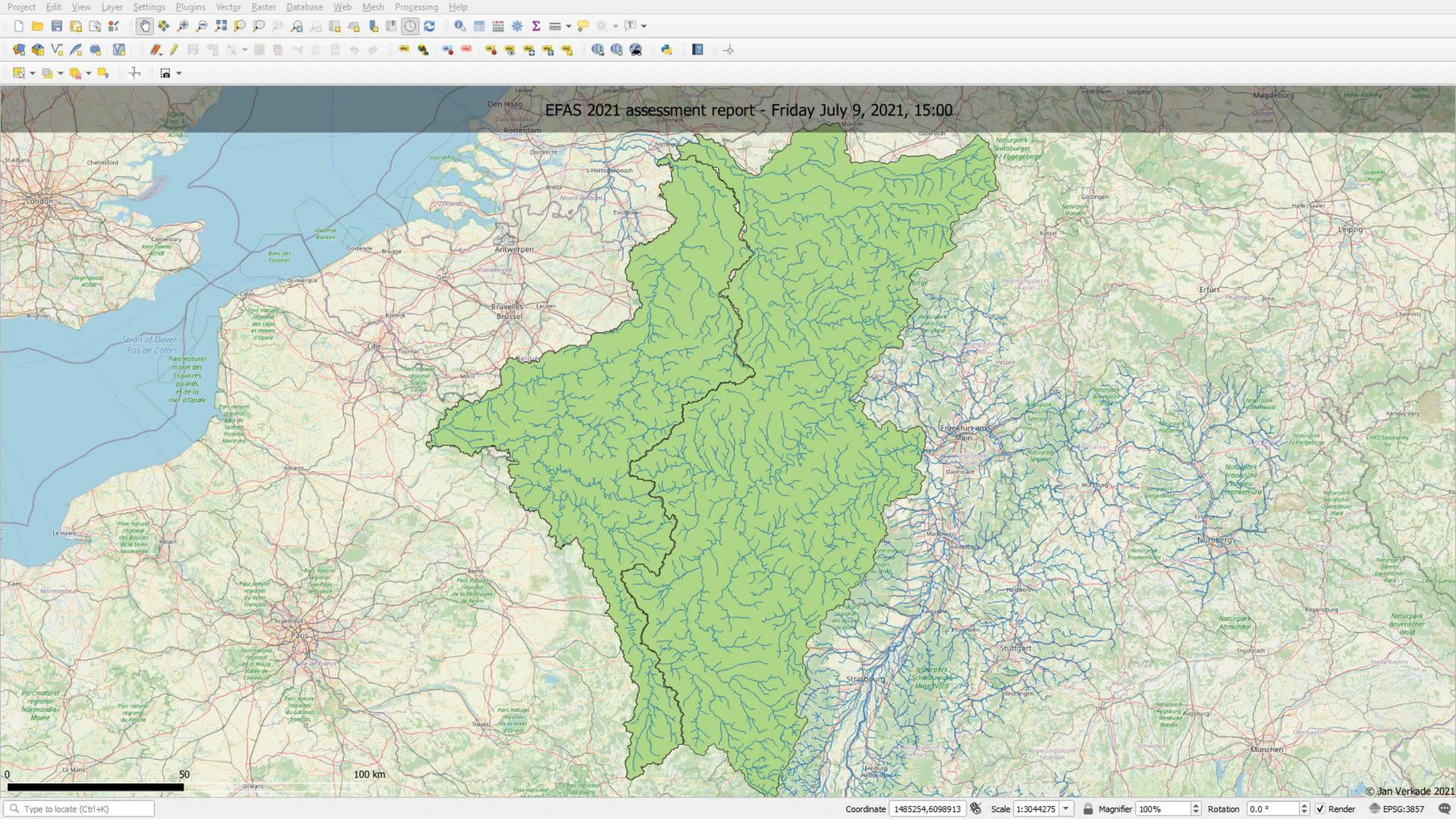
EFAS Formal Flood notifications – animated map

- Green: study area
- Time progresses with 3-hour increments
- Yellow/red: river stretches to which informal/formal notific's apply
 - Taking into account “instructions”
 - Activation times taken from email arrival date/time. Deactivation times are taken from the EFAS portal (Cart/Deactivated notifications)

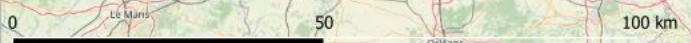


Time

“Reporting points”
(i.e. location of the
notification) and the
river stretches they
are valid for.

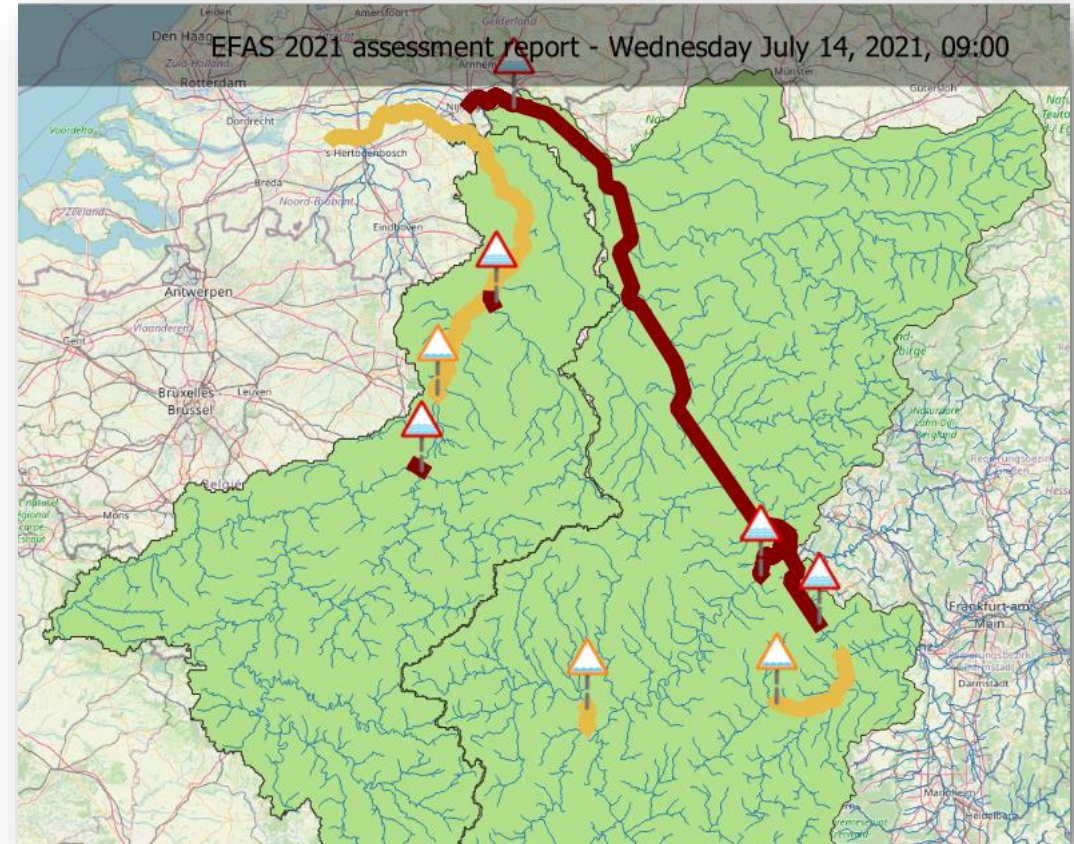


EFAS 2021 assessment report - Friday July 9, 2021, 15:00



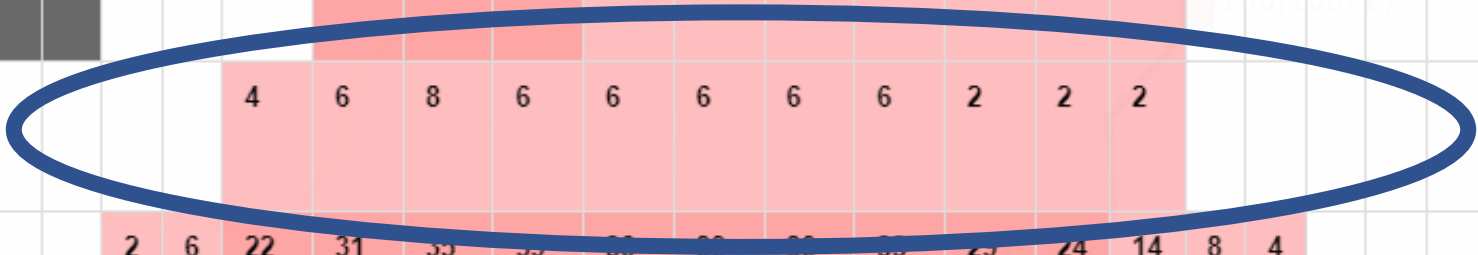


- At height of event, 5 formal notifications and 3 informal notifications in place
- Need to examine whether this was 'sufficient' w.r.t. DISS procedures
- NB: fluvial notifications are only issued for locations which have an upstream area $\geq 2,000$ km². → map can never be fully covered



ECMWF-ENS > 5 yr RP ^

Forecast Day	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20			
2021-07-15 12:00													100	100	100	100	100	100	100	12																	
2021-07-15 00:00											100	100	100	100	100	100	100	100	98	76	27	2															
2021-07-14 12:00												25	31	25	16	12	14	12	10	4	2																
2021-07-14 00:00											4	6	8	6	6	6	6	6	2	2	2																
2021-07-13 12:00									2	6	22	31	33	33	33	33	33	33	23	24	14	8	4														
2021-07-13 00:00										8	16	24	29	27	27	27	25	25	24	20	12	8	2	2													
2021-07-12 12:00										4	6	16	18	24	20	16	16	16	16	16	16	8	4														



Breaks the “chain of consistent forecasts”



What was the added value of EFAS?

- Were notifications sent to the appropriate recipients?
 - Were they used in forecast informed decision-making? If so, how?
 - Did the EFAS forecasts provide additional information over 'home produced' forecasts?
 - ...
- we are looking for EFAS recipients/users to help us answer these questions
(contact details on last slide)



Emergency
Management

Dr Jan Verkade, jan.verkade@rws.nl, +31 6 5161 6107

