Royal Netherlands
Meteorological Institute
Ministry of Infrastructure
and Water Management

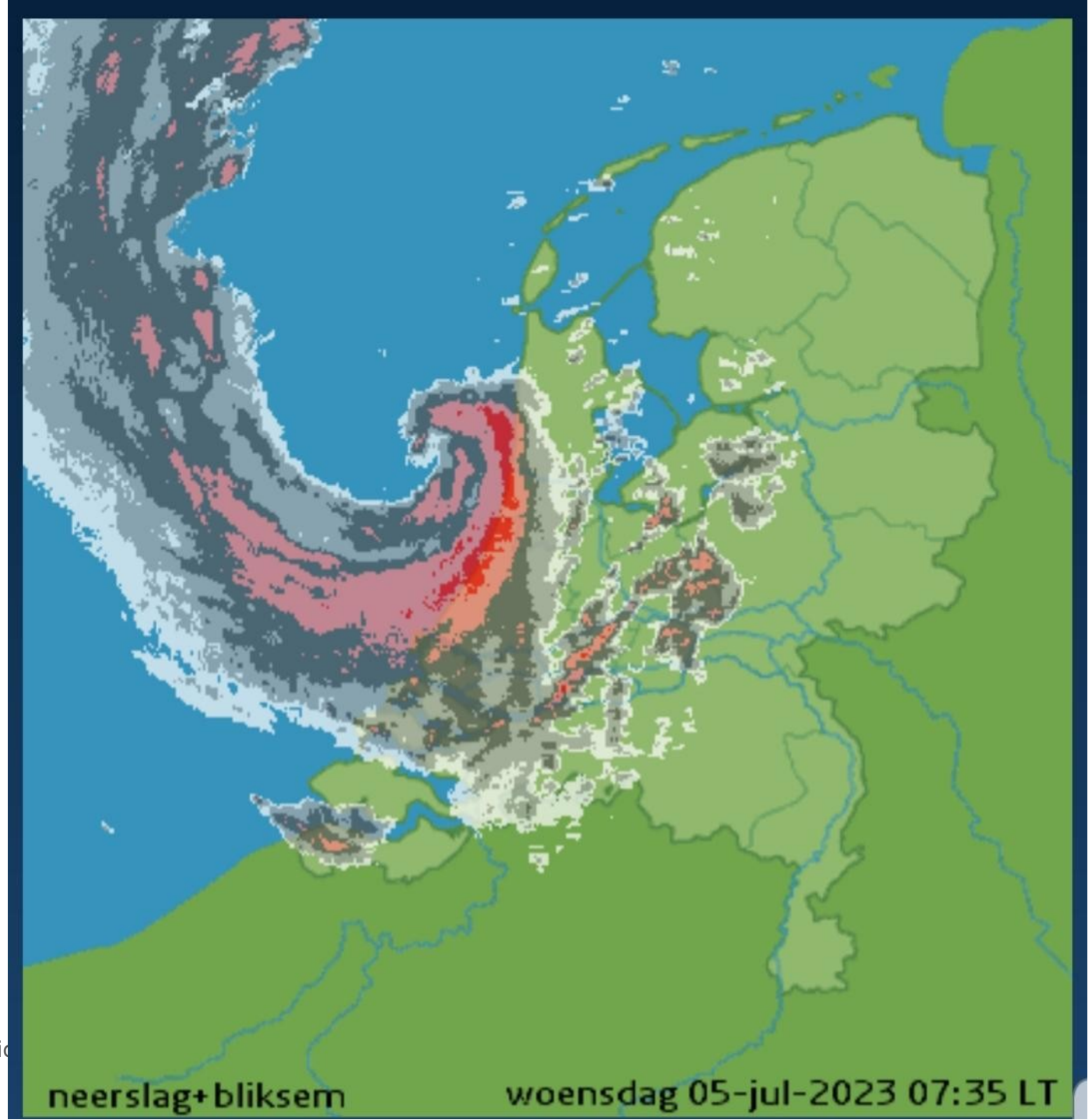
De ouwetjes doen het nog best: Poly vs. HIRLAM

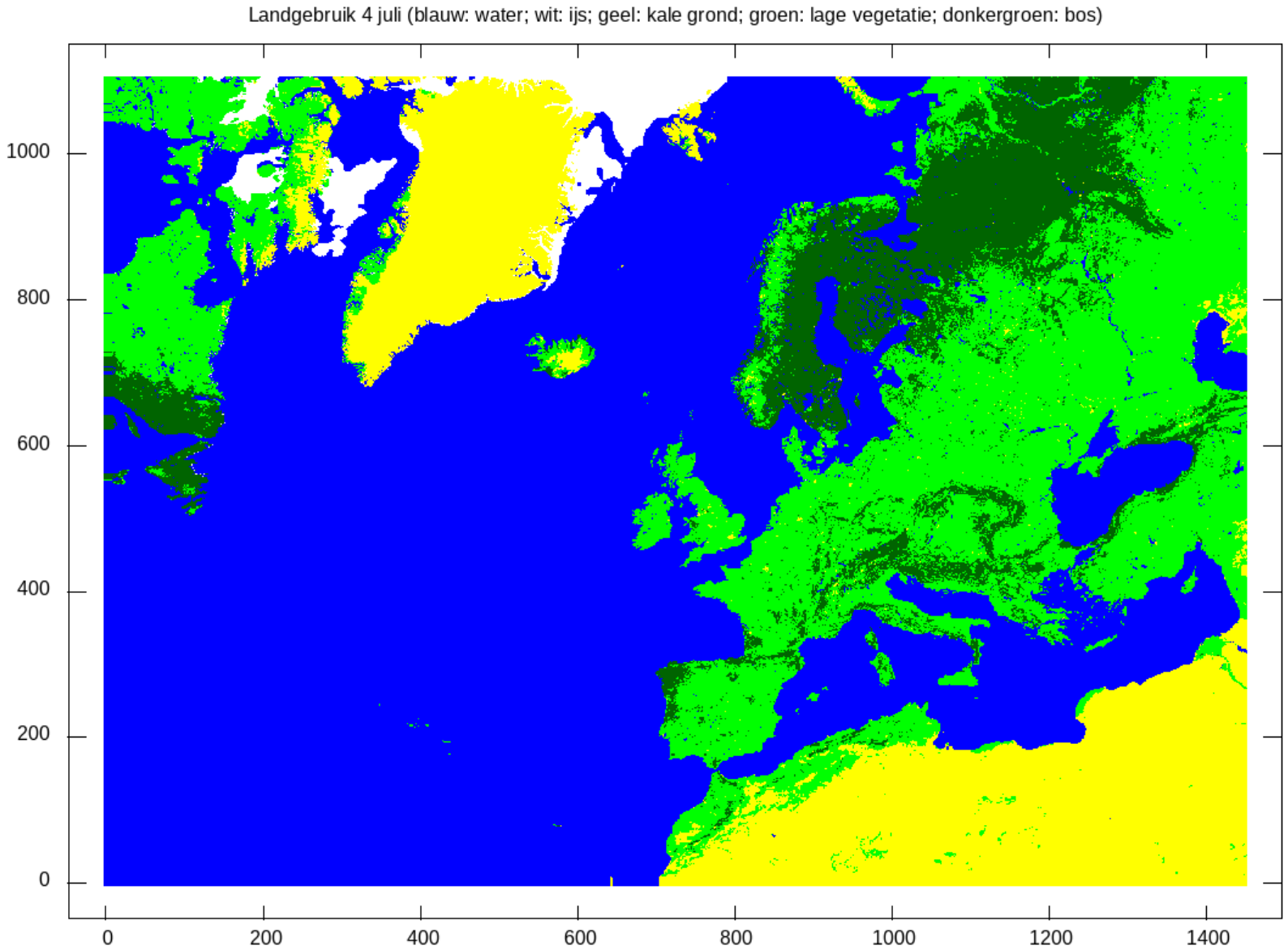
Toon Moene

19 maart 2024

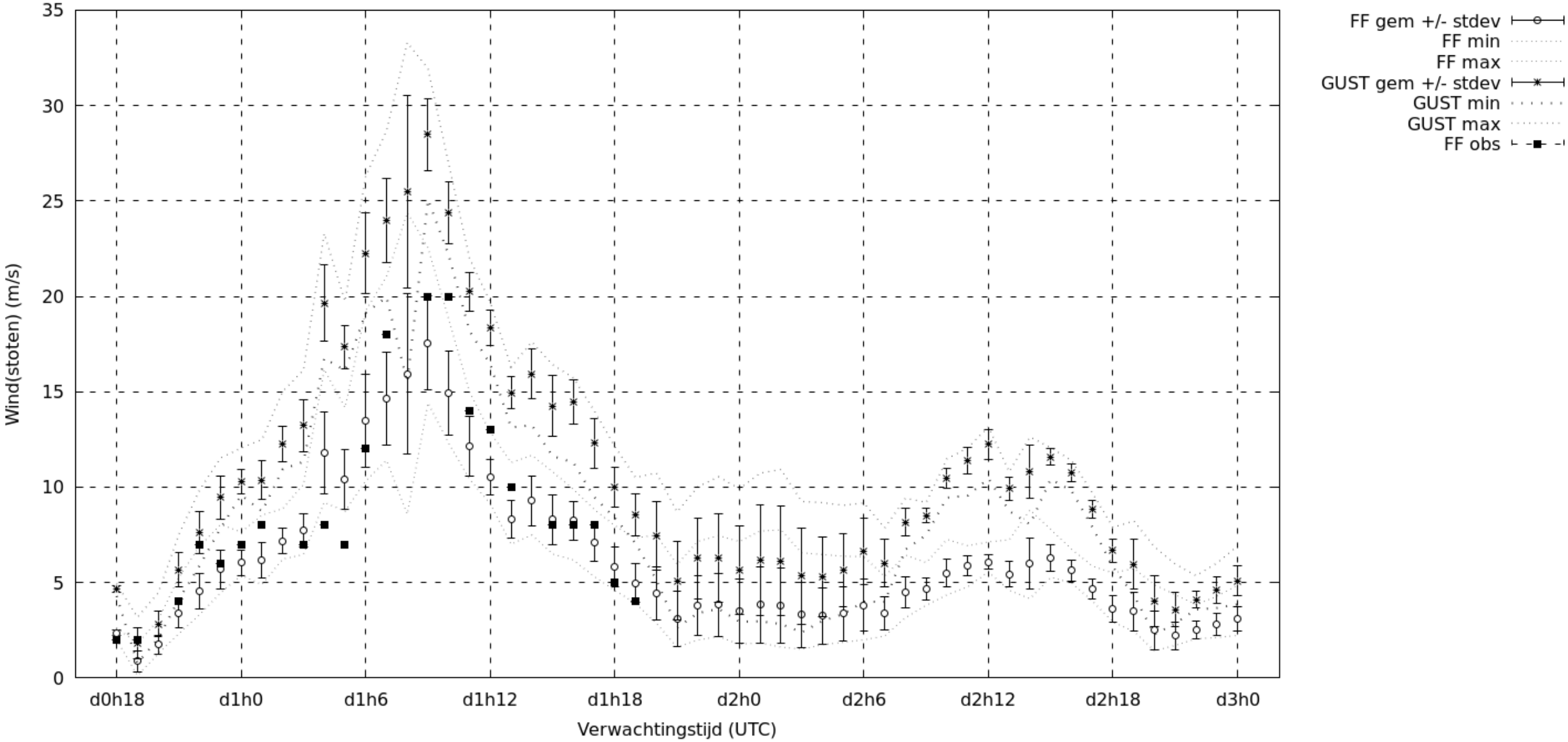
Poly: The Summer Storm of the 5th of July, 2023.

- For the general description of this storm, I rely heavily on the Meteorologica article by Yorick de Wijs (KNMI, WKD) [December 2023].
- Yorick's conclusion:
  - "Uiteindelijk bleken de weermodellen goed in staat om het bijzondere karakter van Poly te simuleren, al bleef het lang onduidelijk waar het zwaartepunt zou komen te liggen en hoe hevig deze [storm] zou worden".
  - His article contains a nice map showing the insecurity about the position of the center both in models **and** in the radar maps [sic].
- ECMWF also made an evaluation about their performance with respect to this storm (a week after their switch to a new ensemble !); see ECMWF evaluation of Poly. Note that you have to log in to see this item.
- All graphs, maps and animations in the following presentation are based on the HIRLAM runs performed on my home PC during the days leading up to this fateful Wednesday. The HIRLAM version is 7.4 (4 years newer than the "operational" HIRLAM run on KNMI's HPC) and has twice the horizontal resolution.


neerslag+bliksem
woensdag 05-jul-2023 07:35 LT


Landgebruik 4 juli (blauw: water; wit: ijs; geel: kale grond; groen: lage vegetatie; donkergroen: bos)
1000
800
600
400
200
0
0
200
400
600
800
1000
1200
1400

Verwachting 2023070418: HollandsNoorderkwartier - 10 meter wind snelheid en windstoten



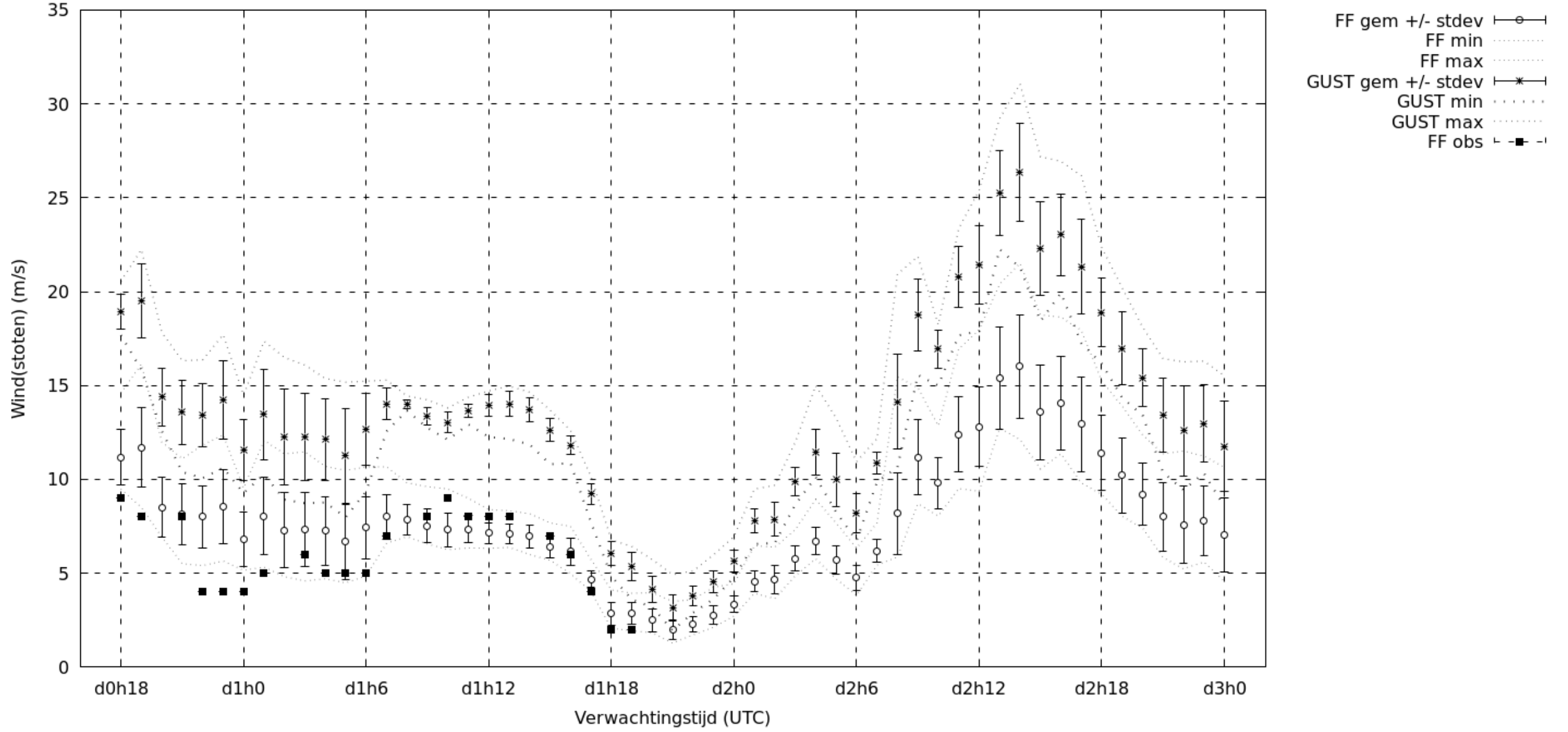
WEERBERICHT voor HollandsNoorderkwartier op woensdag 5 juli 2023 en de volgende dag(en).

woensdag, 7-19 uur lokale tijd:
De temperatuur ligt rond 15 graden Celsius.
De wind neemt af van stormachtig tot matig tussen 11 en 19 uur.
De wind draait van het zuidwesten naar het westen tussen 7 en 12 uur.
Rond 11 uur komen zeer zware windstoten voor.
Er valt 's ochtends tussen 8 en 26 millimeter neerslag.
Het is overwegend bewolkt met 's middags enkele opklaringen.

Google translate:

The temperature is around 15 degrees Celsius.
Winds will decrease from gale-force to moderate between 11 a.m. and 7 p.m.
The wind shifts from the southwest to the west between 7 a.m. and 12 p.m.
Very heavy gusts of wind occur around 11 am.
Between 8 and 26 millimeters of precipitation falls in the morning.
It is mainly cloudy with some spells of sunshine in the afternoon.

Verwachting 2023070318: HollandsNoorderkwartier - 10 meter wind snelheid en windstoten



WEERBERICHT voor HollandsNoorderkwartier op dinsdag 4 juli 2023 en de volgende dag(en).

...

woensdag, 7-19 uur lokale tijd:
De temperatuur ligt rond 15 graden Celsius.
De wind neemt toe van matig tot hard tussen 8 en 16 uur.
De wind draait van het zuidoosten naar het westen tussen 8 en 19 uur.
Tussen 14 en 19 uur komen zware windstoten voor.
Er valt tussen 14 en 23 millimeter neerslag verspreid over de dag.
Het is overwegend bewolkt met tussen de middag enkele opklaringen.

Google translate:

The temperature is around 15 degrees Celsius.
The wind increases from moderate to strong between 8 a.m. and 4 p.m.
The wind shifts from the southeast to the west between 8 a.m. and 7 p.m.
Heavy gusts of wind will occur between 2 p.m. and 7 p.m.
Between 14 and 23 millimeters of precipitation falls throughout the day.
It is mainly cloudy with some clear spells in the afternoon.

Evaluation of the performance of the models.

- The first that's notable in the article by Yorick is that the name "HIRLAM" does not appear.
- However, this is understandable, as the HIRLAM runs (that still continue until today) were not made visible anymore in the picture store for meteorologists ("Kambeelbak").
- Fascinating in picture 7 of the article is the dancing around of the center of the storm both in the models **and** the radar images …

Pseudo Radar Animation 4th of July, 18 UTC

Pseudo Radar Animation 3rd of July, 18 UTC

Timeliness of the information.

- The article makes clear that consensus about the force of the storm and its track only formed around the results of the 00 UTC run of HARMONIE.
- The information from that run becomes available around 2:30 UTC, which during Daylight Saving Time is 4:30 am local time.
- So it is perhaps not surprising that Code Red was only given out at 7 am local time …
- However, the HIRLAM run I showed you was from 18 UTC on the 4th, of which the products would have been available around 11 pm local time on the 4th.
- Of course, not on my home PC (which only completed this run at 10:05 am on the 5th) - but on the next slide I will show why on the KNMI HPC this should have finished around the time I mention above.

Timeliness (II).

- Our current HIRLAM runs on 4 nodes on the HPC and the forecast takes 20 minutes.
- HIRLAM is well parallellised – 4 times as many grid points means 16 nodes "should be enough".
- The 20 minutes then has to be adjusted for
  - 65 layers in the vertical instead of 60.
  - 18 time steps per hour instead of 15 due to higher resolution.
- The 4DVar data assimilation step takes time equivalent to a 16 hour forecast.
- The forecast takes 20 * (65/60) * (18/15) = 26 minutes.
- The 4DVar analysis takes 9 minutes (a third of that).
  Subtract 3 minutes normally used for the 3DVar analysis.
- Result: the elapsed time for this setup would be 26 + 9 – 3 = 32 minutes.
- Conclusion: entirely feasible within the current constraints:
  a forecast well within a one hour delivery time, using resources comparable to a HARMONIE 43 run.

‘En dan nu de hamvraag’

- Why don’t we run HIRLAM 7.4 now, but a 4 year older version ?
- The first priority when starting to use a new machine is to duplicate the operational production on the old machine, so that it can be turned off.
- That meant copying the HIRLAM versions for the operational Europe run, the run for the Caribbean area and the run for the Civil Aviation Authorities.
- Then, work could start on setting up the HARMONIE run – this would take several months.
- Only then we *could* start to think about upgrading models; by that time HIRLAM 7.4 was produced and we could have decided to upgrade the aging Europe run to a newer, better version which surely would have had fewer bugs.
- Alas, we never decided to do so (indeed, that was literally what happened).

But this old stuff (2012) – why is it relevant in 2024 ?

- Because we could easily run into the same trap the coming 10-15 years.
- We surely will have to deal with the paradigm shift to using machine learning as the basis for operational weather forecasting.
- Once these computations prove effective and at least as good as those based on physical models, the question will arise: Why keep the latter around ?
- On the other hand, it is hard to understand how to do climate research without physical models – after all, machine learning models only learn by perusing *existing* data sources …
- Well, OK – but why keep physical models around for weather forecasting ?
- You see where this is heading ….