AUTOMATION AND THE CHANGING ROLE OF THE FORECASTER:

A COMPARITIVE EVALUATION OF THE SKILL DISPLAYED BY CURRENT MANUALLY DERIVED OFFICIAL FORECASTS WITH THOSE AUTOMATICALLY GENERATED

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PRESENTATION TO AMOS-ICTMO DARWIN 11-15 JUNE 2019

SUMMARY

The relative levels of skill displayed by the current manually derived 'raw' official forecasts out to Day-7 for Melbourne, Australia, and that of various sets of corresponding automatically generated weather forecasts (over a 9-month period from April 2018 to December 2018), are evaluated and compared.

An evaluation of automatically generated forecasts for Day-8, Day-9 and Day-10 is also conducted.

The automatically generated forecasts are those based upon a statistical interpretation of the output of three Numerical Weather Prediction models (ACCESS, ECMWF, GFS) and, for Day-1 to Day-7 inclusive, a consensus of those interpretations with the current manually derived 'raw' official forecasts.

But firstly, to place in context what follows, Figures 1 and 2 respectively depict historical trends in the accuracy of Melbourne maximum temperature forecasts (over the past 50 years) and precipitation forecasts (over the past 20 years).

Figures 1 and 2 demonstrate the dramatic increase in forecast skill that has taken place over recent decades.

Focusing now on comparing the manually derived 'raw' official forecasts out to Day-7 with the various sets of corresponding automatically generated weather forecasts, preliminary results (Table 1 and Figures 3 to 10) suggest that:

(a) For most weather elements, the Day-1 manually derived 'raw' official forecasts are superior, whilst the Day-2 manually derived 'raw' official forecasts are best for the temperature predictions.

(b) However, for Days 3-7, some combination of the manually derived 'raw' official forecasts and the automatically generated weather forecasts yields the best outcome.

(c) Some potentially useful skill, albeit limited, is evident in the automatically generated predictions for Day-8, Day-9 and Day-10.

(d) Regarding the Numerical Weather Prediction models, the respective algorithms used to interpret them in terms of weather are identical for the 9am and 3pm wind predictions (for which the ECMWF seems to perform best). However, they are not identical for temperature and precipitation predictions (for which the GFS seems to perform better than the other two). This means that the apparent outperformance of the GFS, regarding the temperature and precipitation forecasts, may simply arise from the better interpretive algorithm used with the GFS.

FIGURE 1 Historical trend in the accuracy of Melbourne maximum temperature forecasts

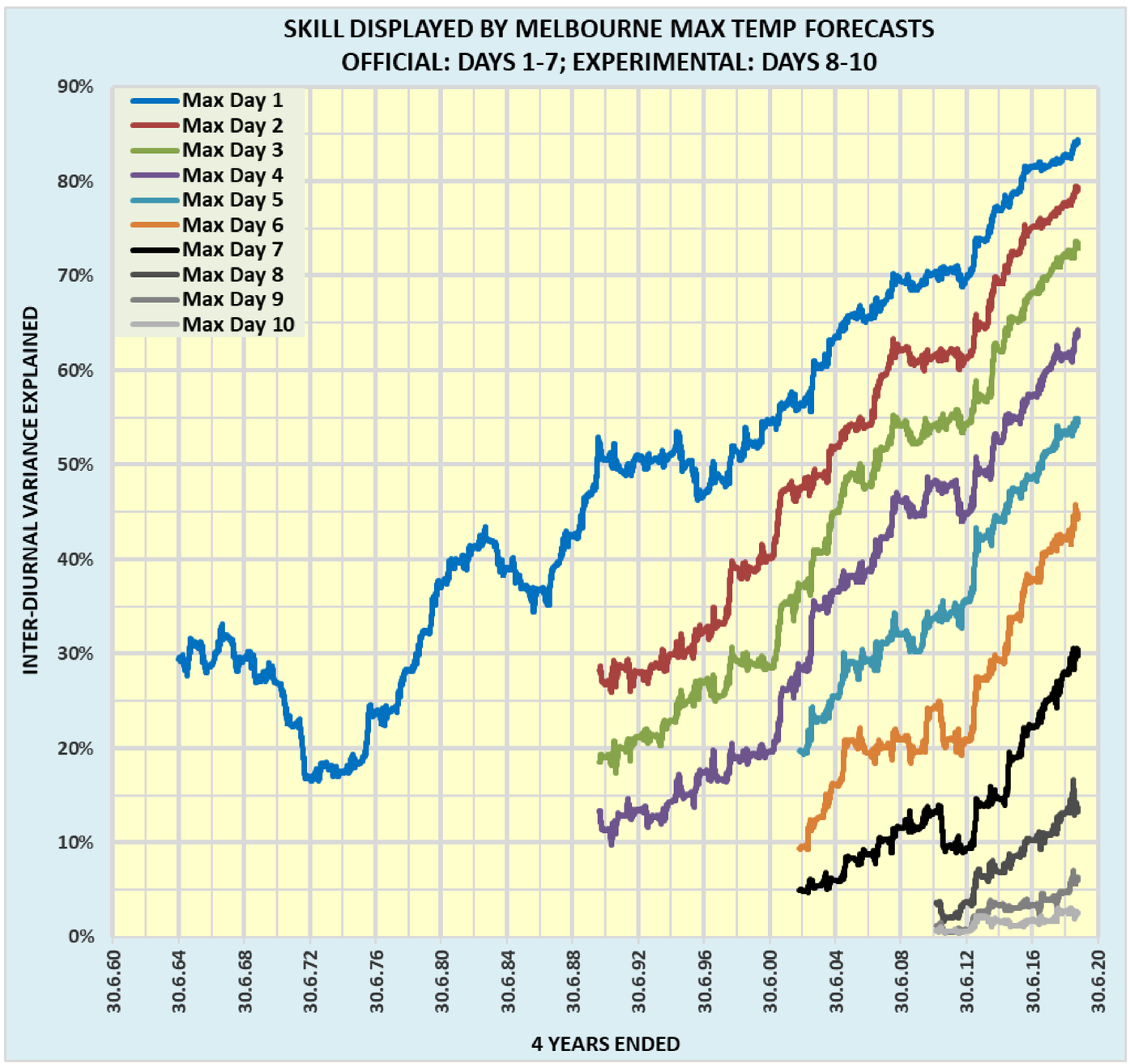

FIGURE 2 Historical trend in the accuracy of Melbourne precipitation amount forecasts

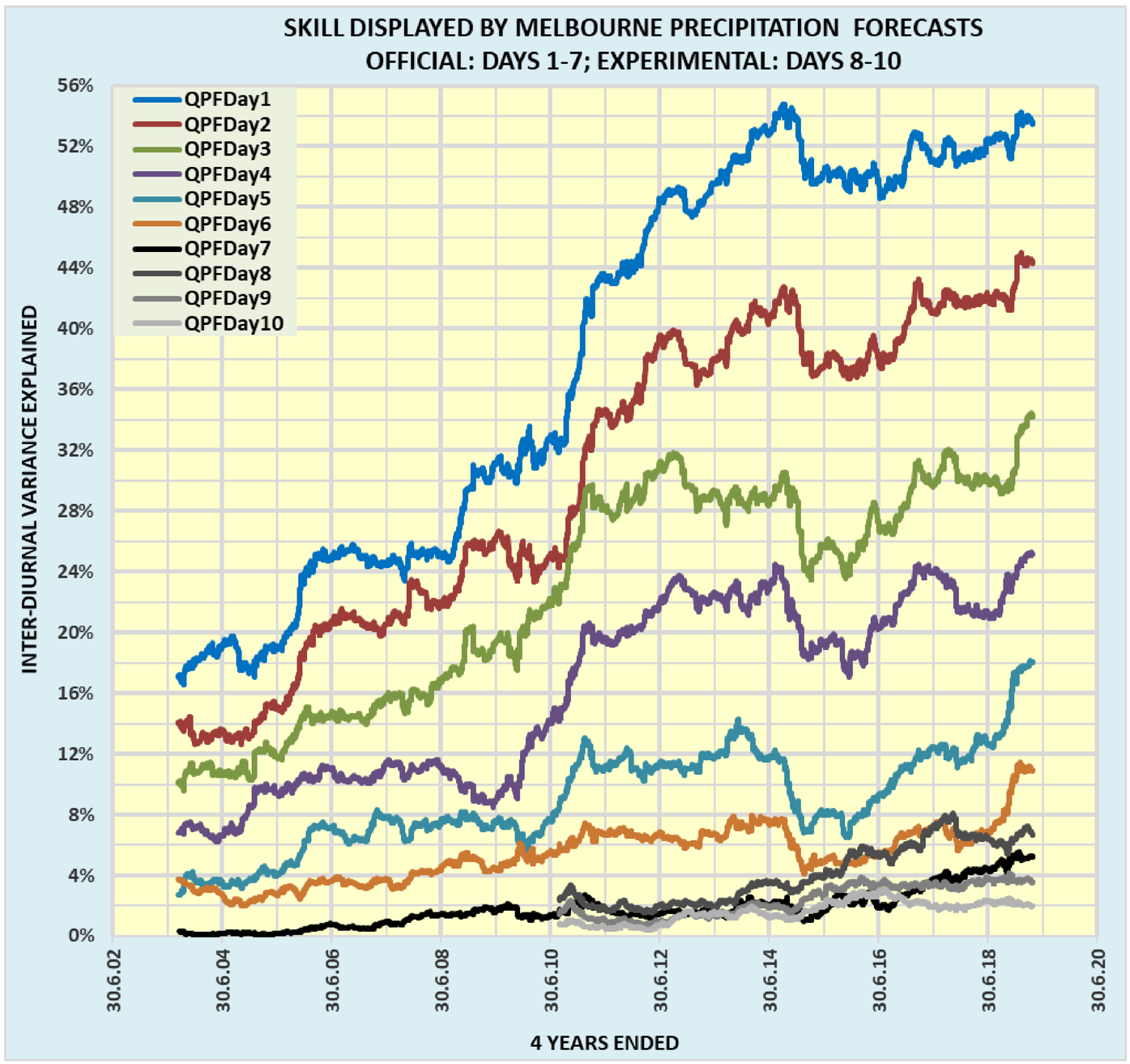

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FIGURE 3 – an overall (all elements combined) outperformance of the consensus forecasts for almost all lead times

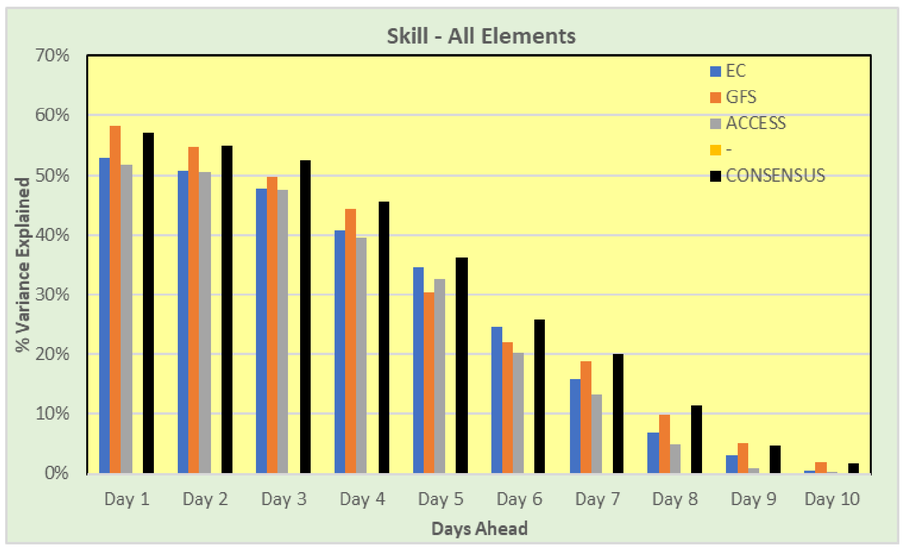

FIGURE 4 - all elements combined, except wind (so as to include official forecasts), reveals an outperformance of official forecasts for short lead times; consensus or GFS best for most longer leads

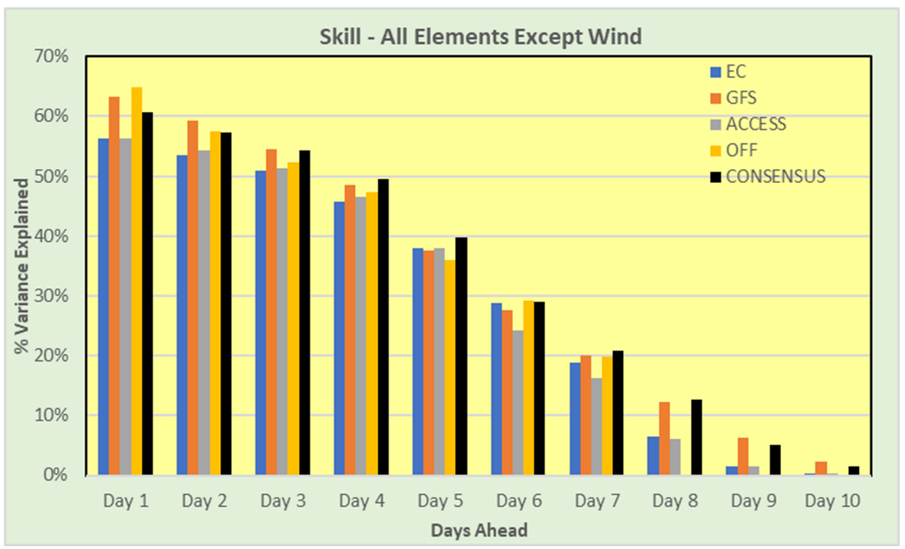

FIGURE 5 – an outperformance of the official Max Temp forecasts for Day-1 and Day-2; consensus or GFS best for most longer leads

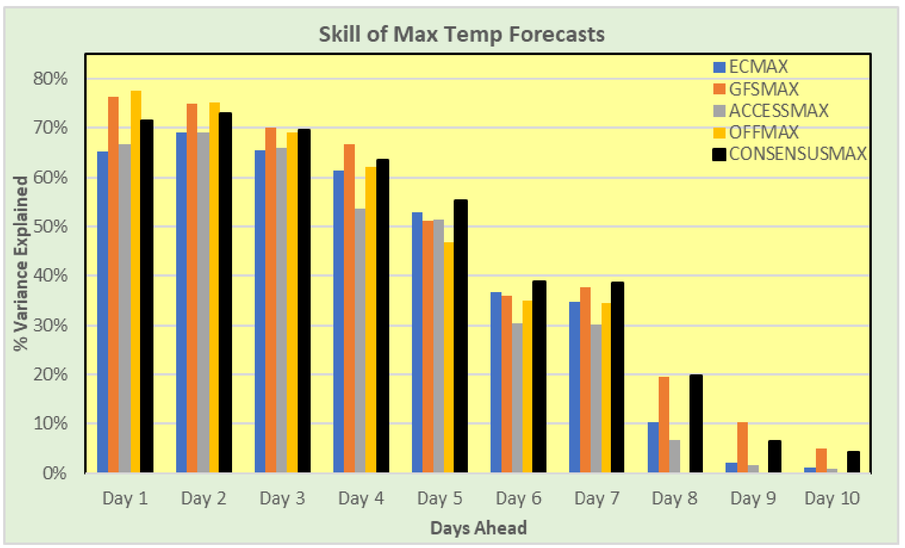

FIGURE 6 - an outperformance of the official Precip Amount forecasts for Day-1; mixed outcomes for longer leads

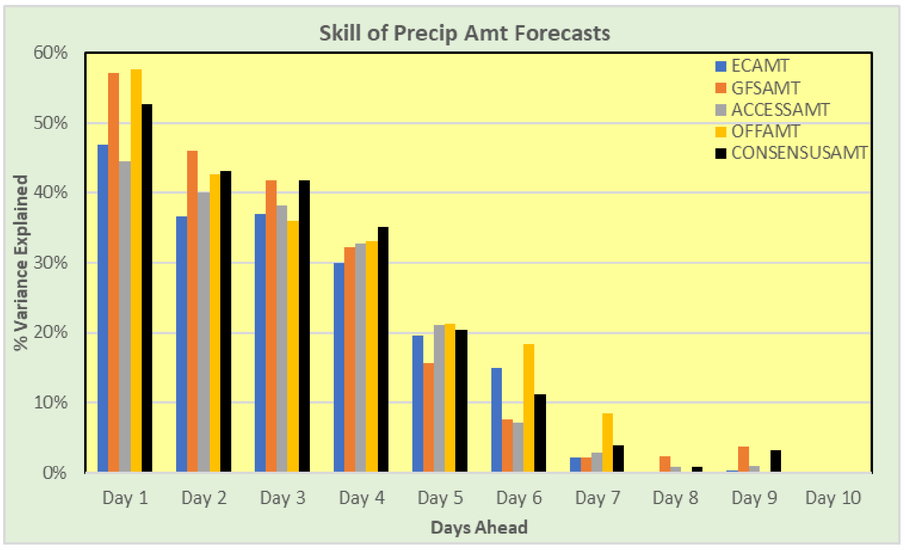

TABLE 1 % Inter-diurnal variance of the observed weather at Melbourne [Min & Max Temp, Amount & Probability of Precipitation (PoP), 9am & 3pm Wind] explained by forecasts derived from the EC, GFS & ACCESS numerical weather prediction models and compared with both official and consensus predictions

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Week 1	Days 1-10	Days 3-7	Days 8-10
ECMIN	72.5%	69.5%	63.3%	61.0%	52.6%	45.1%	24.2%	13.0%	3.5%	0.2%	55.5%	40.5%	49.3%	5.6%
GFSMIN	74.1%	72.8%	67.5%	64.0%	58.4%	49.5%	32.9%	22.6%	7.5%	3.8%	59.9%	45.3%	54.4%	11.3%
ACCESSMIN	72.3%	68.5%	63.9%	63.0%	49.6%	44.4%	18.2%	10.8%	2.7%	0.1%	54.3%	39.3%	47.8%	4.5%
OFFMIN	79.9%	74.1%	69.7%	64.8%	53.4%	48.1%	22.0%	-	-	-	58.9%	-	51.6%	-
CONSENSUSMIN	74.7%	70.8%	66.2%	64.0%	54.7%	47.1%	25.9%	22.3%	8.7%	1.0%	57.6%	43.5%	51.6%	10.7%
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Week 1	Days 1-10	Days 3-7	Days 8-10
ECMAX	65.3%	69.0%	65.5%	61.4%	52.8%	36.8%	34.7%	10.4%	2.1%	1.0%	55.1%	39.9%	50.2%	4.5%
GFSMAX	76.3%	74.8%	70.2%	66.7%	51.1%	35.9%	37.6%	19.5%	10.4%	5.0%	58.9%	44.7%	52.3%	11.6%
ACCESSMAX	66.6%	69.1%	66.0%	53.6%	51.5%	30.5%	30.1%	6.6%	1.6%	0.9%	52.5%	37.6%	46.3%	3.0%
OFFMAX	77.6%	75.1%	69.1%	62.2%	46.9%	34.9%	34.5%	-	-	-	57.2%	-	49.5%	-
CONSENSUSMAX	71.5%	72.9%	69.7%	63.6%	55.3%	38.9%	38.6%	19.9%	6.5%	4.3%	58.6%	44.1%	53.2%	10.2%
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Week 1	Days 1-10	Days 3-7	Days 8-10
ECAMT	46.8%	36.6%	37.0%	30.1%	19.6%	14.9%	2.2%	0.2%	0.3%	-0.3%	26.8%	18.8%	20.8%	0.1%
GFSAMT	57.1%	46.0%	41.8%	32.3%	15.6%	7.6%	2.1%	2.3%	3.7%	0.0%	28.9%	20.8%	19.9%	2.0%
ACCESSAMT	44.5%	40.0%	38.1%	32.7%	21.0%	7.0%	2.9%	0.8%	1.0%	-0.1%	26.6%	18.8%	20.4%	0.6%
OFFAMT	57.7%	42.6%	35.9%	33.1%	21.2%	18.4%	8.5%	-	-	-	31.1%	-	23.4%	-
CONSENSUSAMT	52.7%	43.1%	41.8%	35.1%	20.4%	11.1%	3.9%	0.8%	3.2%	0.0%	29.7%	21.2%	22.5%	1.3%
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Week 1	Days 1-10	Days 3-7	Days 8-10
ECPOP	40.3%	38.6%	38.2%	30.7%	27.1%	18.6%	14.0%	2.5%	0.1%	0.6%	29.6%	21.1%	25.7%	1.1%
GFSPOP	45.6%	43.3%	38.5%	31.5%	25.0%	17.8%	7.7%	4.4%	4.0%	0.0%	29.9%	21.8%	24.1%	2.8%
ACCESSPOP	42.0%	39.4%	37.1%	37.3%	29.4%	14.8%	13.8%	5.8%	0.5%	0.2%	30.5%	22.0%	26.5%	2.2%
OFFPOP	44.5%	38.4%	34.7%	29.0%	22.6%	15.4%	14.4%	-	-	-	28.4%	-	23.2%	-
CONSENSUSPOP	44.2%	41.9%	39.6%	35.4%	29.0%	19.0%	14.9%	7.8%	2.3%	0.4%	32.0%	23.5%	27.6%	3.5%
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Week 1	Days 1-10	Days 3-7	Days 8-10
ECWIND9AM	49.1%	49.2%	43.7%	33.5%	32.1%	19.7%	9.3%	6.2%	6.7%	0.4%	33.8%	25.0%	27.7%	4.4%
GFSWIND9AM	47.2%	43.8%	43.0%	38.6%	18.9%	13.5%	19.4%	6.1%	2.6%	1.6%	32.1%	23.5%	26.7%	3.4%
ACCESSWIND9AM	42.0%	43.8%	41.3%	28.0%	20.7%	11.4%	4.4%	3.0%	-0.1%	0.9%	27.4%	19.5%	21.2%	1.2%
-	-	-	-	-	-	-	-	-	-	-	-	-		-
CONSENSUSWIND9AM	49.2%	50.0%	49.0%	39.7%	30.8%	21.9%	16.6%	9.3%	4.0%	2.6%	36.8%	27.3%	31.6%	5.3%
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Week 1	Days 1-10	Days 3-7	Days 8-10
ECWIND3PM	43.1%	41.0%	38.3%	28.4%	23.2%	12.3%	10.3%	8.8%	6.4%	0.9%	28.1%	21.3%	22.5%	5.4%
GFSWIND3PM	49.3%	47.1%	37.7%	33.0%	14.0%	7.5%	13.6%	4.5%	2.6%	0.8%	28.9%	21.0%	21.2%	2.6%
ACCESSWIND3PM	42.4%	42.2%	39.2%	22.9%	23.2%	13.3%	10.5%	2.2%	0.1%	-0.1%	27.7%	19.6%	21.8%	0.7%
-	-	-	-	-	-	-	-	-	-	-	-	-		-
CONSENSUSWIND3PM	50.4%	50.3%	48.5%	35.5%	27.0%	16.8%	20.4%	8.6%	3.8%	1.4%	35.6%	26.3%	29.6%	4.6%

FIGURE 7 – an outperformance of the official Min Temp forecasts for short lead times; mixed outcomes for longer leads

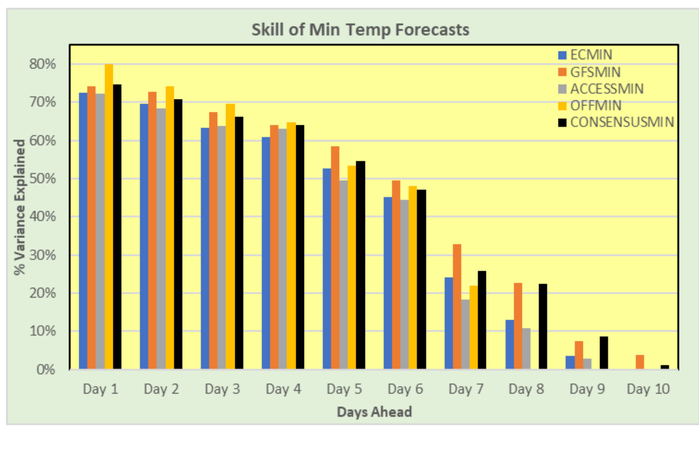

FIGURE 8 – an outperformance of the GFS Precip Probability forecasts for short lead times; mixed outcomes for longer leads

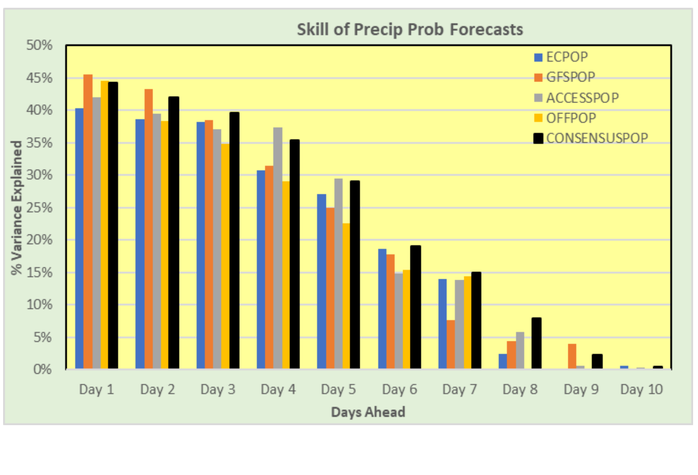

FIGURE 9 – an outperformance of the 9 am wind consensus forecasts for almost all lead times, with the EC not far behind

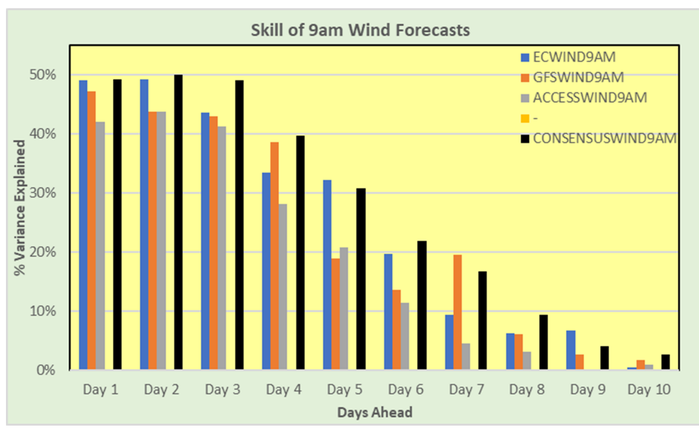

FIGURE 10 – an outperformance of the 3 pm wind consensus forecasts for almost all lead times, with the EC (again) not far behind