Application and verification of ECMWF products 2008

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1. Summary of major highlights

There was one main new developmentsat KNMI in 2007 concerning the use of the ECMWF model: an EPS based heat and health warning system was introduced.

2. Use and application of products

2.1 Post-processing of model output

2.1.1 Statistical adaptation

The MOS interpretation scheme based on ECMWF output products is still operational for Tmin, Tmax, precipitation probabilities and sunshine duration. For most parameters the MOS is based on a combination of results of the deterministic model and EPS.

2.1.2 Physical adaptation

2.1.3 Derived fields

The ECMWF EPS is used to update the medium range forecast and also to assess subjectively the confidence of the deterministic statements. Several products are operationally available: ECMWF (day5-7) clusters, KNMI clusters (i.e. clusters on a daily basis), tubes, and plume plots. Also the forecaster is consulting the website of ECMWF for Extreme Forecast Indices.

2.2 Use of products: a heat and health warning system

A heat and health warning system was introduced in close collaboration between the National Institute of Health (RIVM) and KNMI. We use a simple heat index in the Netherlands: a heat wave is called when the maximum temperature has been over 25 degrees Celsius for 5 consecutive days, three of which have a maximum temperature over 30 degrees. (This corresponds to an average temperature of a least 28 Celsius) . With EPS a probability estimate is made of such an event and is sent by automatic email to the Health Institute. In fact mails are sent at an even lower "trigger" threshold to alert people as early as possible. A mail is sent when there is a 20% probability that the maximum temperature reaches 27 degrees or more in 5 consecutive days at any place in The Netherlands. This will trigger various internal warnings between all the institutions in the Netherlands which are involved with health issues. When there is a 90% probability that the official criterion is reached a warning is issued to the general public, but only if RIVM thinks that health is at risk. There have been no such warnings in 2007 (nor a heat wave).

3. Verification of products

3.1 Objective verification

3.1.1 Direct ECMWF model output (both deterministic and EPS)

The verification of model output based on the objective classification of 500 hPa fields (Kruizinga, 1979) has been continued. This classification into fixed flow regimes (27 classes) is performed for 00 UTC fields only.

The forecasts are classified for +12, +36, +60 upto and including +228 lead times. In Table 1 the hit frequencies of forecast classes are presented from 1981 until 2007. **The summary is the same as last year: the scores have improved!**

Lead time in hours

	12	**36**	**60**	**84**	**108**	**132**	**156**	**180**	**204**	**228**
1981	82	64	51	40	27	20				
1982	80	66	51	39	29	20				
1983	86	72	57	46	33	23				
1984	84	69	54	39	28	20				
1985	85	72	58	42	28	21				
1986	84	72	54	33	29	26				
1987	87	72	55	43	30	24				
1988	89	79	65	51	35	26				
1989	90	81	70	55	45	31				
1990	95	80	68	54	40	29	22	14	11	12
1991	93	82	68	52	38	24	17	17	11	10
1992	93	82	68	49	40	27	22	17	13	8
1993	93	83	68	50	37	26	14	12	11	10
1994	91	82	71	50	35	25	20	15	6	7
1995	93	80	71	53	39	30	22	19	13	8
1996	93	80	72	54	42	33	23	16	11	7
1997	94	85	76	53	45	33	26	15	15	14
1998	95	84	70	53	43	32	25	19	14	11
1999	95	85	75	54	46	31	21	12	12	11
2000	96	87	73	65	47	36	26	20	13	10
2001	93	86	74	63	43	34	22	14	11	9
2002	96	88	79	65	50	36	26	21	16	10
2003	96	89	78	66	50	36	26	20	16	10
2004	95	91	80	66	54	38	25	21	14	11
2005	95	90	80	70	56	43	30	21	15	12
2006	95	91	84	70	55	40	31	22	20	13
2007	96	91	82	72	58	43	35	24	19	12

(Hit frequency expected with random forecasts is about 4 %)

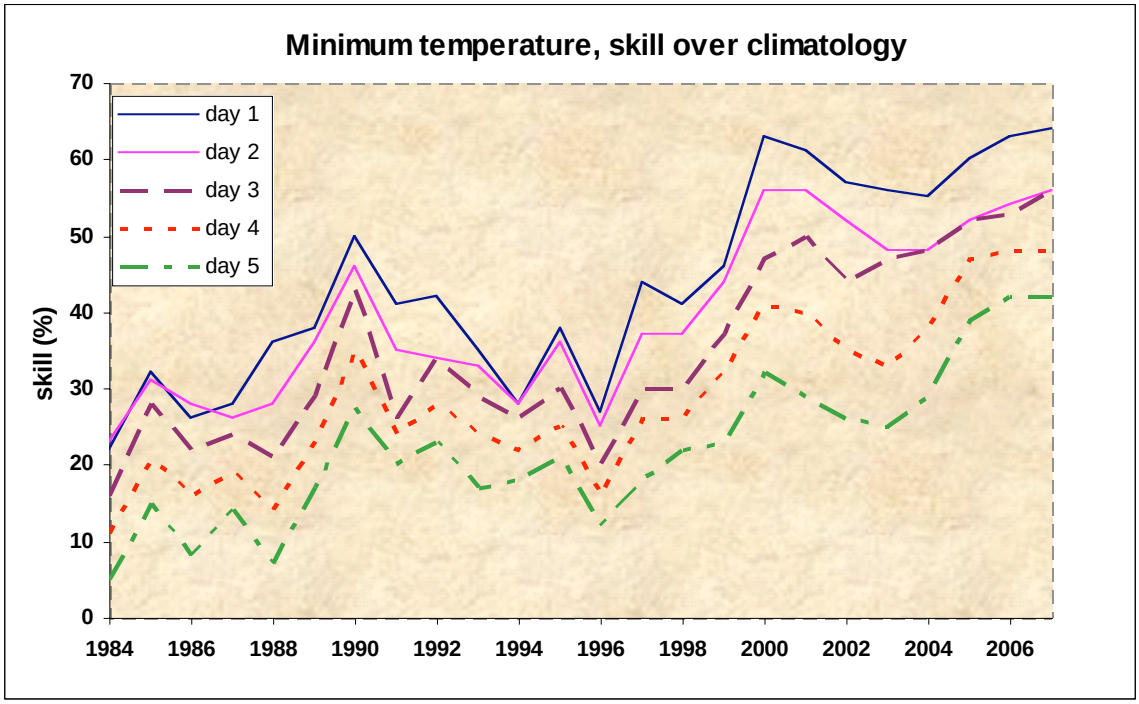
Table 1 Relative frequency of hits (%) of ECMWF forecasts for objectively classified flow patterns in the periods December to December ending in 1981, ..., 2007 respectively.

3.1.2 ECMWF model output compared to other NWP models

3.1.3 Post-processed products

Verification of MOS of Tmin, Tmax and precipitation

The routine scores for Tmin, Tmax and precipitation probability have been updated. The results are presented in figs 3,4 with respect to climatology.



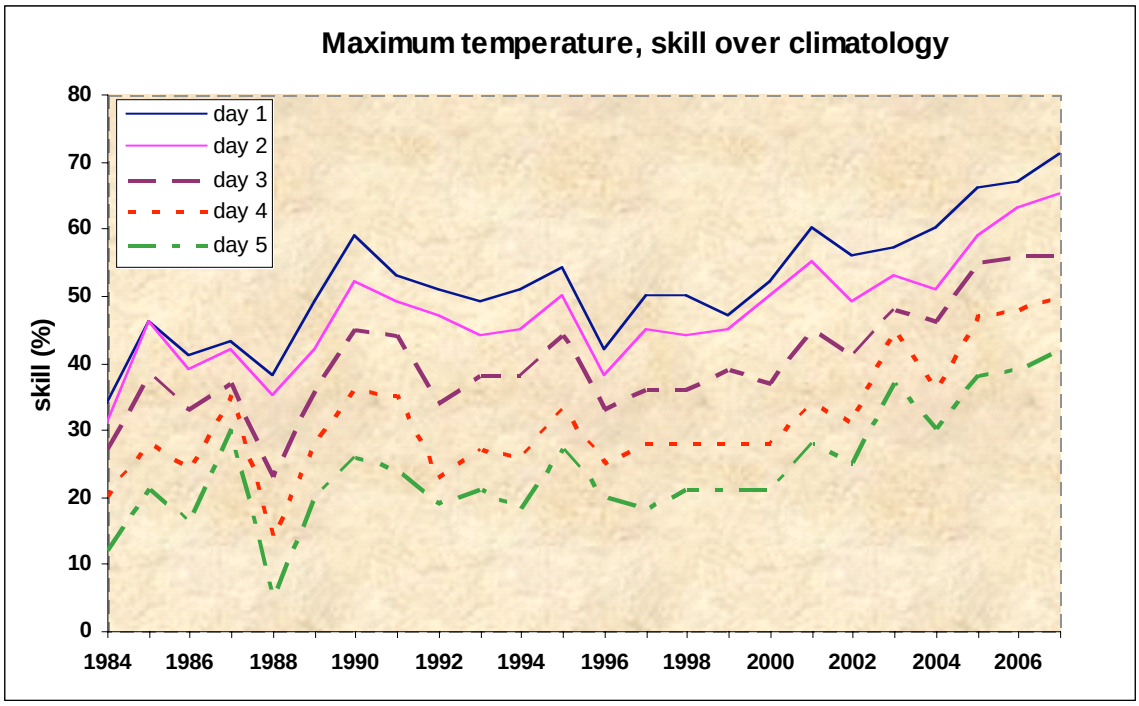


Fig. 3ab Skill scores for minimum and maximum temperature for 1984 through 2007
Lead time in days; day 1 is based on a 36 hours forecast for minimum temperature and +48 for maximum temperature, and so on.

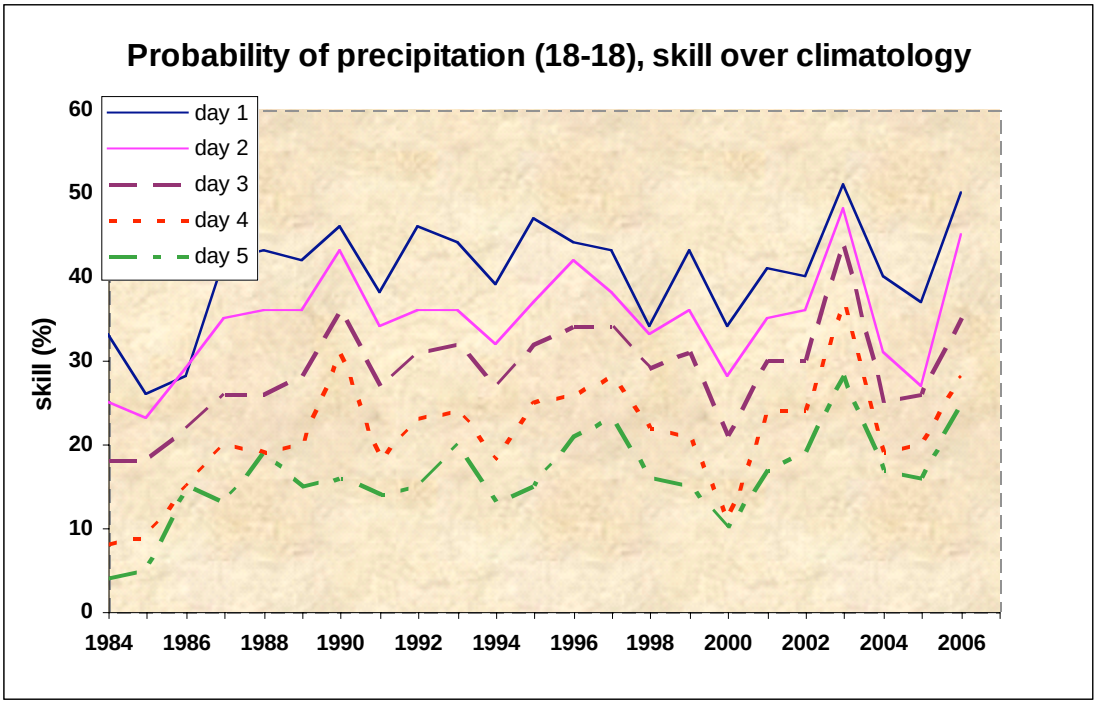


Fig. 4 Skill scores for probability of precipitation for 1984 until 2007. Lead time in days; day 1 is starting at +36 with respect to the ECMWF model, and so on.

3.1.4 End products delivered to users

3.2 Subjective verification

none

4. References to relevant publications

Kruizinga, S. (1979). Objective classification of daily 500 mbar patterns. Sixth Conference on Probability and Statistics in Atmospheric Sciences, Banff, Alberta, Canada.

Wilks, D.S. (2006). Statistical methods in the atmospheric sciences. Academic Press.