Hydrometeorological Research Centre of Russia

On accuracy of the COSMO-RU7 low cloud amount forecasting

N.P. Shakina, E.N. Skriptunova, A.R. Ivanova

COSMO/CLM User Seminar DWD, Offenbach/Main, 05-07 March 2013

The low cloud forecasting represents an important element of the aviation weather service. It is of practical interest to estimate accuracy of the model cloud forecasts, especially with respect to the cloud amounts defined as “broken” and “overcast”.

In the Aeronautical meteorology Division of the Hydrometeorological Centre of Russia, we have created a database of aerodrome observations as reported in METAR telegrams. The database is operatively continuing since 2001. The observations include registration of low (ceiling below 1500 m), cloud amount (octants) every 30 min (at some aerodromes, 1 h). In total, 45 aerodromes with regular observations in the former European USRR are included in the database.

The COSMO-RU7 predicts cloud amounts (0 to 100%) in the layer up to 800 hPa. The results – analysis (initial fields) and forecasting fields with 12 and 24 h projection – are collected for 00 and 12 UTC during July 2011 to April 2012.

The predictand is formulated in the following two ways:

-maximum low cloud amount for ± 1 h with respect to 00 and 12 UTC,- that is, maximum from 5 observations (for instance, 23.00, 23.30, 00.00, 00.30, 01.00).

- observed low cloud amount at 00 and 12 UTC exactly.

The predictor is the model cloud amount in the gridpoint closest to the aerodrome.

The predictand fields are compared against the predictors – that is, with analysis (initial fields) and 12- and 24-h forecasting fields.

Only the clouds ≥ 5 oct are considered as a dichotomic variable (occurrence or non-occurrence)

In Tables below, results of comparison are shown for 20 of 45 aerodromes considered. For each aerodrome, the accuracy characteristics of model analysis or forecasting are presented for the 1st predictand. In the lower lines, averaged (over 45 aerodromes) results are shown for both 1st and 2nd predictands.

The two results differ but slightly. Still, the results for the 2nd predictand should be considered preferable because of a higher percent of hit rate (real occurrence correctly predicted).

Table 1. Agreement between low cloud > 5 oct model analysis and aerodrome observations (predictand is taken as maximum cloud amount from 5 observation times 0.5 h distant)

Aerodrome	Case number	Occur.freq. %	Occur.correct forecast,%	Hit rate %	FAR, %	Peirce Index
Murmansk	495	43.6	60.8	74.5	39.2	0.37
Arkhangelsk	402	47.5	80.0	73.3	20.0	0.57
Tallinn	541	56.4	81.9	59.3	18.1	0.42
St.-Petersburg	543	54.9	79.6	64.1	20.4	0.44
Riga	543	49.4	85.6	66.8	14.4	0.56
Vilnius	543	59.1	83.4	61.1	16.6	0.44
Minsk	534	57.1	81.6	59.7	18.4	0.42
Nizhny Novgorod	541	48.1	82.5	72.3	17.5	0.58
M.,Sheremetyevo	524	48.1	78.1	72.2	21.9	0.54
M.,Vnukovo	531	52.2	82.6	71.8	17.4	0.55
M.,Domodedovo	524	46.2	81.1	72.7	18.9	0.58
Kyiv	538	46.5	80.2	56.8	19.8	0.45
Odessa	543	36.8	76.0	49.0	24.0	0.40
Simferopol	541	37.2	72.3	46.8	27.7	0.36
Volgograd	537	27.2	58.5	70.5	41.5	0.52
Rostov-Don	537	28.7	63.6	66.9	36.4	0.52
Krasnodar	543	36.6	79.8	51.8	20.2	0.44
Stavropol	535	23.4	47.0	69,6	53.0	0.46
Anapa	538	26.4	56.0	43.0	44.0	0.31
Min. Vody	527	43.8	81.5	53.2	18.5	0.44
Sochi	509	24.8	57.4	21.4	42.6	0.16
Total/Average	23365	40.0	70.0	60.7	29.2	0.44
Predictand is cloud amount observed at 00 or 12 UTC exactly						
Total/Average	22259	33.1	64.0	64.7	36.0	0.47

Table 2. Accuracy of the model low clouds >5 oct 12 h forecasts, July 2011 – April 2012

Aerodrome	Case number	Occur.freq., %	Occur.correct forecast,%	Hit rate %	FAR, %	Peirce Index
Murmansk	484	43.4	58.7	75.2	41.3	0.35
Arkhangelsk	400	48.2	69.2	74.6	30.8	0.44
Tallinn	531	55.9	88.2	67.7	11.8	0.56
St.-Petersburg	532	54.5	77.9	75.2	22.1	0.50
Riga	532	49.6	82.8	72.7	17.2	0.58
Vilnius	532	59.8	87.1	67.9	12.9	0.53
Minsk	523	57.0	85.7	70.5	14.3	0.55
Nizhny Novgorod	530	48.5	81.3	79.8	18.7	0.63
M.,Sheremetyevo	513	48.7	75.6	74.4	24.4	0.52
M.,Vnukovo	521	53.0	83.1	74.6	16.9	0.58
M.,Domodedovo	513	47.8	78.4	75.5	21.6	0.56
Kyiv	527	46.1	81.4	63.0	18.6	0.51
Odessa	532	36.8	77.6	45.9	22.4	0.38
Simferopol	530	37.5	72.6	49.2	27.4	0.38
Volgograd	526	27.9	60.2	72.1	39.8	0.54
Rostov-Don	527	28.3	58.4	67.8	41.6	0.49
Krasnodar	532	37.6	80.5	47.5	19.5	0.41
Stavropol	524	22.7	43.5	56.3	56.5	0.35
Anapa	528	27.1	59.8	46.9	40.2	0.35
Min. Vody	517	44.3	82.0	57.6	18.0	0.48
Sochi	501	24.4	50.8	50.8	49.2	0.35
Total/Average	22903	40.0	70.0	64.7	30.0	0.47
Predictand is cloud amount observed at 00 or 12 UTC exactly						
Total/Average	21824	33.4	63.5	68.3	36.5	0.48

Table 3. Accuracy of the model low clouds >5 oct 24 h forecasts, July 2011 – April 2012 (predictand is taken as maximum cloud amount from 5 observation times 0.5 h distant)

Aerodrome	Case number	Occur. freq., %	Occur.correct forecast,%	Hit rate %	FAR, %	Peirce Index
Murmansk	495	42.6	57.2	73.5	42.8	0.33
Arkhangelsk	408	48.5	68.5	75.8	31.5	0.43
Tallinn	541	55.4	78.9	65.8	21.1	0.44
St.-Petersburg	543	54.7	76.3	73.7	23.7	0.46
Riga	543	50.1	80.0	66.2	20.0	0.50
Vilnius	543	58.9	86.0	69.4	14.0	0.53
Minsk	534	56.7	87.6	72.3	12.4	0.59
Nizhny Novgorod	541	48.6	80.5	79.7	19.5	0.62
M.,Sheremetyevo	523	48.4	77.0	74.3	23.0	0.54
M.,Vnukovo	532	53.0	82.0	75.9	18.0	0.57
M.,Domodedovo	525	47.2	80.0	77.4	20.0	0.60
Kyiv	538	46.3	81.5	63.9	18.5	0.51
Odessa	543	36.8	81.1	45.0	18.9	0.39
Simferopol	541	37.9	80.3	49.8	19.7	0.42
Volgograd	537	28.1	58.1	71.5	41.9	0.51
Rostov-Don	537	28.7	56.9	61.7	43.1	0.43
Krasnodar	543	38.3	79.5	44.7	20.5	0.38
Stavropol	535	22.8	45.8	54.1	54.1	0.35
Anapa	538	26.8	55.0	42.4	45.0	0.30
Min. Vody	526	44.9	83.4	55.5	16.6	0.46
Sochi	511	24.5	51.2	50.4	48.8	0.35
Total/Average	23365	40.0	70.0	60.7	30.1	0.46
Predictand is cloud amount observed at 00 or 12 UTC exactly						
Total/Average	22269	33.4	62.4	67.8	37.6	0.47

The lowest (though practically consistent) efficiency corresponds to the southern stations: North Caucasus (Stavropol, Anapa), Black Sea coast (Sochi). Also, the same is found for Murmansk (Kola Peninsula).

Note that the estimates are almost similar for analysis and forecasting fields. This implies that in the initial fields of low clouds, about 25-30% of low cloud occurrences, are not reflected in the model initial fields and, on the contrary, 30 to 40% of gridpoints with model low clouds disagree with observations.

Conclusion

- The COSMO-RU7 forecasting of the low cloud amount ≥ 5 oct is found to be efficient enough for practical use.
- Rather high percentages of false alarms and especially of non-predicted occurrences of the phenomenon should be a subject for further improvement. In this respect, attention should be payd to characteristics of the initial cloud fields as compared with observations.