The latest results in QPF and verification over Poland

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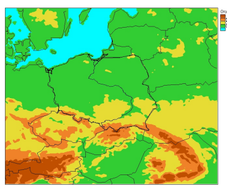
The project “Tackle deficiencies in quantitative precipitation forecasts” is one of the priority projects within the COSMO consortium. We had analyzed 4 days with heavy precipitation - 3 May 2005, 4 May 2005, 10 June 2005 and 9 August 2005. In the first step we run 20 experiments using COSMO LM version 3.19 . Next we run 5 different experiments using model version 4.0. We present results of the last 5 QPF cases.

We also present monthly verification of operational model results against SYNOP stations and 308 rain gauges. For the fields generated by the model the following parameters were extracted: the 2m temperature, the 2m dew point temperature, the pressure reduced to MSL and the wind speed and 24h precipitation. For the verification of surface continuous parameters we used Mean Error (ME) and Mean Square Error (RMSE). The errors estimators were calculated for all stations and for whole country area. For the24h accumulated precipitation we calculated indices from the contingency table. We used thresholds: 0.5, 1, 2.5, 5, 10, 20, 25, 30 mm and we calculated Frequency Bias Index (FBI), Probability Of Detection event (POD), False Alarm Ratio (FAR).

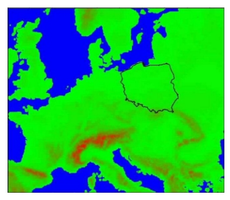
Model Configuration

QPF EXPERIMENTS



Domain size	
200 x 200 grid points	193 x161 grid points
Horizontal Grid Spacing	
0,0625 (~7km)	0,1250 (~14km)
Time Step	
40 sec	80 sec
Forecast Range	
48h	72h
Initial Time of Model Runs	
00 UTC	00 UTC
Model Version Run	
4.0	before June 2007 3.05 4.0

OPERATIONAL MODEL



QPF Experiments

Case	EXPERIMENTS DESCRIPTION
Sensitivity studies by changing the initial conditions	
CTRL 4.0	Reference version – COSMO model 4.0
QV090	Reduction of atmospheric water vapor mixing ratio by 10 % in cloud free regions
Numerics	
RK	Runge-Kutta core
Physical parameterizations	
CONkfb	Kain-Fritsch-Bechtold convection scheme including explicit exchange of ice and cloud water to the grid-scale variables
CONmod	Modification of Tiedtke convection scheme regarding evaporation, turbulent entrainment, mixed-phase saturation adjustment and exchange of cloud water and cloud ice with grid-scale variables

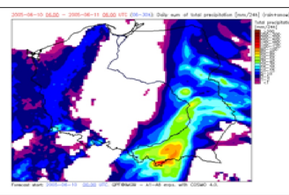
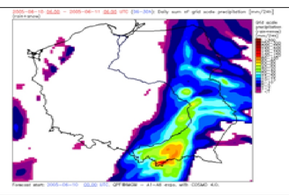
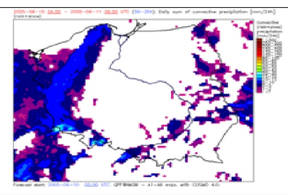
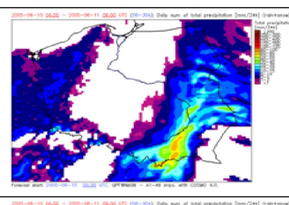
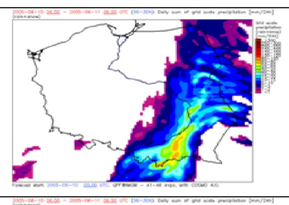
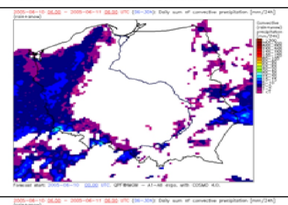
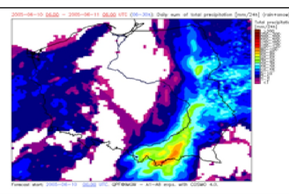
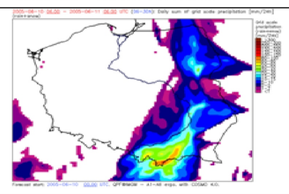
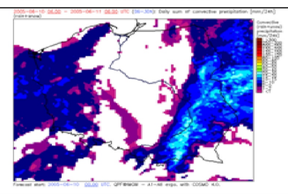
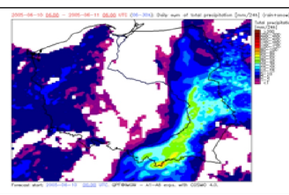
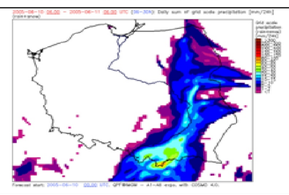
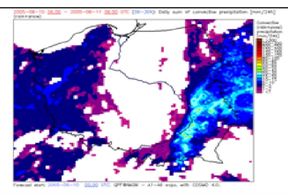
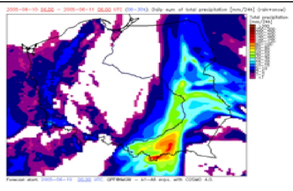
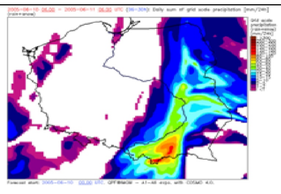
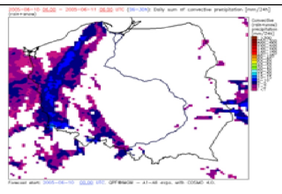
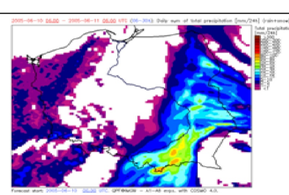
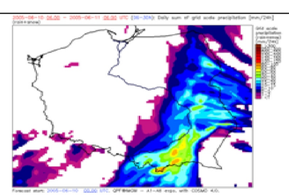
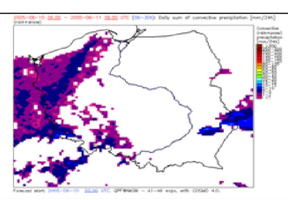
CASE	DESCRIPTION
Exp. A1	CTRL 4.0
Exp. A2	CTRL 4.0 + QV090 + RK
Exp. A3	CTRL 4.0 + CONkfb
Exp. A4	CTRL 4.0 + QV090 + RK + CONkfb
Exp. A5	CTRL 4.0 + CONmod
Exp. A6	CTRL 4.0 + QV090 + RK + CONmod

Statistic Results

	3 May 2005								4 May 2005							
	Max FOR	*Max CON*	*Max GSP*	*Aver FOR*	*Aver CON*	*Aver GSP*	*CON %*	*GSP %*	*Max FOR*	*Max CON*	*Max GSP*	*Aver FOR*	*Aver CON*	*Aver GSP*	*CON %*	*GSP %*
Exp. A1	88.7	34.9	86.4	10.6	3.9	6.7	36.8	62.2	61.1	17.0	61.1	11.8	2.3	9.5	19.5	80.5
Exp. A2	36.0	19.4	31.5	8.4	3.7	4.7	44.1	55.9	66.3	11.4	64.4	8.4	2.0	6.4	23.8	76.2
Exp. A3	49.5	19.1	44.2	8.2	5.4	2.8	65.9	34.1	53.3	17.5	51.6	9.4	2.6	6.8	27.7	72.3
Exp. A4	41.2	24.7	29.7	7.5	4.8	2.7	64.0	36.0	38.0	12.3	36.0	8.1	2.6	5.5	32.1	67.9
Exp. A5	69.4	13.9	66.3	10.1	2.3	7.8	22.8	77.2	86.7	8.7	86.6	12.5	0.9	11.6	7.2	92.8
Exp. A6	41.5	8.5	36.5	6.7	1.6	5.1	23.9	76.1	59.5	3.8	58.0	8.3	0.6	7.7	7.2	92.8

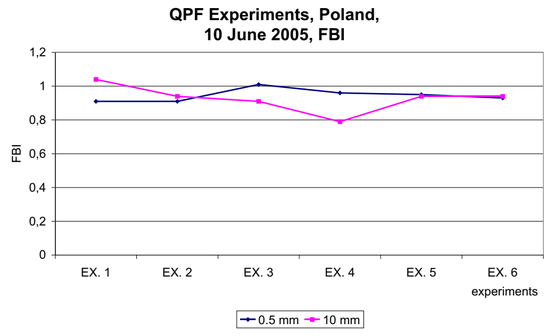
	10 June 2005								9 August 2005							
	Max FOR	*Max CON*	*Max GSP*	*Aver FOR*	*Aver CON*	*Aver GSP*	*CON %*	*GSP %*	*Max FOR*	*Max CON*	*Max GSP*	*Aver FOR*	*Aver CON*	*Aver GSP*	*CON %*	*GSP %*
Exp. A1	123.2	21.2	118.6	17.1	1.8	15.3	10.5	89.5	84.1	6.4	83.8	4.3	0.9	3.4	20.9	79.1
Exp. A2	67.3	17.4	67.3	11.0	1.3	9.7	11.8	88.2	65.8	4.1	65.5	3.1	0.4	2.7	12.9	87.1
Exp. A3	100.7	24.2	94.4	15.3	3.3	11.9	22.2	77.8	99.5	10.2	89.3	4.0	0.9	3.1	22.5	77.5
Exp. A4	60.3	26.3	59.5	10.2	2.4	7.7	24.5	75.5	77.0	9.5	69.1	3.2	0.8	2.4	25	75
Exp. A5	121.3	12.4	119.0	17.5	0.8	16.7	4.6	95.4	93.2	2.6	93.2	4.1	0.4	3.7	9.8	90.2
Exp. A6	76.0	8.3	75.4	11.4	0.5	10.9	4.4	95.6	61.6	3.1	61.6	3.0	0.2	2.8	6.7	93.3

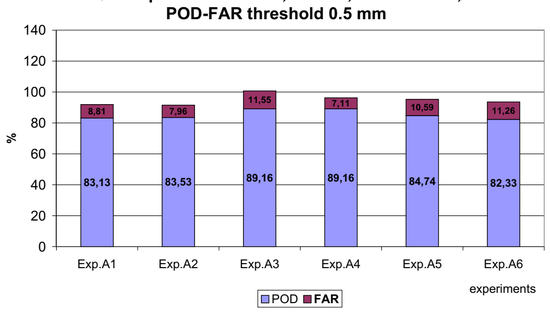
Case Study - 10 June 2005

	Daily sum of total precipitation [mm/24h] (snow + rain)	Daily sum of grid scale precipitation [mm/24h] (snow + rain)	Daily sum of convective precipitation [mm/24h] (snow + rain)
Exp.A1			
Exp.A2			
Exp.A3			
Exp.A4			
Exp.A5			
Exp.A6			

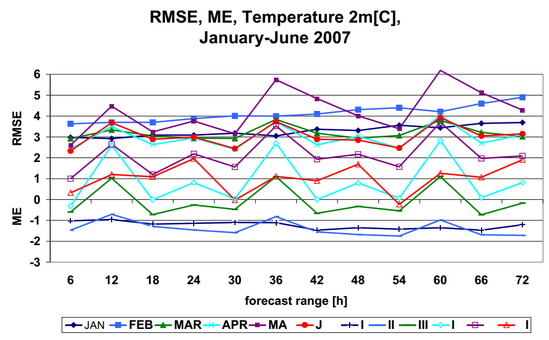
Verification Results

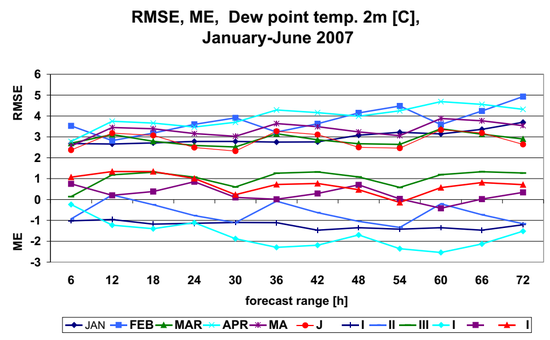
QPF

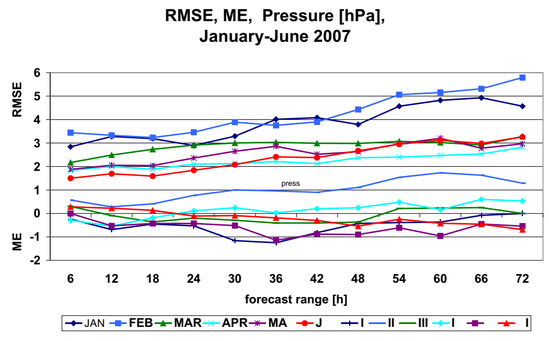


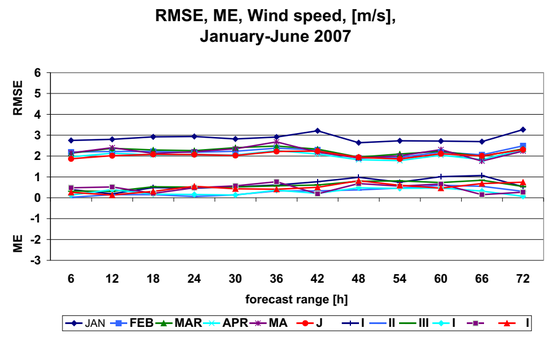


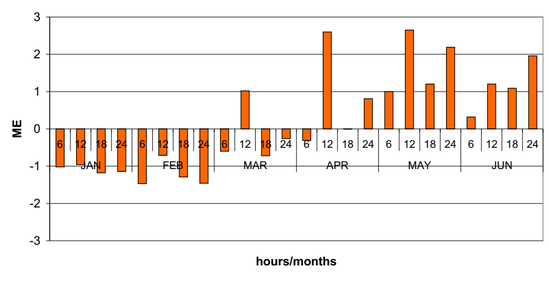
SYNOP STATIONS

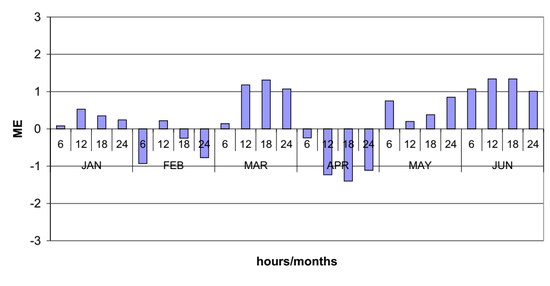


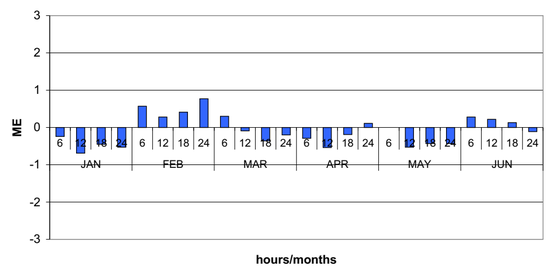


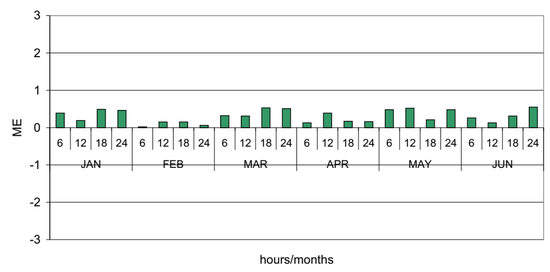




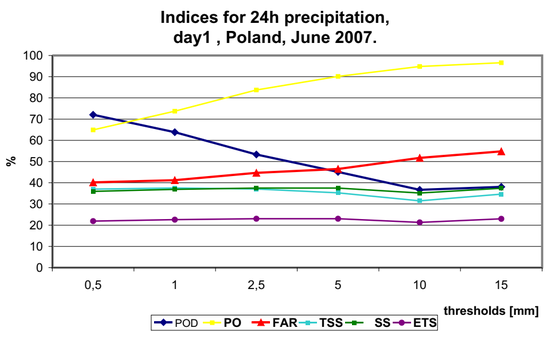


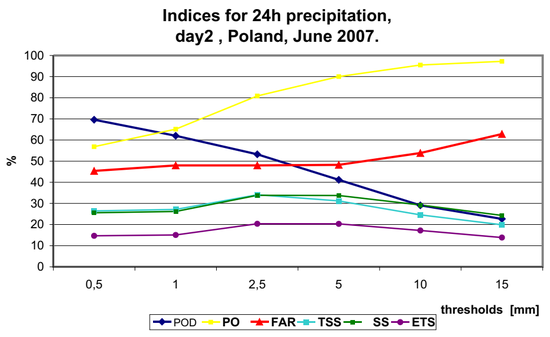


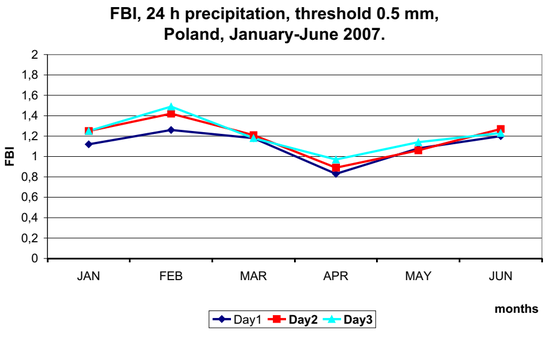


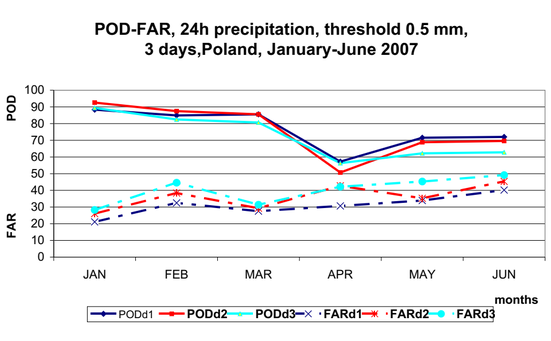


RAIN GAUGES









The latest results of QPF experiments and verification of operational model runs against data from SYNOP stations and rain gauges from January 2007 to June 2007 are presented above.

QPF Project

In most QPF experiments for threshold 0.5 mm Frequency Bias Index (FBI) is near 1. For thresholds over 25 mm the index is above 1. For our case study (10 June 2005) the best improvement of the average precipitation was produced by experiment QV090+RK+CONkfb. The best predicted maximum precipitation was done in experiment QV090+RK+CONmod.

Verification of meteorological elements

For the temperature 2m we did not observe a diurnal cycle of RMSE from January to February. During this period ME was below zero. From March to June we observed a diurnal cycle of RMSE at 12 UTC. For the dew point ME was positive for March, May and June. ME was negative for January, February and April. RMSE for the pressure increased with the forecast time. RMSE was above 3 for January and February and below 3 for other months. ME for the wind speed was always positive and small (ME<1) during the whole period and increased with forecast time.The 24h accumulated precipitation was over predicted in January, February and June.