

Testing Radiation and Cloudiness Parameterization

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Outline

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- The fog case
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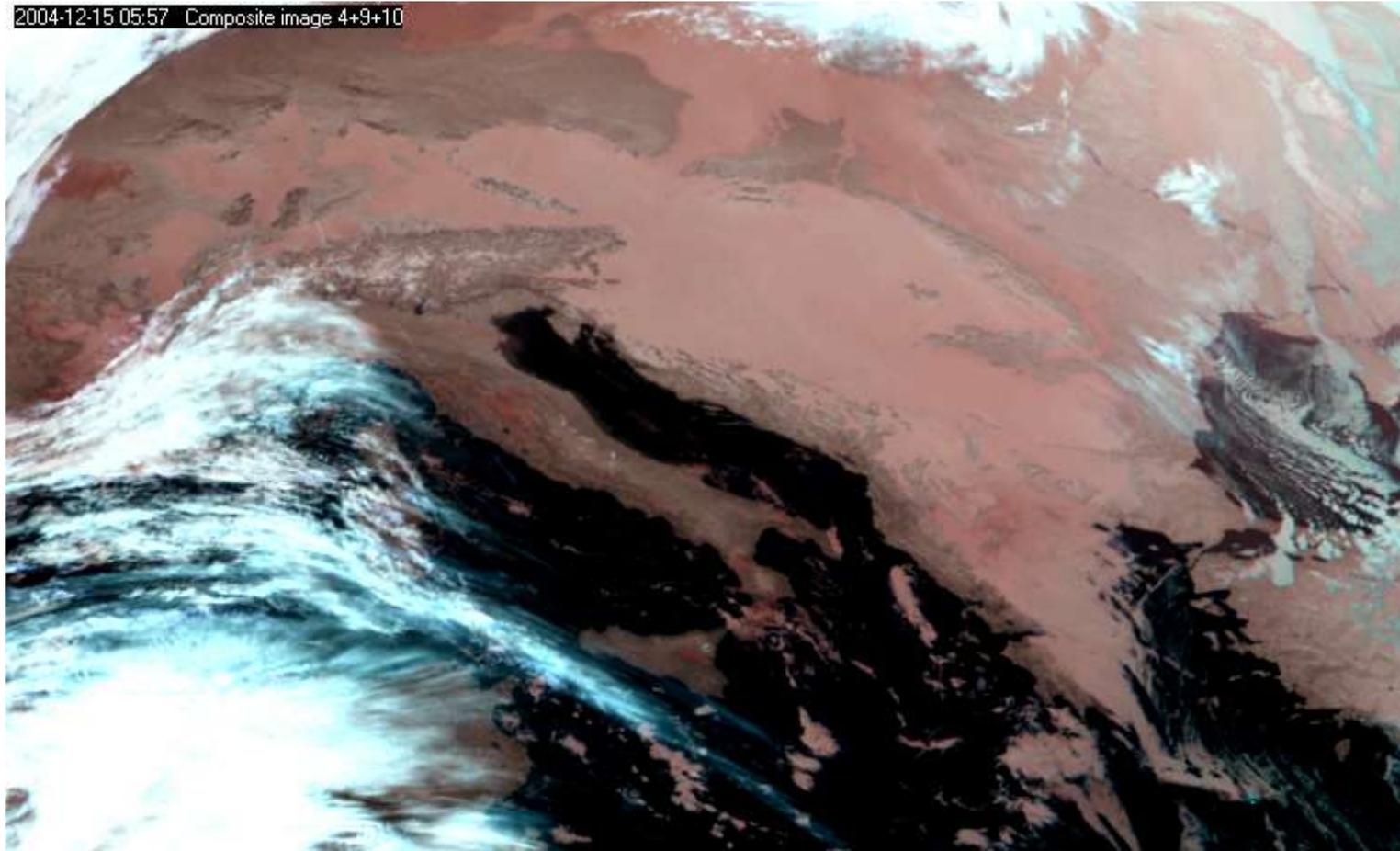
Introduction

- In cases of stable atmosphere with low-level inversion and low cloudiness or fog, operational version of the ALADIN model does not predict enough low cloudiness and consequently the diurnal cycle of the 2 m temperature is too pronounced
- Model initially recognizes conditions favourable for low-cloudiness or fog formation, but not enough clouds are diagnosed, leading to temperature having an emphasized diurnal cycle

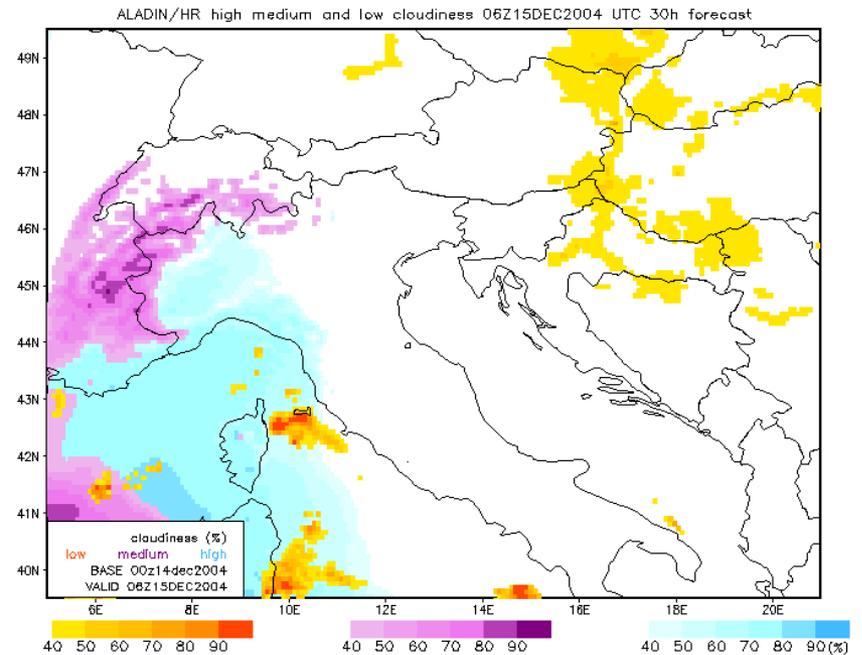
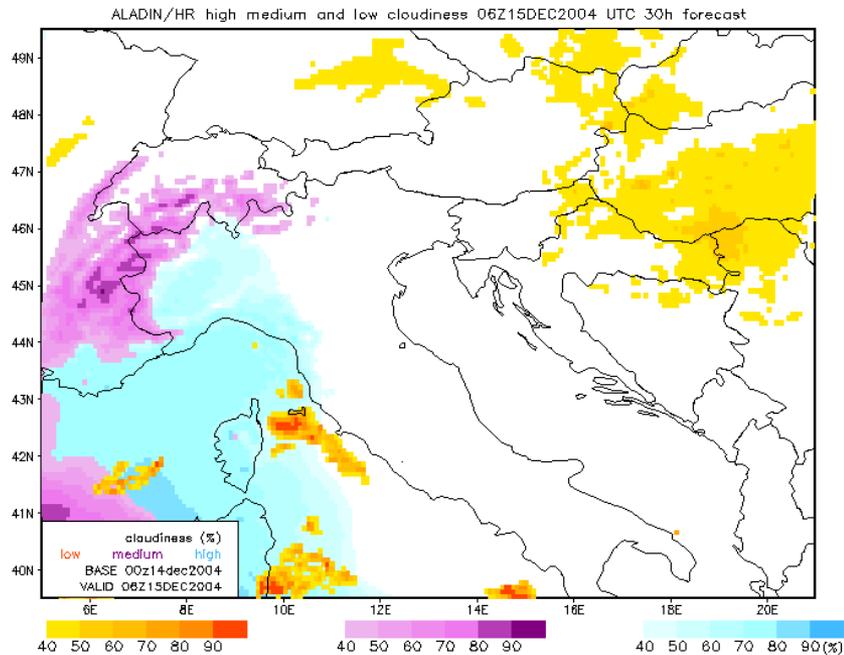
Methods

- Random, random maximum and maximum cloud overlap assumptions,
- Different critical relative humidity profiles (“old” and “new”)
- Cloudiness schemes:
 - Operational
 - Xu-Randall (1996)
- Radiation schemes:
 - Operational
 - Operational including net exchange rate formulation (NER)
 - FMR scheme (Morcrette, 1989) called with different intervals.

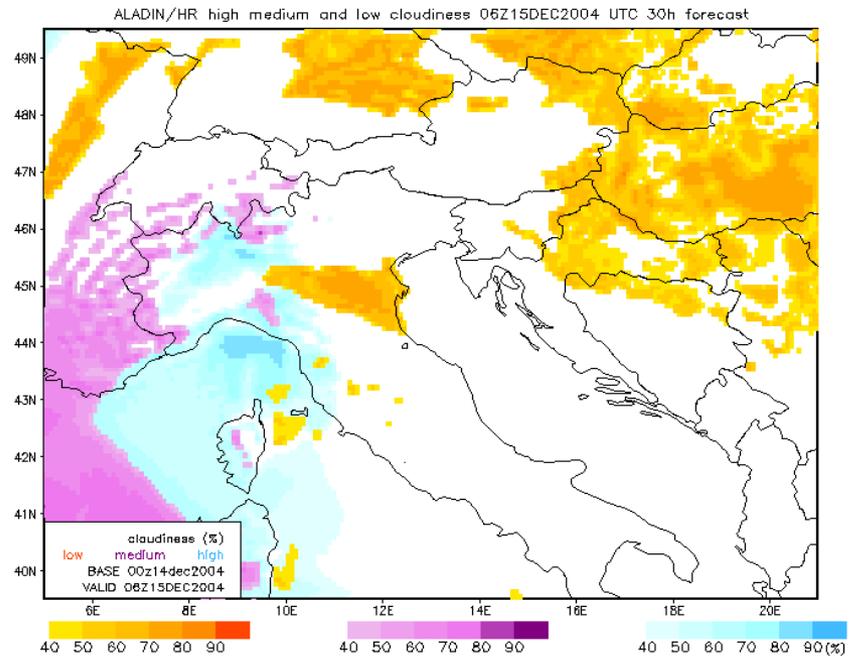
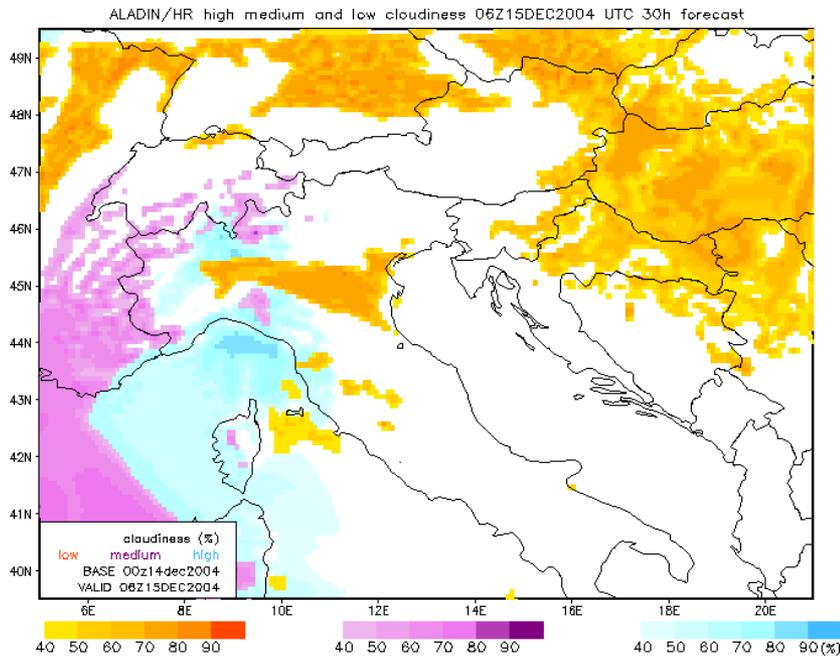
The fog case



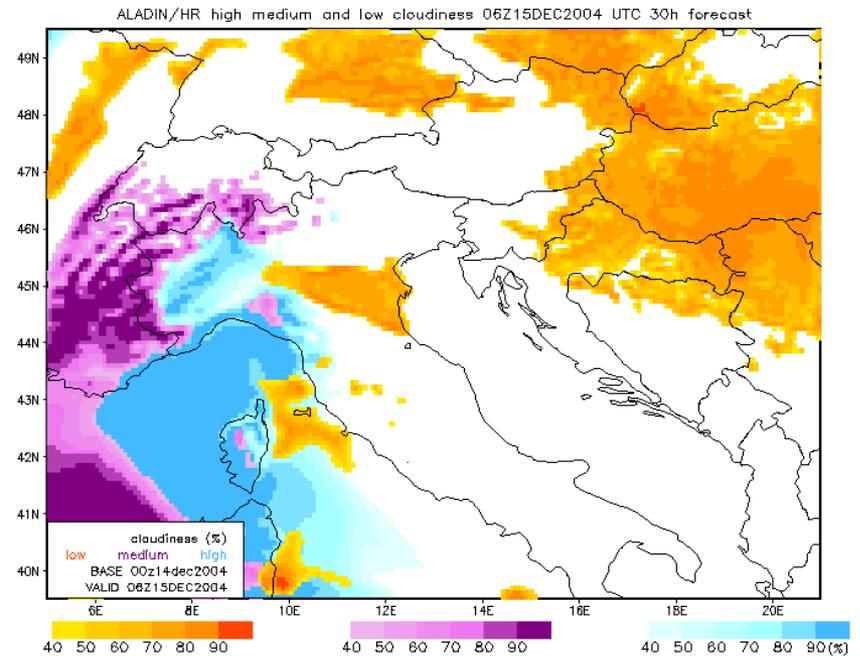
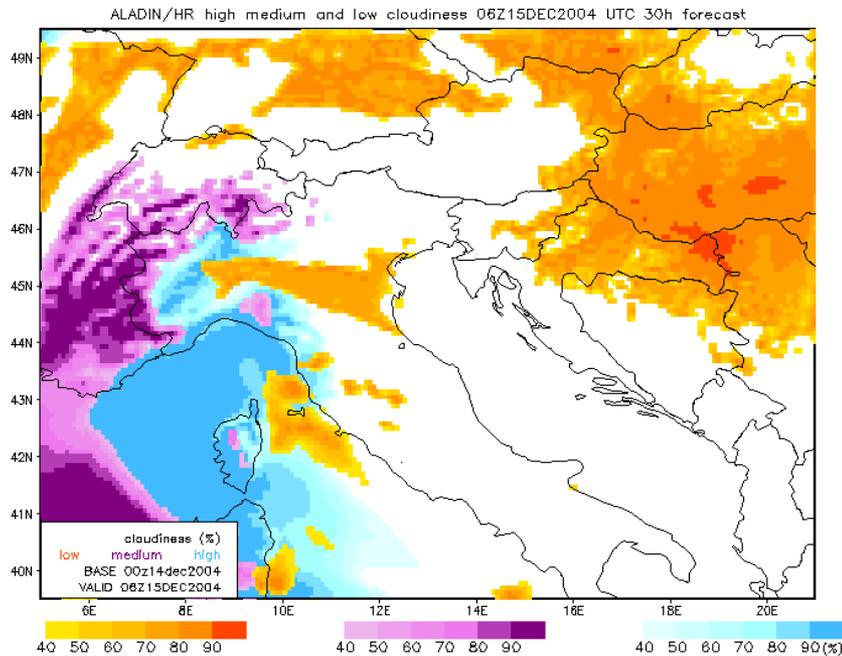
- Meteosat-8 RGB composite of channels 3.9, 10.8 and 12.0 μm for December 15th 2004, 06 UTC. Fog or low clouds over Southeastern Europe are clearly visible.



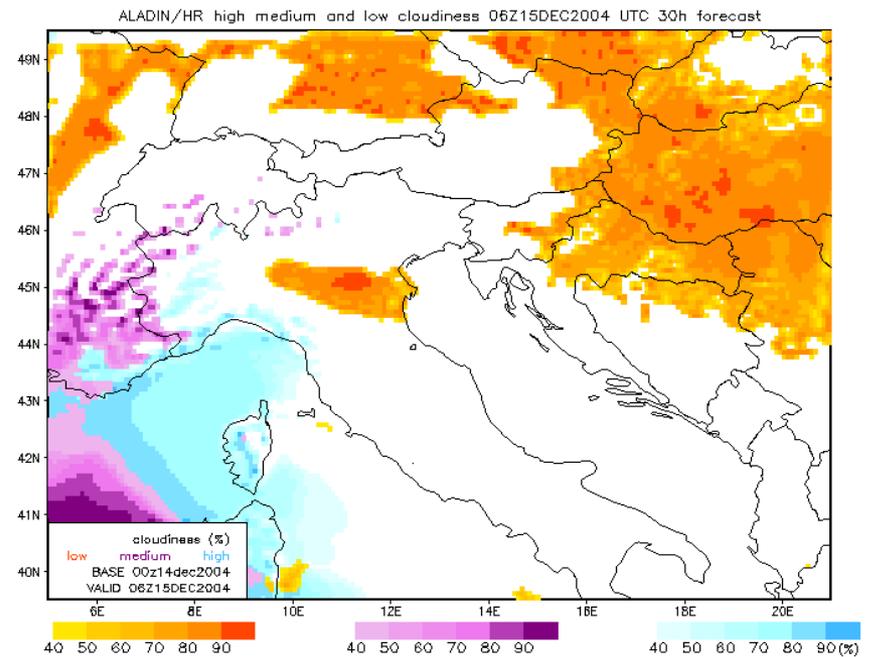
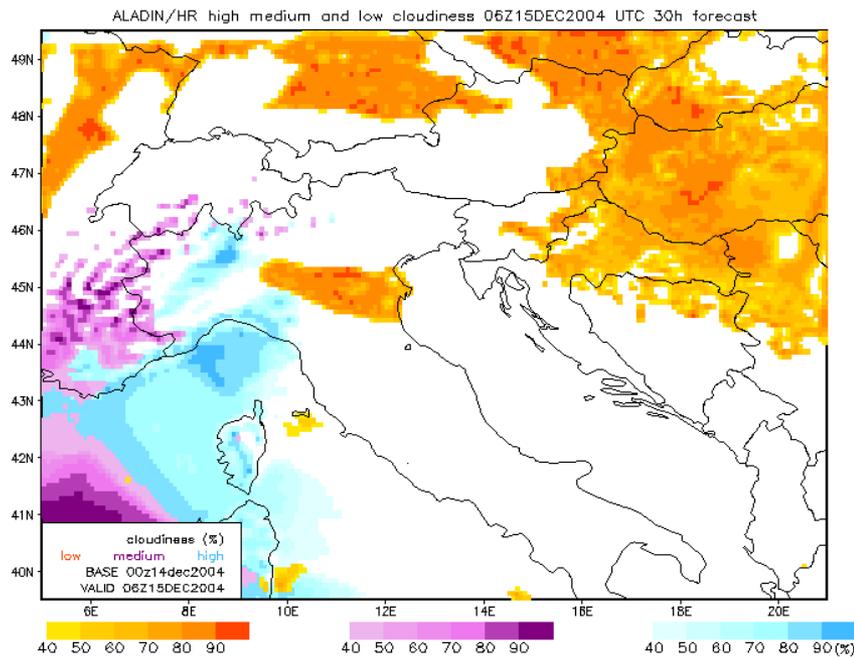
- Low, medium and high cloudiness, with **operational radiation (left)** and **NER (right)**, **random overlap** using **operational cloudiness** scheme and critical relative humidity profile, 30 hour forecast starting 00 UTC 14th December 2004.



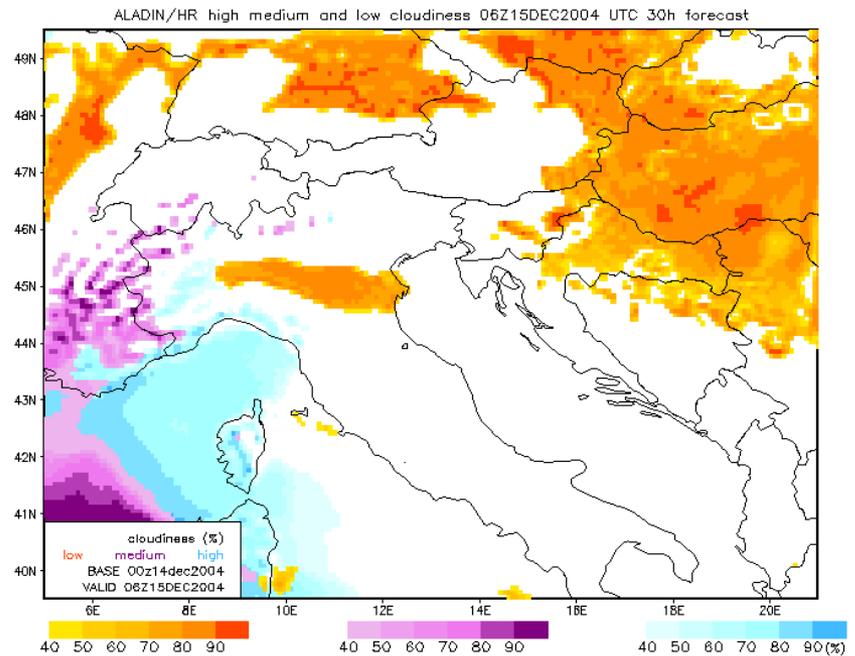
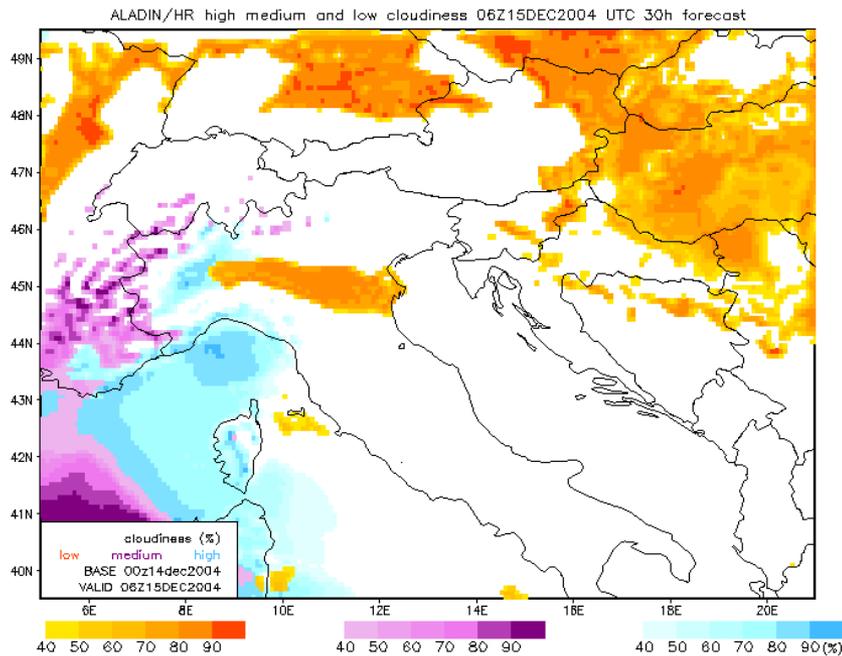
- Low, medium and high cloudiness, with **operational radiation (left)** and **NER (right)**, **random maximum** overlap using **Xu-Randall cloudiness** scheme and new critical relative humidity profile, 30 hour forecast starting 00 UTC 14th December 2004.



- Low, medium and high cloudiness, with **operational radiation (left)** and **NER (right)**, **random overlap** using **Xu-Randall cloudiness** scheme with new critical relative humidity profile, 30 hour forecast starting 00 UTC 14th December 2004.

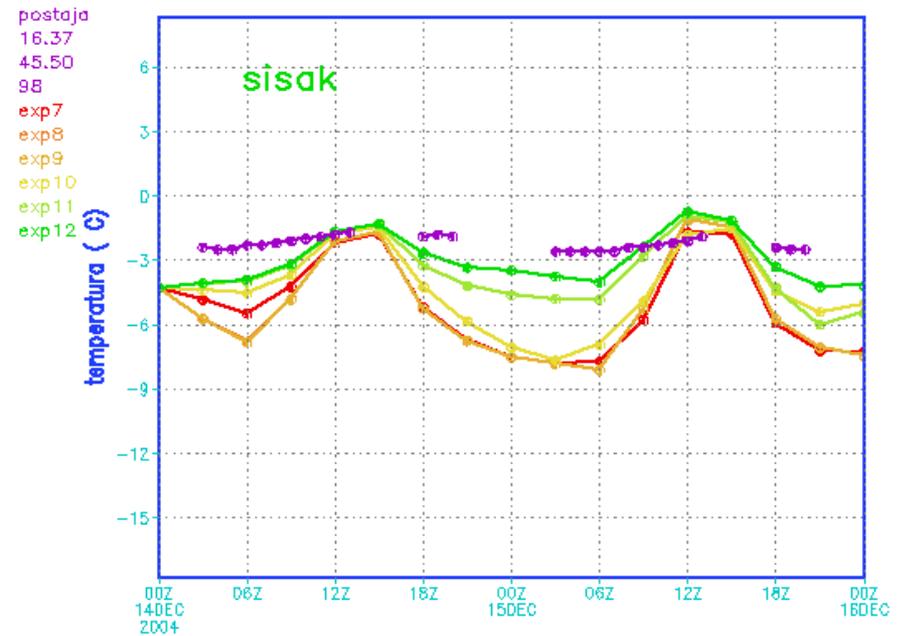
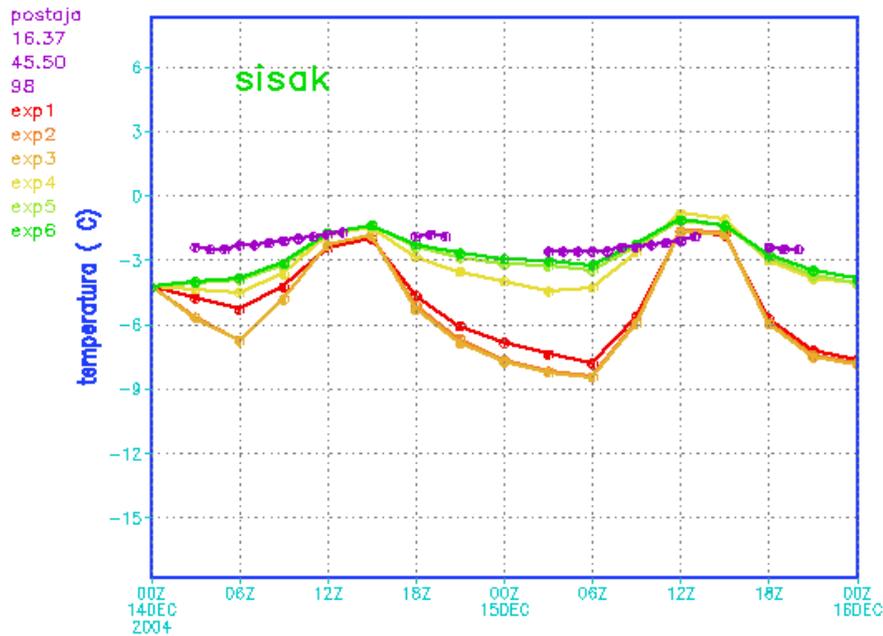


- Low, medium and high cloudiness, with **FMR radiation scheme** called with 1 hr interval, with **maximum** (left) and **random overlap** (right) and **Xu-Randall cloudiness** scheme with new critical humidity profile, 30 hour forecast starting 00 UTC 14th December 2004.



- Low, medium and high cloudiness, with **FMR radiation scheme** called with 3 hr interval, with maximum (left) and random overlap (right) and **Xu-Randall cloudiness** scheme with new critical humidity profile, 30 hour forecast starting 00 UTC 14th December 2004.

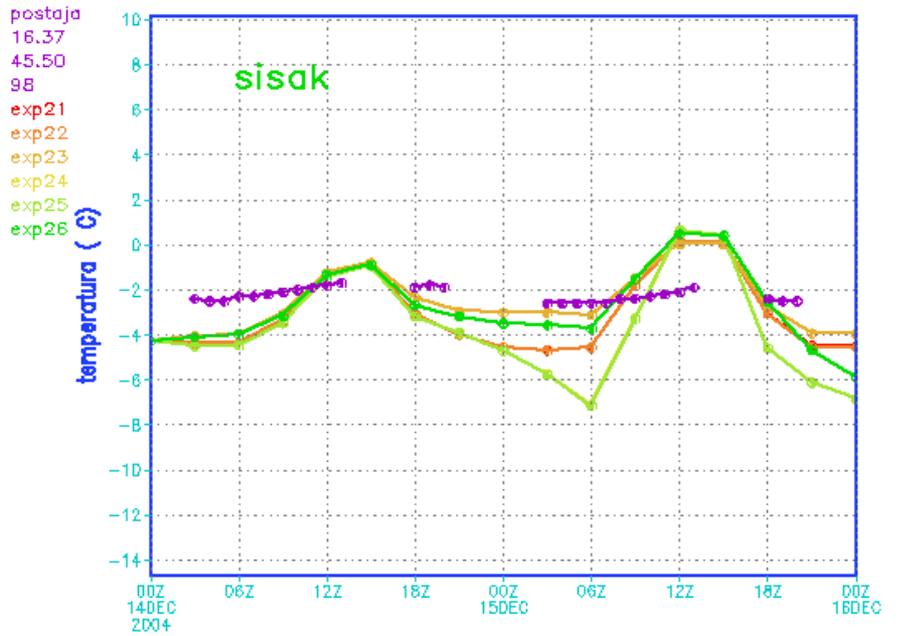
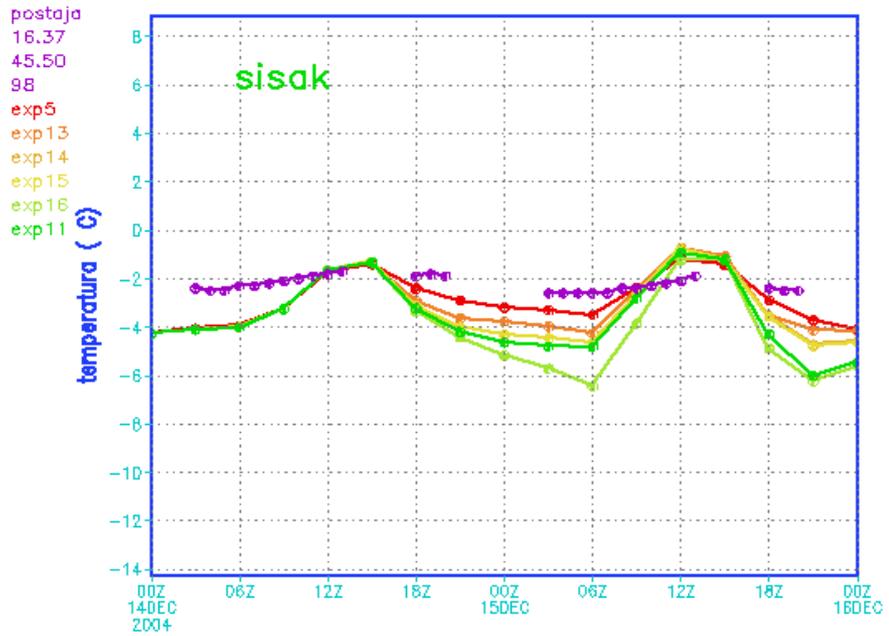
Comparison to measurements



- Comparison of the modelled 2m temperature evolution for 00 UTC run on 14th December 2004 with measured data from synoptic station with operational random scheme (left) and including NER (right).

reference
 rand max
 rm+new RH
 XR cloud
 random
 old RH

Comparison to measurements (2)

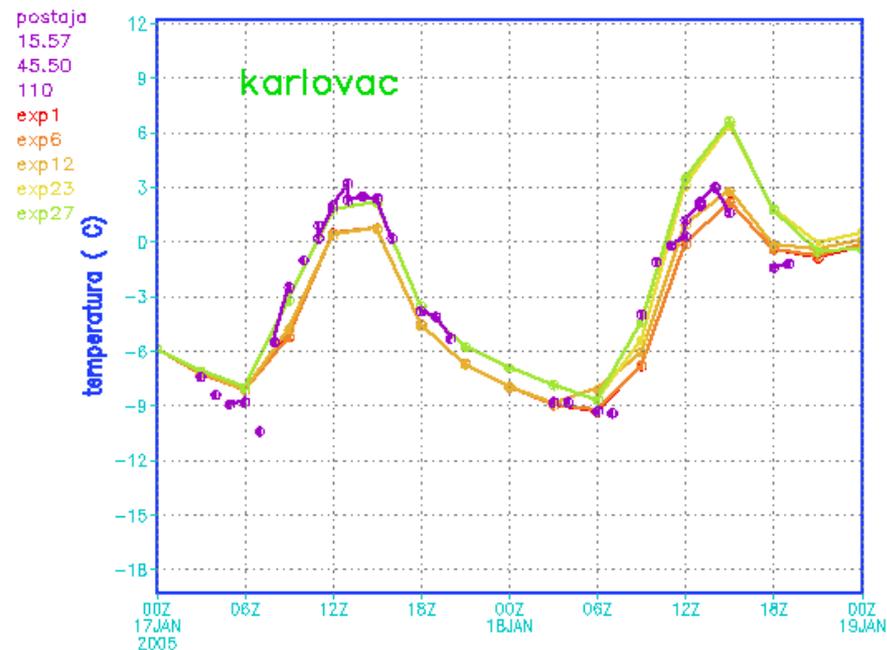
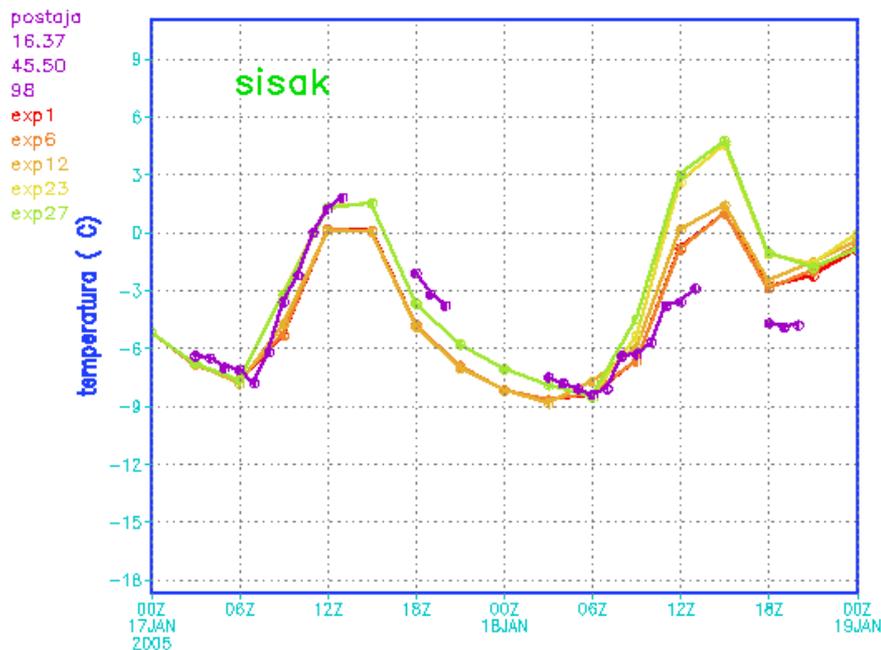


- Comparison of the modelled 2m temperature evolution for 00 UTC run on 14th December 2004 with measured data from synoptic station with only parts of NER FMR (right).

reference
LRMIX
LRPROX
LRSTAB
LRTDL
NER

max, 1hr
r-max, 1hr
rand, 1hr
max, 3hr
r-max, 3hr
rand, 3hr

No clouds



- Comparison of the modelled 2m temperature evolution for 00 UTC run on 14th December 2004 with measured data from synoptic station

oper
XR cloud
NER
FMR, 1hr
FMR, 3hr

Results

- New relative humidity profile only slightly increases low cloudiness.
- Random maximum overlap significantly reduces the amount of clouds and amplified the diurnal variation of temperature when compared to the random overlap results.
- Xu-Randall cloudiness scheme gives more clouds and improves 2m temperature forecast.
- More sophisticated radiation schemes did not improve results.

Summary and conclusions

- Unsatisfactory model forecast in fog has encouraged a study of alternative radiation and cloudiness schemes combined with different cloud overlap assumptions.
- The parameterization of cloudiness seems more important than the radiation parameterization for better forecast of 2m temperature.