Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Impact of the latent heat nudging on the soil moisture

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- Experiment: 18 months (April 2009 – August 2010) COSMO-DE without LHN
  → compare with operational COSMO-DE with LHN
- Main focus: – influence of LHN on soil moisture ?
  – feedback of soil moisture e.g. on precipitation forecast ?

impact on soil moisture

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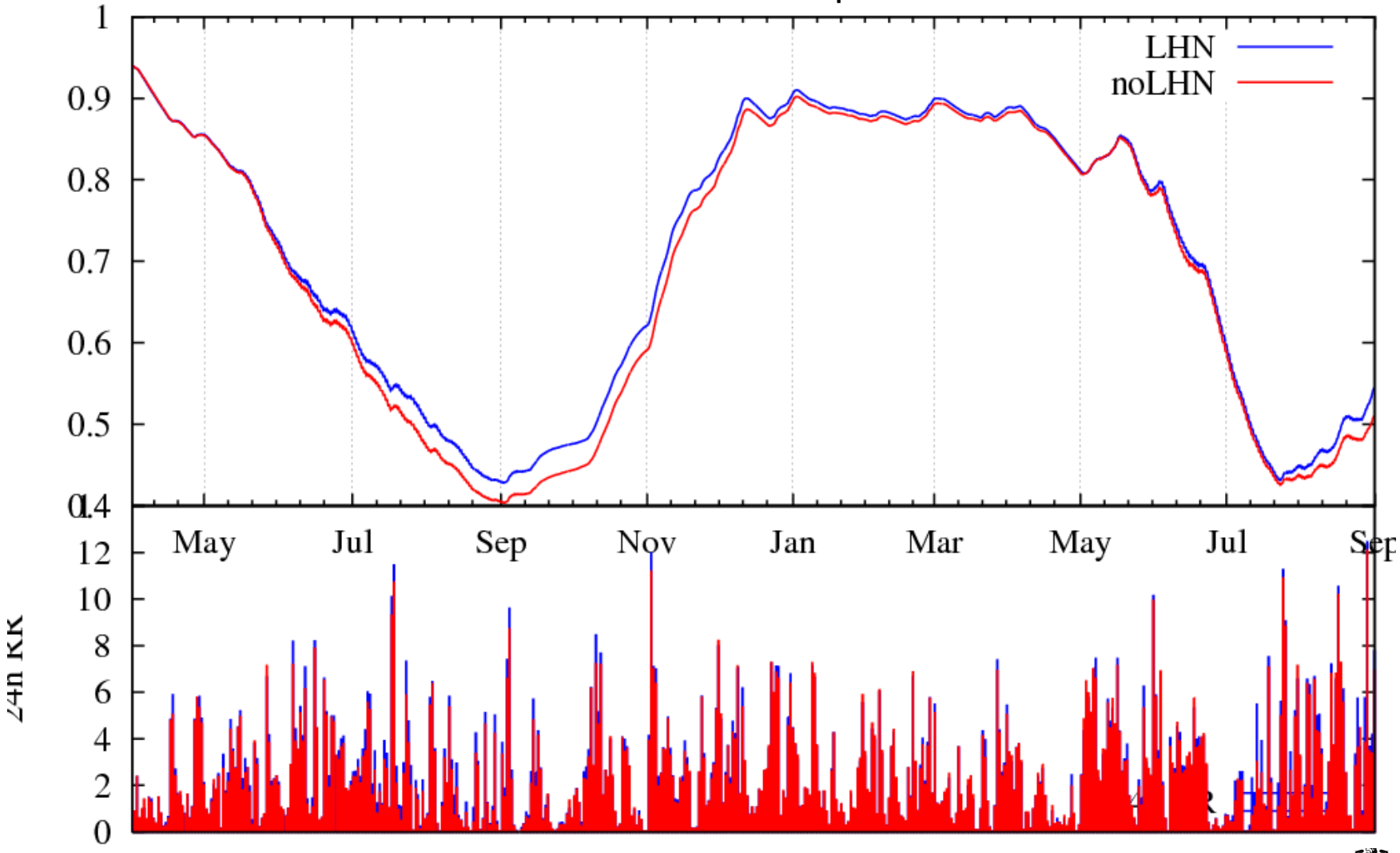
normalised soil moisture at 54 cm depth in COSMO-DE domain



impact on soil moisture

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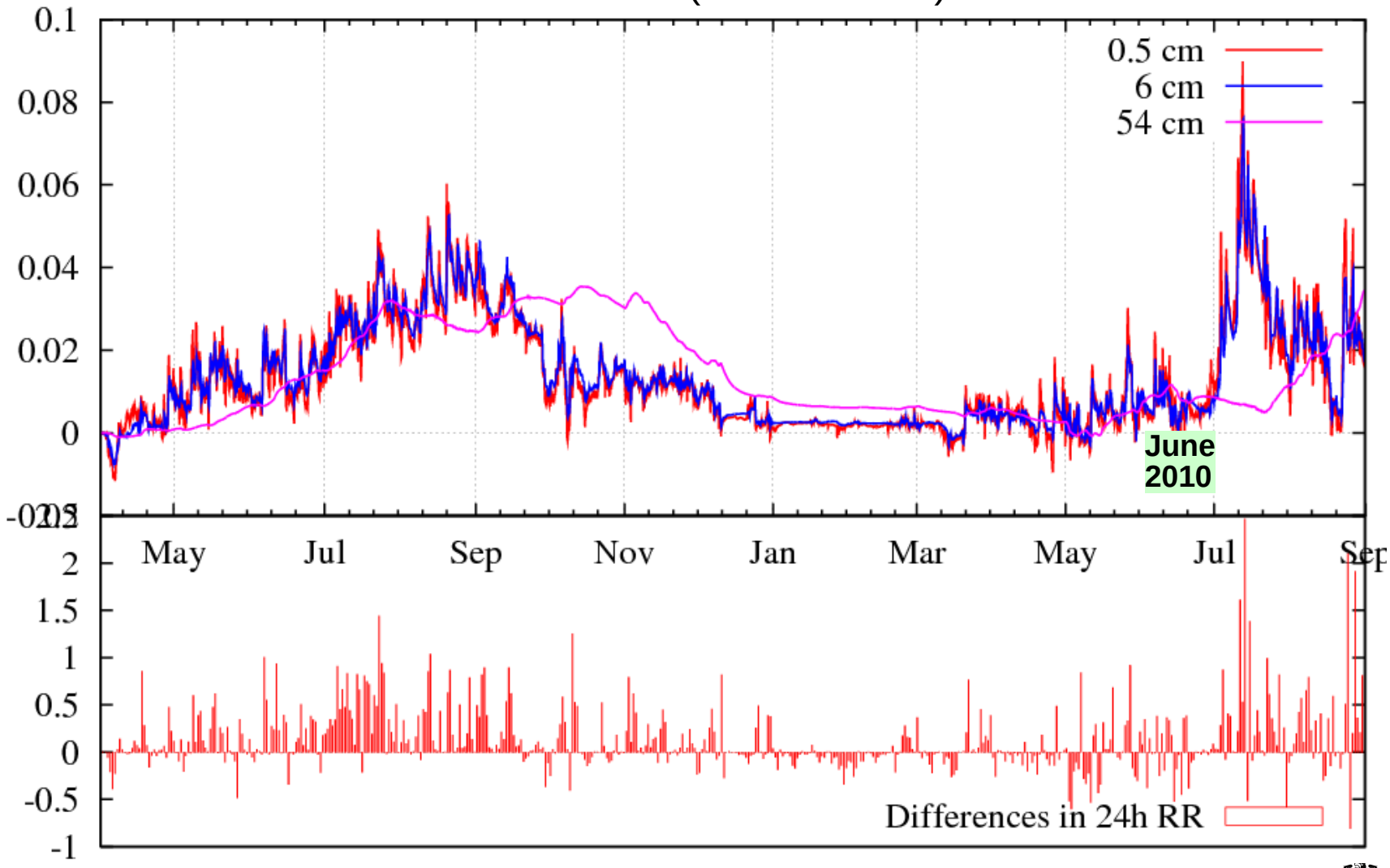
differences in norm. soil moisture (LHN - noLHN) in COSMO-DE domain



impact on soil moisture

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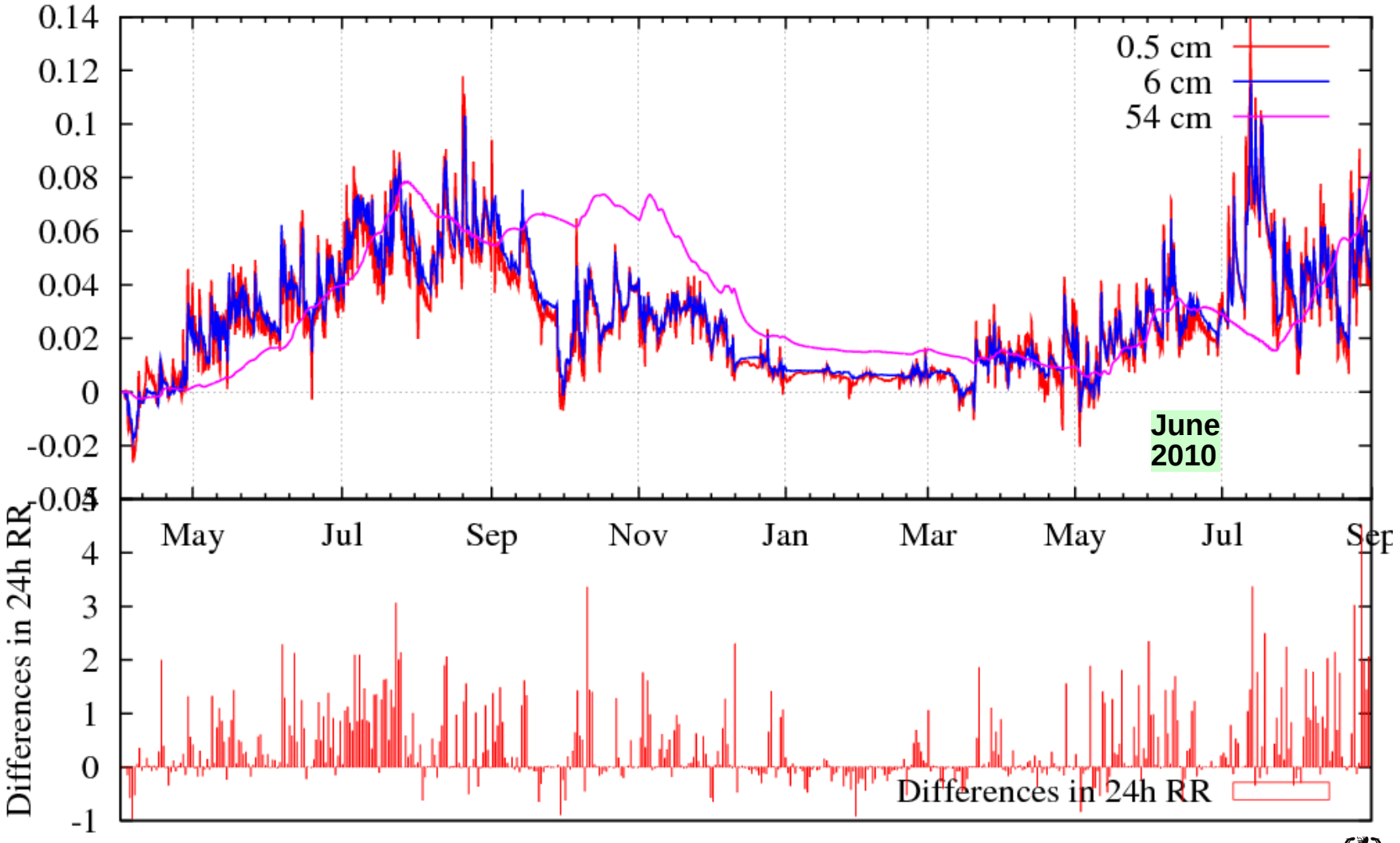
differences in norm. soil moisture (LHN - noLHN) inside radar data domain



impact on soil moisture

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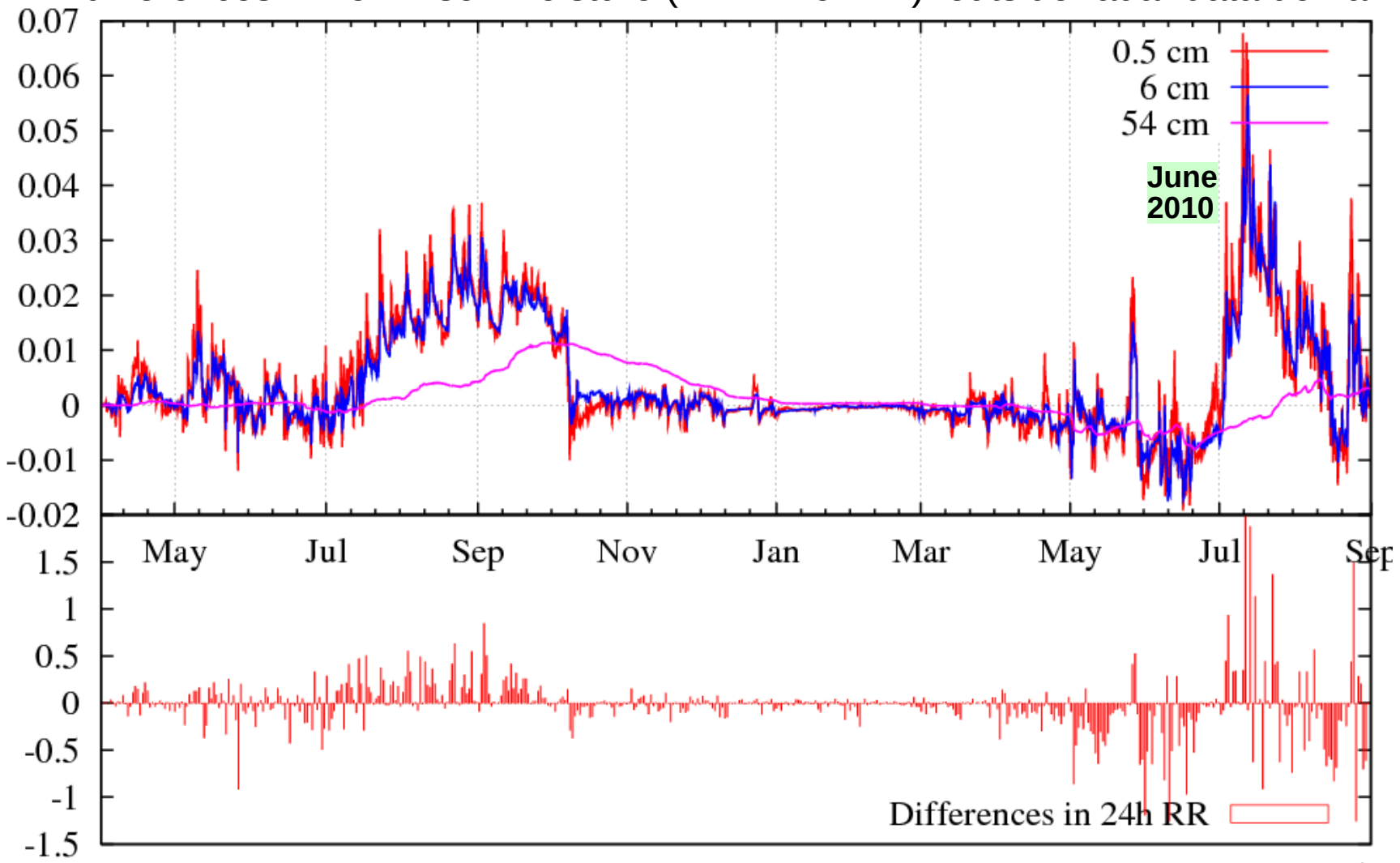
differences in norm. soil moisture (LHN - noLHN) outside radar data domain



impact on soil moisture

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- summer: without LHN, precip is underestimated,
  and soil tends to dry too much
- winter: without LHN, COSMO-DE produces slightly more precipitation,
  deficit in soil moisture is reduced (but not eliminated within radar domain)
- impact on soil moisture is not limited to radar data domain (i.e. LHN domain)

impact on surface parameters

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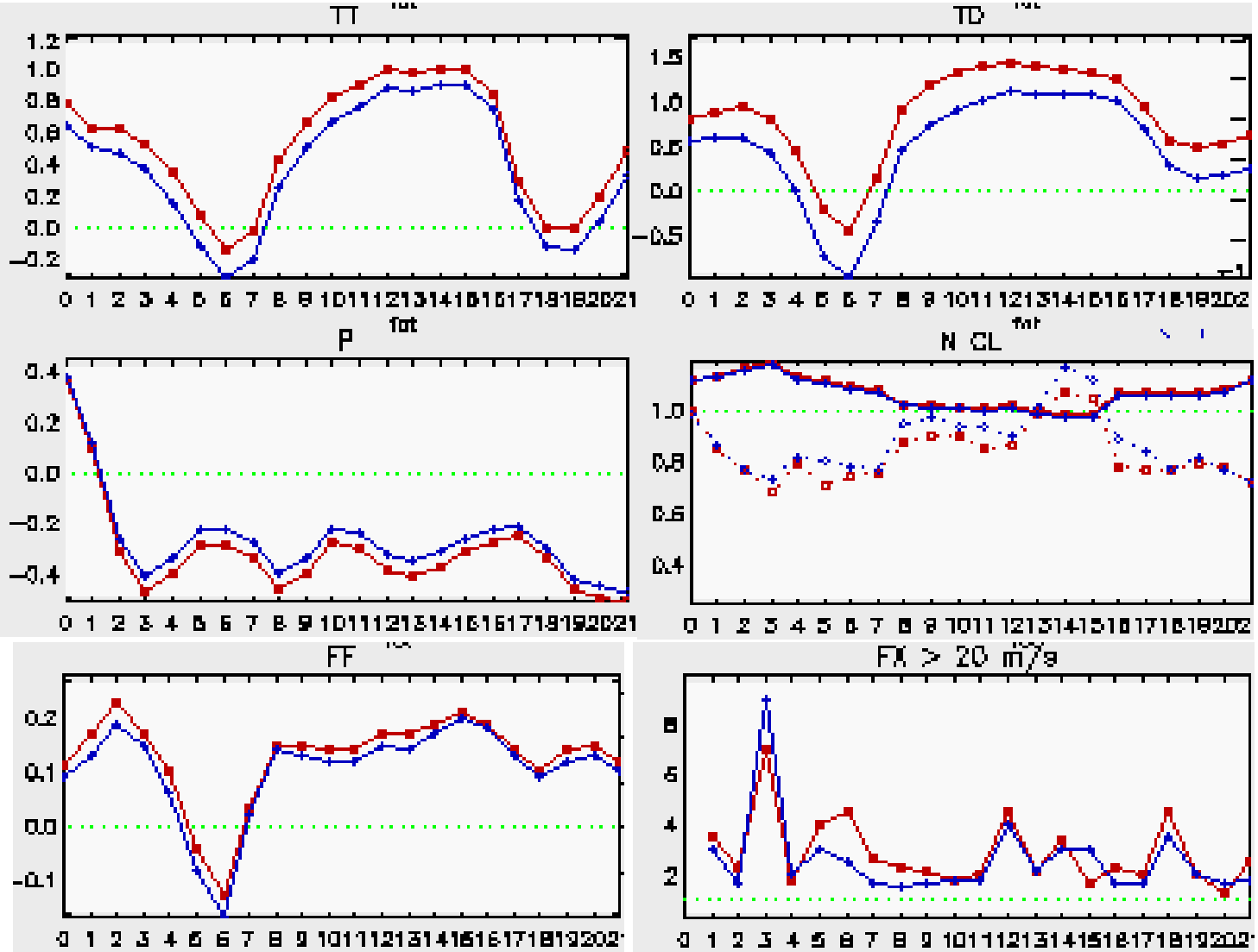
June 2010,

12 UTC runs

BIAS

LHN
noLHN



impact on surface parameters

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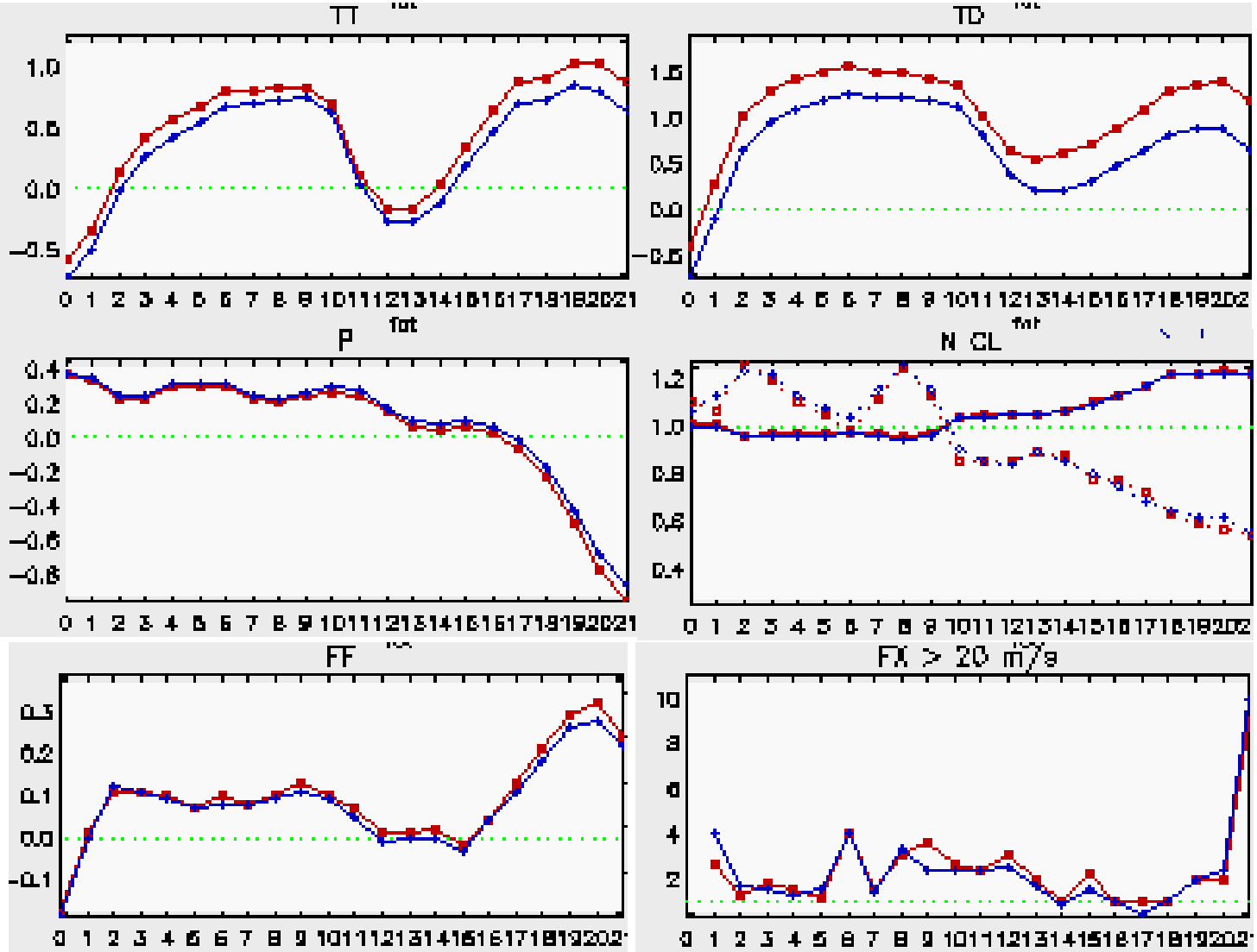
June 2010,

18 UTC runs

BIAS

LHN
noLHN



impact on surface parameters

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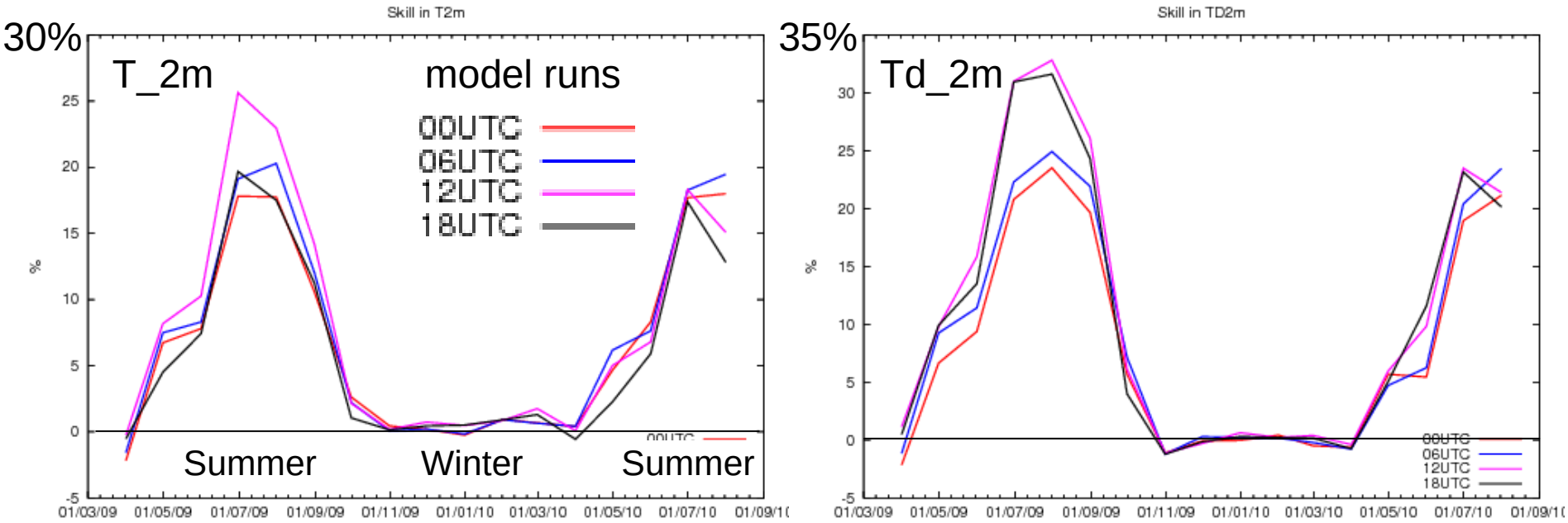
monthly relative forecast skill (1 – rmse(LHN) / rmse(noLHN))

for 2-m temperature, 2-m dew point depression , March 2009 – August 2010



→ the higher soil moisture content due to LHN leads to improves T-2m , Td-2m forecasts, benefit lasts over whole forecast time

impact on precipitation

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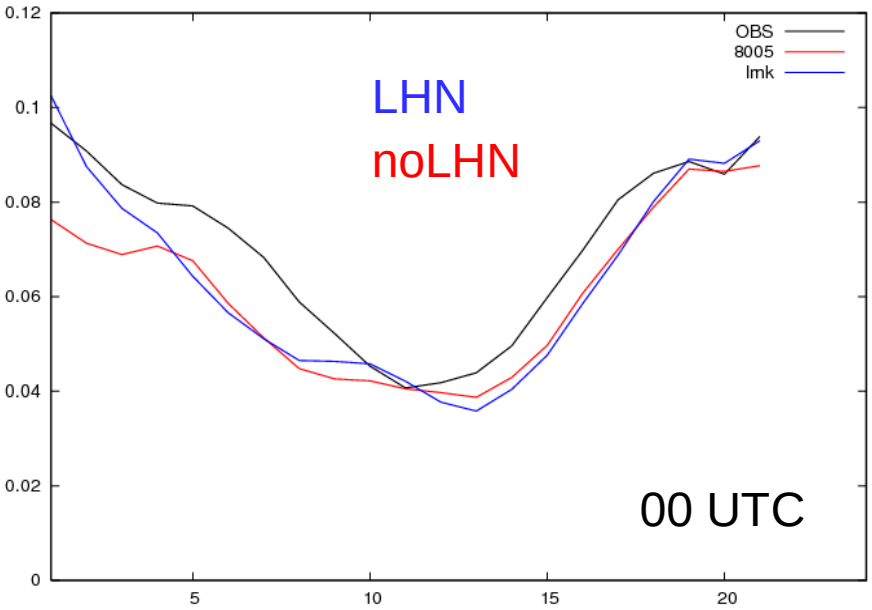
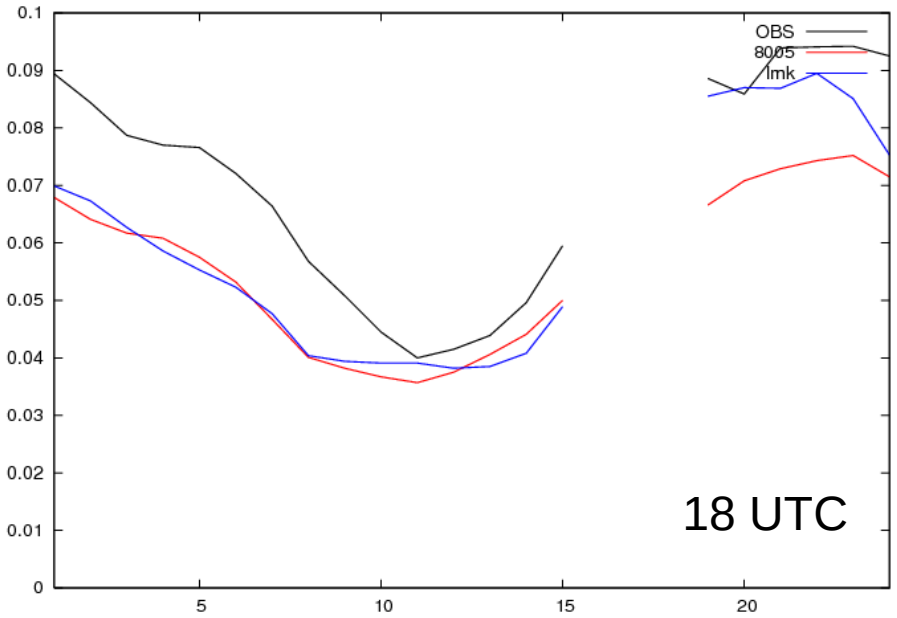
diurnal cycle of precipitation (compared to radar) , June 2010

00 / 18 UTC runs





→ improvement (increase) in first few hours of forecast

impact on precipitation

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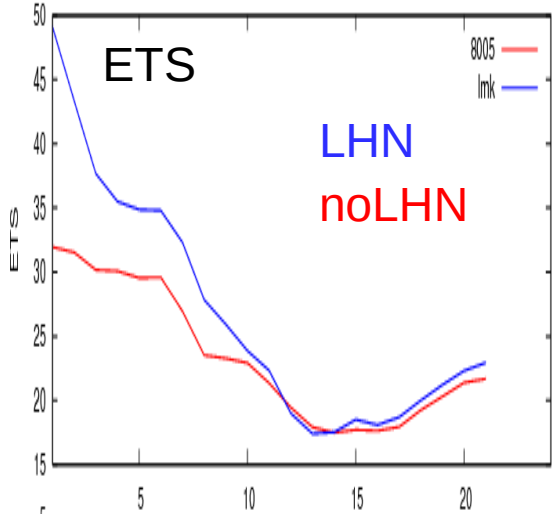
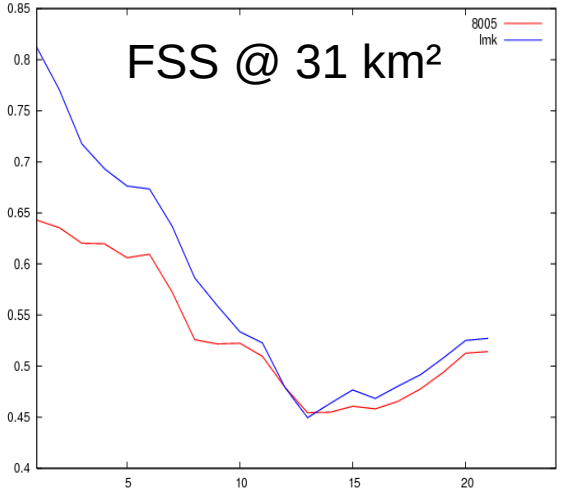
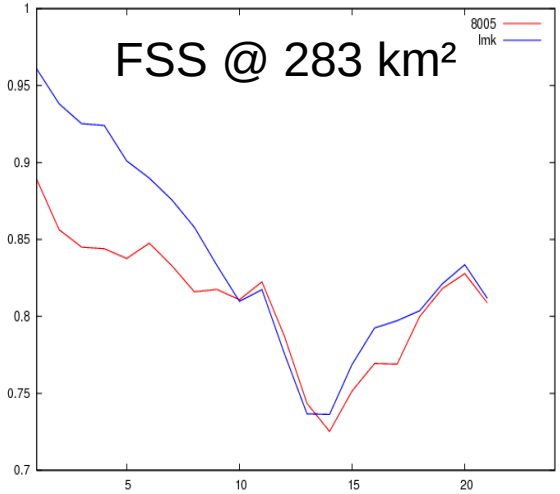
June 2010 , 00-UTC runs

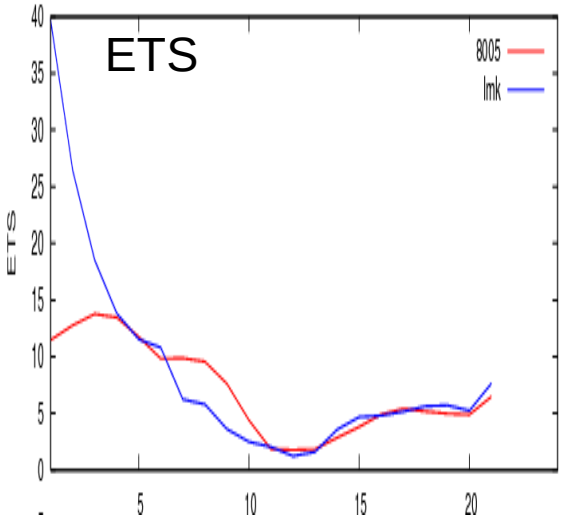
0.1 mm/h

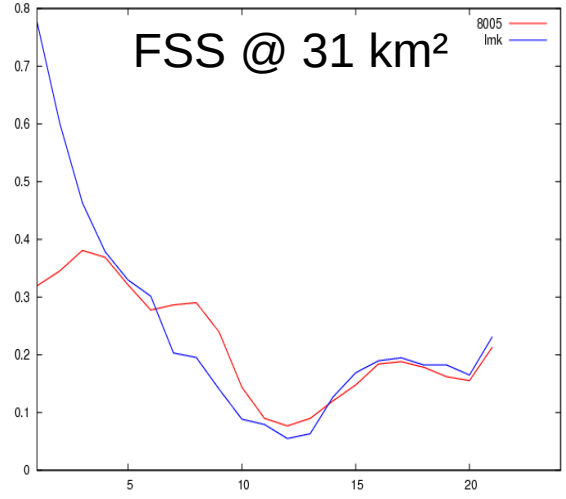


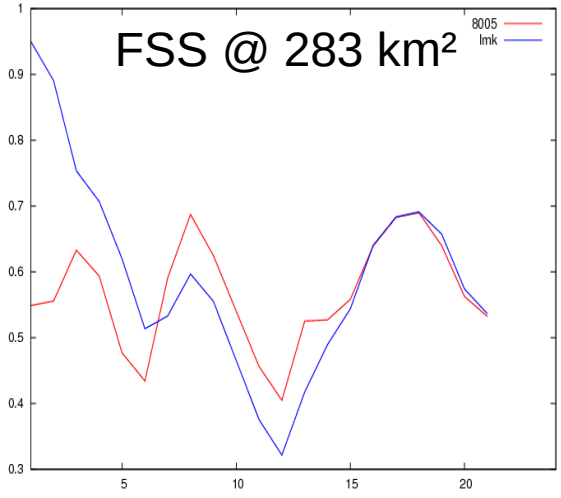




2.0 mm/h







impact on precipitation

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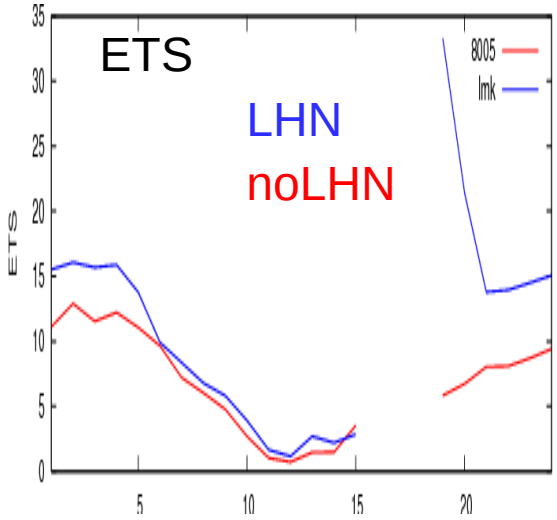
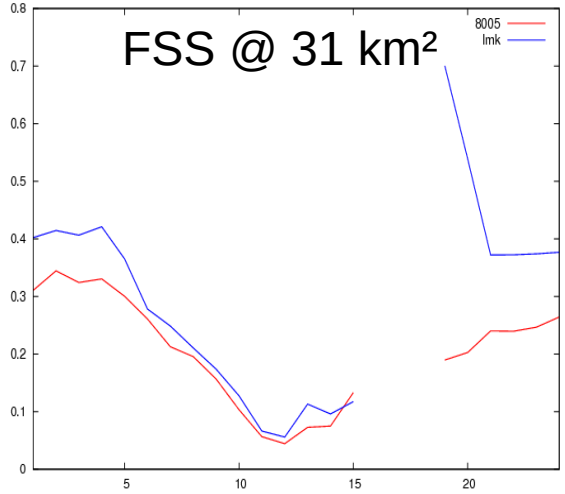
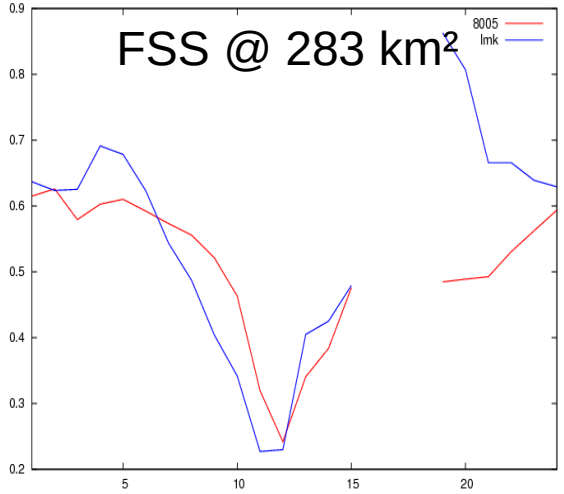
2.0 mm/h

June 2010

18-UTC runs

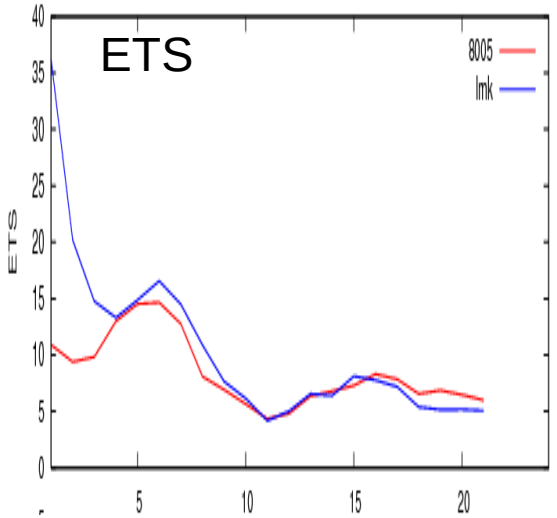


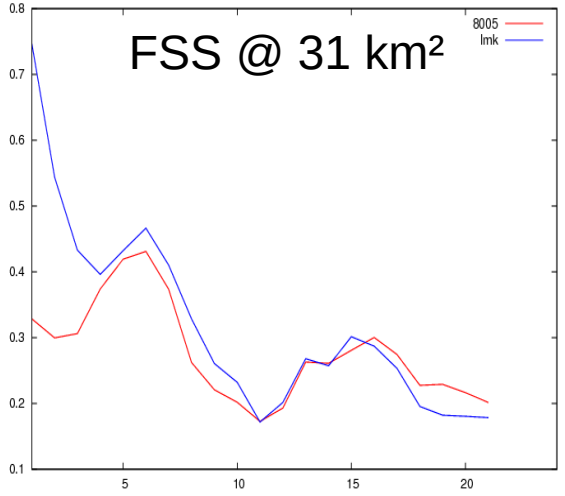


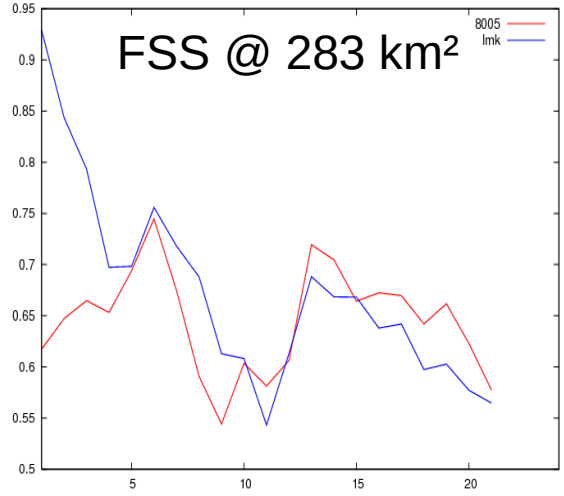


July 2010

00-UTC runs







feedback of improved soil moisture on precipitation

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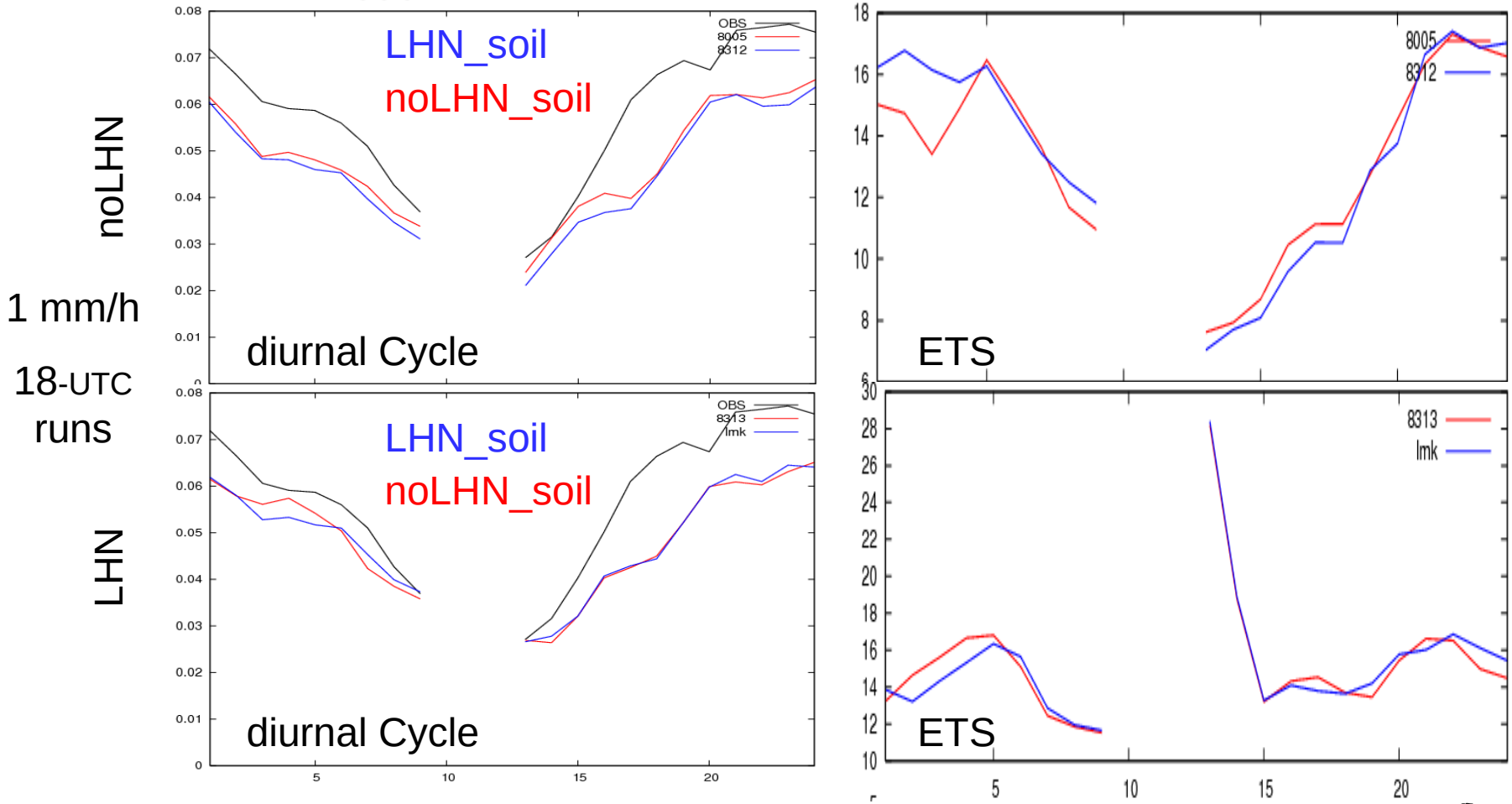
2 cross experiments in order to evaluate impact of soil moisture (June 2010):

- LHN runs starting with noLHN soil moisture at the first assimilation
- noLHN runs starting with LHN soil moisture at the first assimilation



summary

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- LHN increases soil moisture content, particularly in summer
- increase of soil moisture improves T2m , Td2m , and other surface parameters over whole forecast lead time
- increase of soil moisture, if at all, tends to slightly (!) deteriorate precipitation forecast skill
- as known before: LHN improves precipitation in first few hours of forecast (~ 6hrs)