ID 0034

An overview of road surface conditions forecasting in Météo-France

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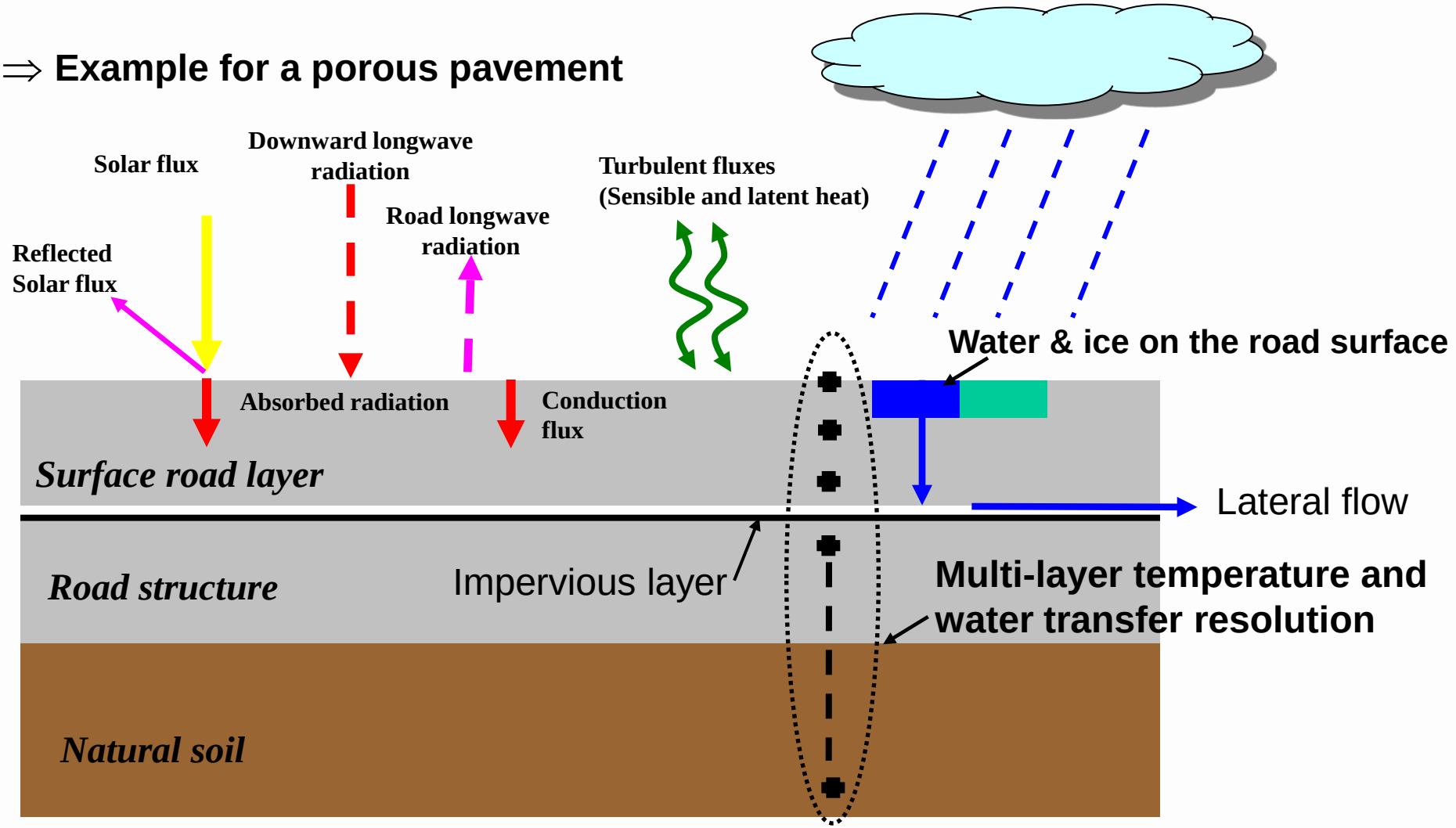
Outlook

1. **Météo-France surface models**
2. Operational Forecast products
3. Ongoing work on road weather forecast
4. Conclusions

The ISBA-Route model

⇒ **Example for a porous pavement**

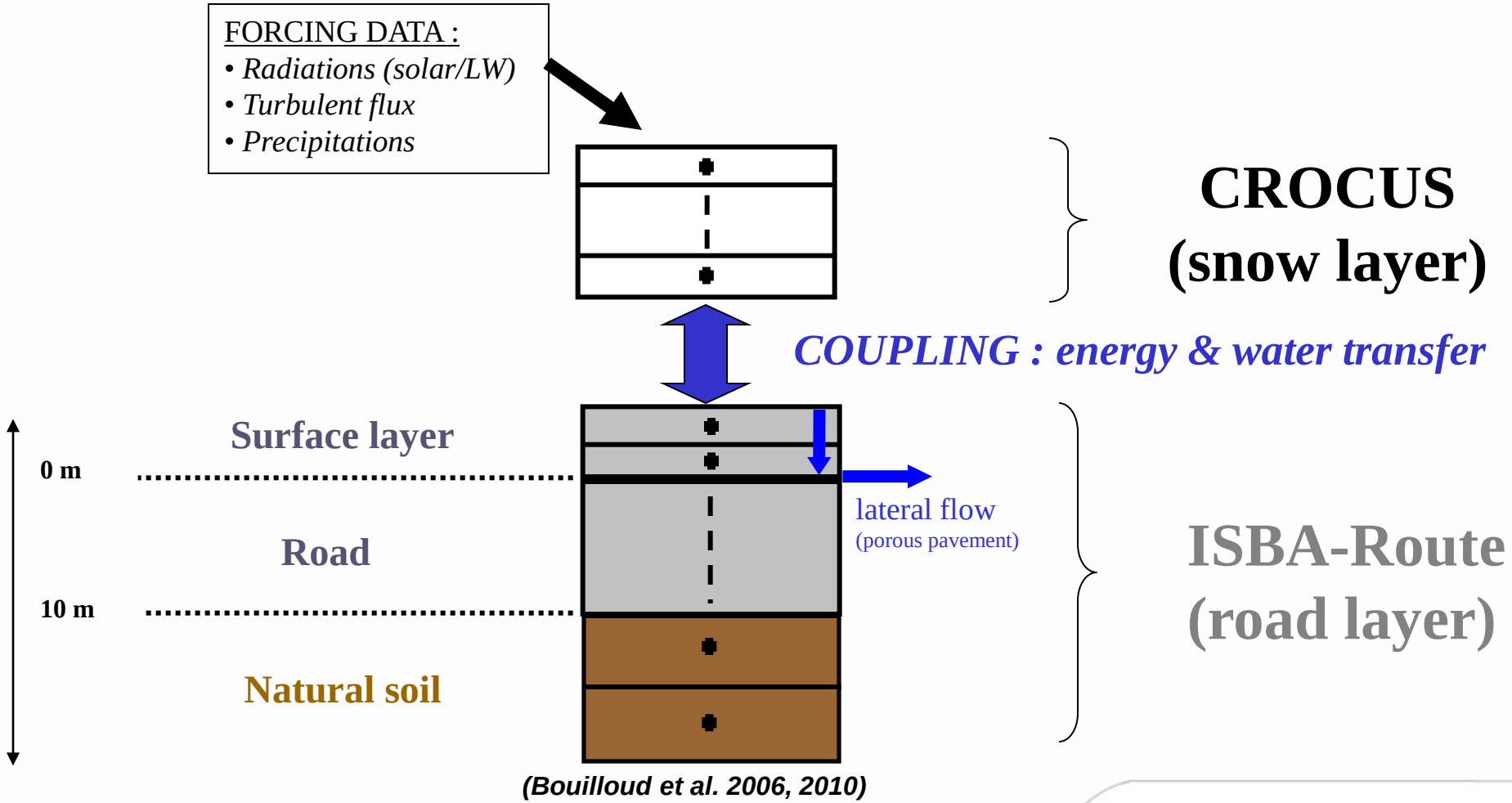


(Bouilloud 2006)

10 m temperature, water and ice profiles

The ISBA-Route/CROCUS coupled model

⇒ **CROCUS SNOWPACK MODEL is used to describe the snow layer on the road**



(Bouilloud et al. 2006, 2010)

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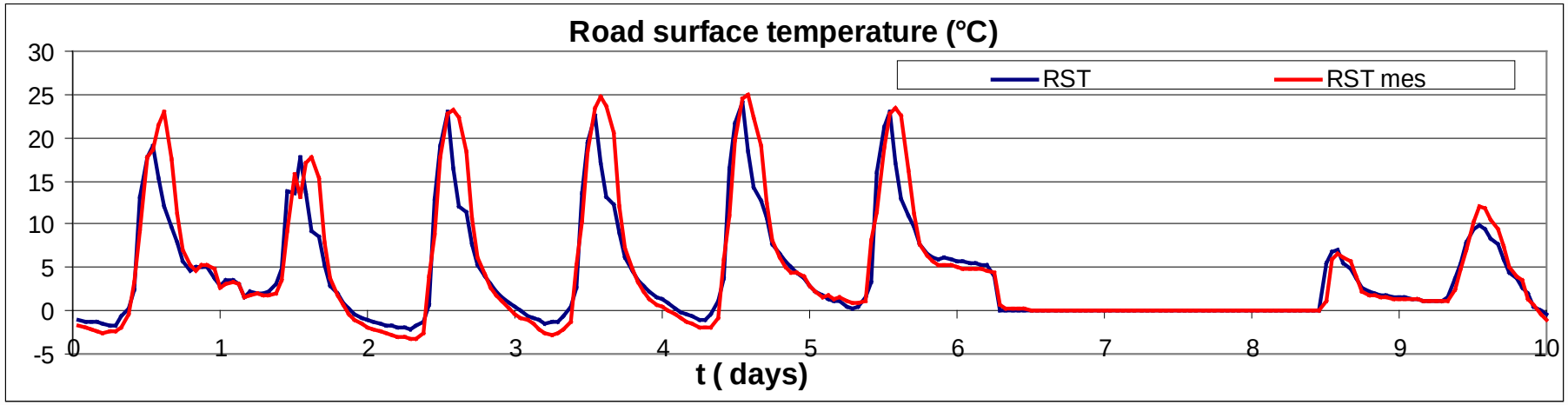
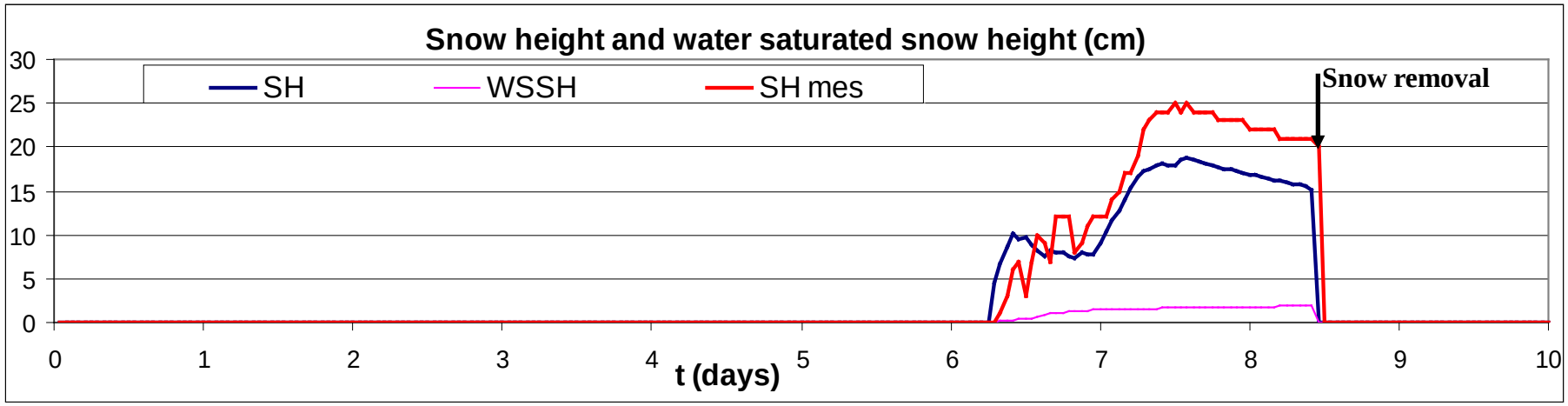
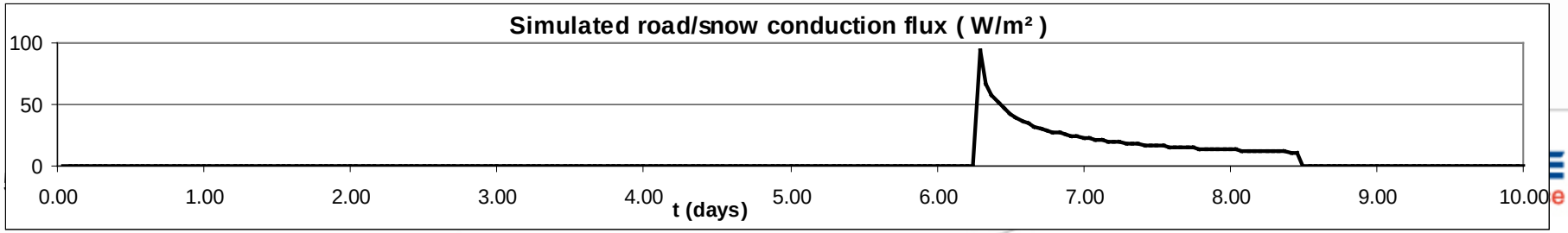
Validation on experimental site







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The SAFRAN-ISBA-Route system (SIR)

- Forecast mode of SAFRAN : Downscaling on a 8km grid of the NWP model ARPEGE

- Use of ISBA-Route for the forecast of road surface temperature over France

  - operational since 2004
  - 48h forecast range (96h since last winter)
  - 1 daily production network at 6 UTC

Limited use in 2012

The AROME-ISBA-Route system (AIR)

High-resolution mesoscale AROME model

Non hydrostatic model

High vertical resolution – 60 levels (inequally spaced)

Cloud microphysics (MesoNH)

Data assimilation (radar, satellite, surface stations)

ISBA-Route

Improvements :

- Grid resolution (2.5km) and orographic details
- No need for downscaling
- Accurate microphysic description (species of hydrometeor)
- low-level conditions (atmospheric boundary layer)
- 4 daily production network (0h, 6h, 12h, 18h) until 30h forecast range

Operational since winter 2010/2011

Statistical results

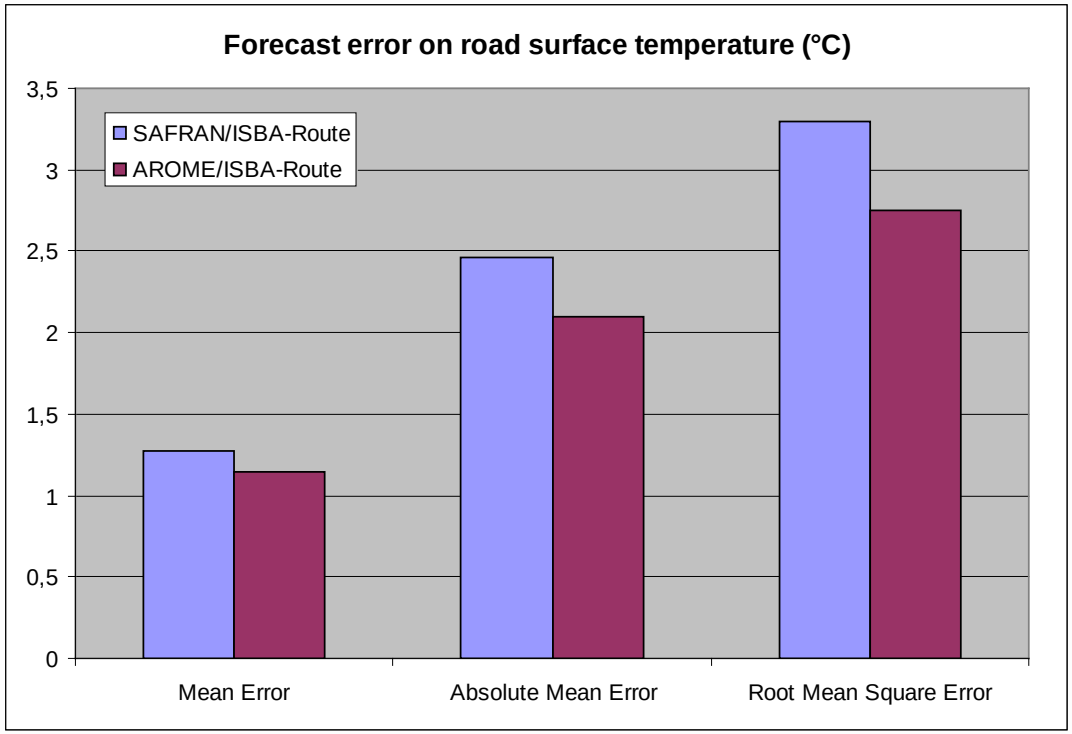
30h-Forecast scores of road Surface Temperature against 102 road weather stations (1 November 2010 - 1 April 2011)

- **Reduction of forecast errors** when new AIR system is used

⇒ Averaged RMSE reduction ≈ 0.5°C

⇒ Can reach 1°C in mountain area

- **Positive mean error (cold bias)** leading to too many forecast of the event « negative road surface temperature » with a false alarme ratio of 38%.



Need to decrease the cold bias to improve the forecast of negative road surface temperature events

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Evolution of the production : PrevExp-IR

All Models (ARPEGE,AROME, ECMWF, UK…)
Observations, ensemble forecasts…

Human forecasters national & local expertise
⇒Integrate all the improvements concerning numerical weather prediction

ISBA-Route/CROCUS model

Road surface conditions forecast

Real-time test for the 2011/2012 winter

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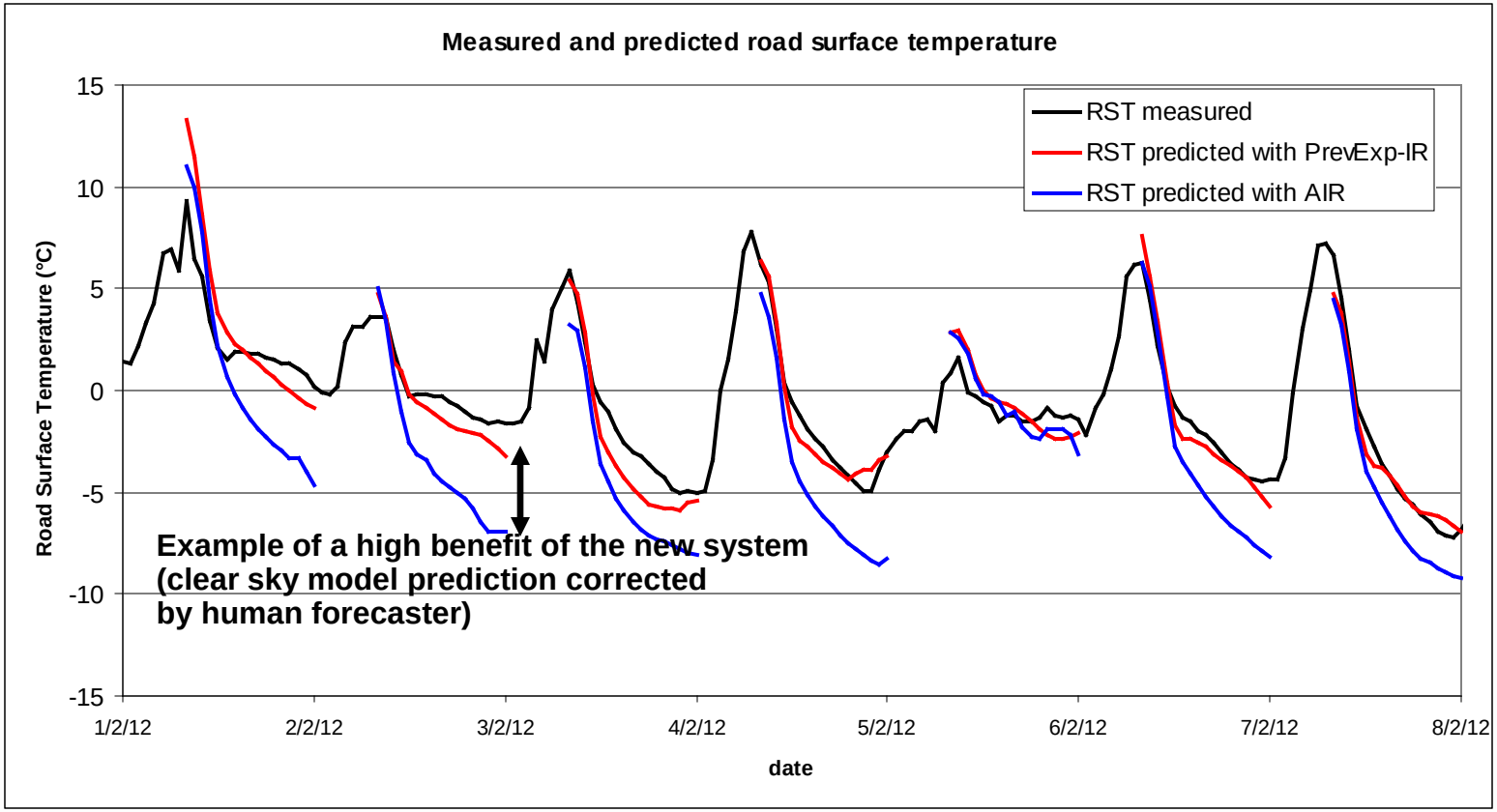
The PrevExp-IR system

Time series of observed and forecasted Road Surface Temperature (RST) for a station located in the South-West of France (February 2012)



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The PrevExp-IR system

RST Forecast scores comparison beween PrevExp-IR/AIR

example for the first night (18h-6h) forecast of the mid-day run (winter 2011/2012)

	ME (°C)	RMSE(°C)	DR (%)	FAR(%)	HSS
PrevExp-IR	**-0.1**	1.8	84	**16**	0.77
AIR	**1.2**	2.2	93	**30**	0.69

Large bias reduction & improvement of the forecast event of« Negative road surface temperature »

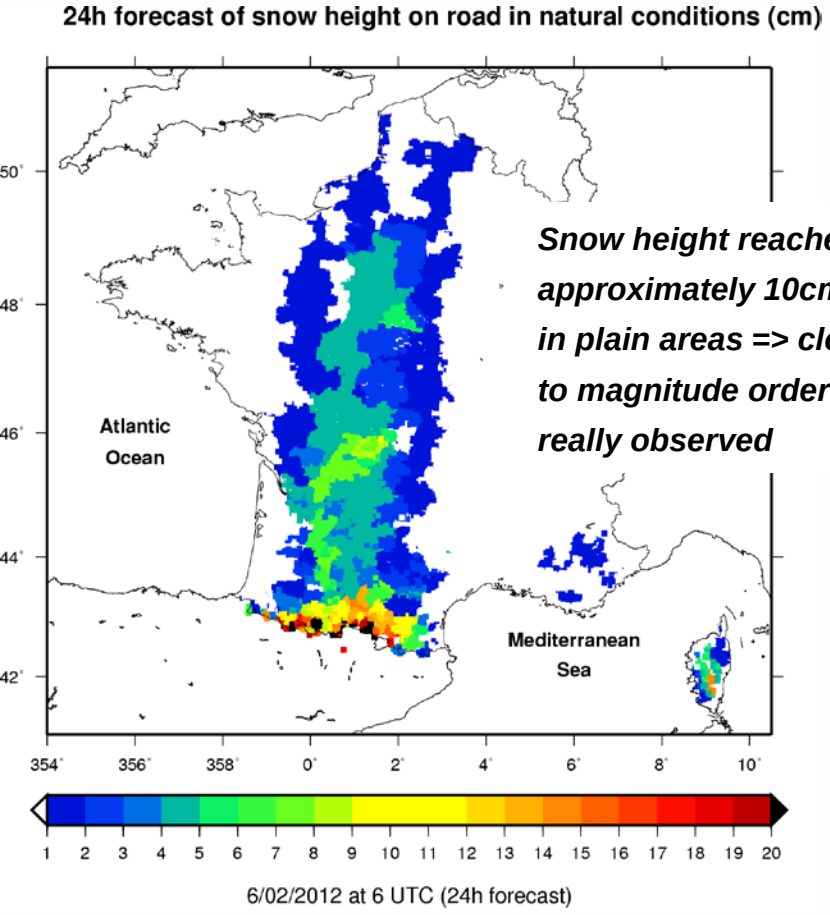
Extension of the forecast range at 3 days with good predictability of road surface temperature (no significant decrease of scores for the 2nd and 3rd night)

ME: Mean Error / RMSE : Root Mean Square Error / DR : Detection Ratio
FAR : False Alarm Ratio / HSS : Heidke Skill Score

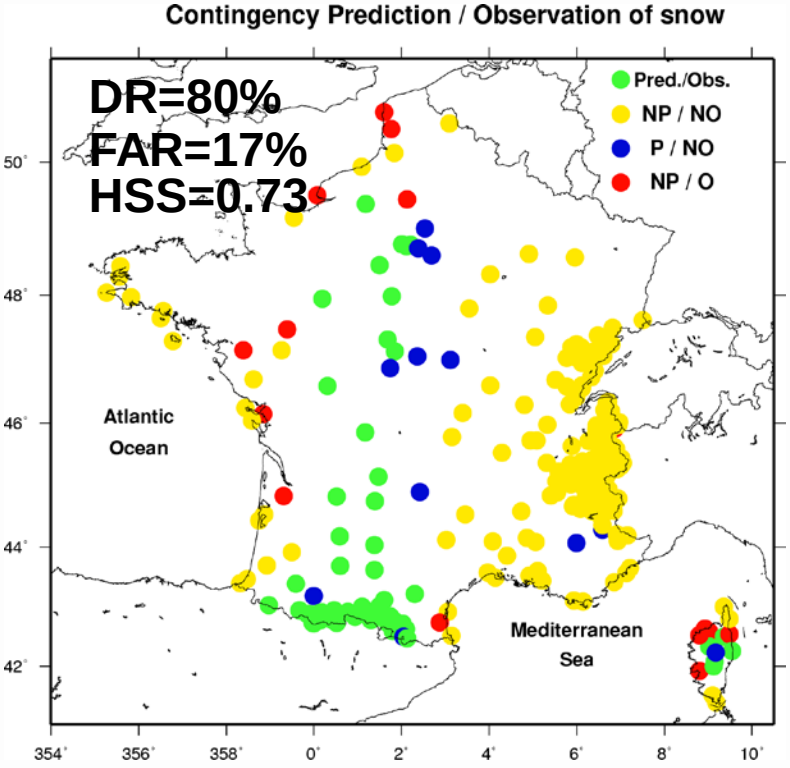
Snow height & type forecasting

Cases study of forecasted snow height on the road (February 5-6 2012)

Configuration : ISBA-Route/CROCUS model (with same atmospheric predicition as the PrevExp-IR system)



Snow height reached approximately 10cm in plain areas => close to magnitude orders really observed



Satisfactory forecast of the spatial extension of the event but with some discrepancies on the boundaries (but NP/O cases might be cases of snowmelt on road and not on natural soils with very low snow heights)

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Conclusions

- **RST forecast scores are improved when the high-resolution AROME model is coupled to ISBA-Route :**
  - ⇒ **Constant improvements provided by atmospheric modeling research groups**

- **Human forecasters expertise has been introduced in the forecast process**
  - **Improvement for the 3 days forecast range**
  - **Large reduction of false alarms ratio and cold bias**

⇒ **New product in operations will be available next winter**

- **Forecast of Snow height & type on the road using a new detailed model**

⇒ **Real time evaluation during next winter before an operationnal use**

- **All these developments will be integrated into the geolocalised information system dedicated to nowcasting and forecasting for the French road sections : OPTIMA**

Thank you

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Local road surface temperature forecast

local measurements from RWIS to improve forecast scores

Bias correction : statistical adaptations using climatologies
Correction of initial road temperature profiles with real time integration of RWIS measurements in Météo-France database

Main results :

⇒ Reduction of the RMS errors for the full RWIS sample

- **- 0.6°** for the 6h-forecast range
- **- 0.25°** for the 30h forecast range

⇒ Low reduction of the RMS errors with only road surface temperature measurement but can reach **- 0.4°** for the 30 h forecast range for RWIS with deep measurements

⇒ High potential for nowcasting applications

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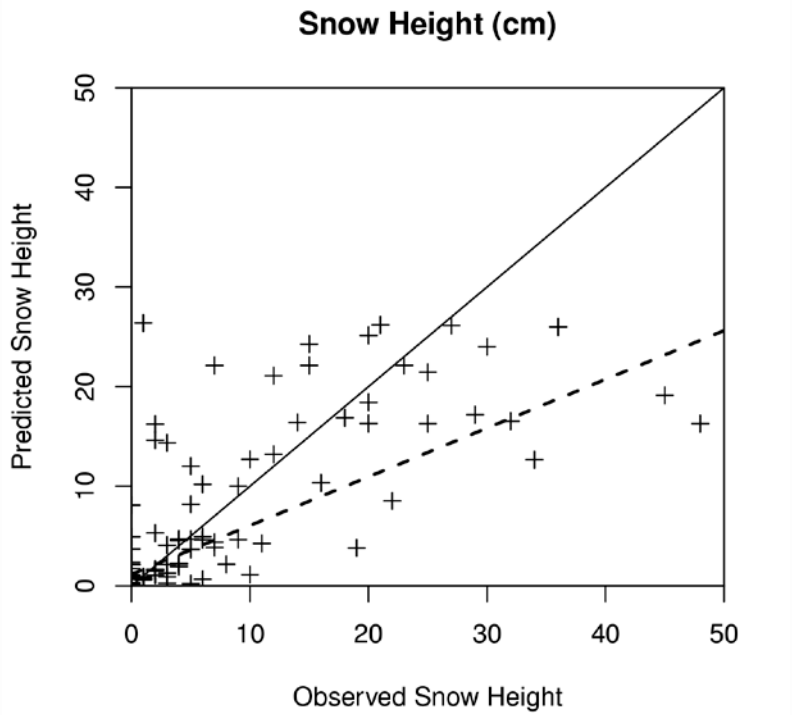

Underestimation of the predicted snow height but for winter maintenance the prediction of a low snow height (some cm) is informative

Need to perform a better evaluation with comparison of the same parameters (i.e. observed snow height on road)

Agreement between prediction of snow height on road in natural conditions (i.e without accounting for trafic, snow removals or de-icers) and observations of snow on natural soils => Informative prediction