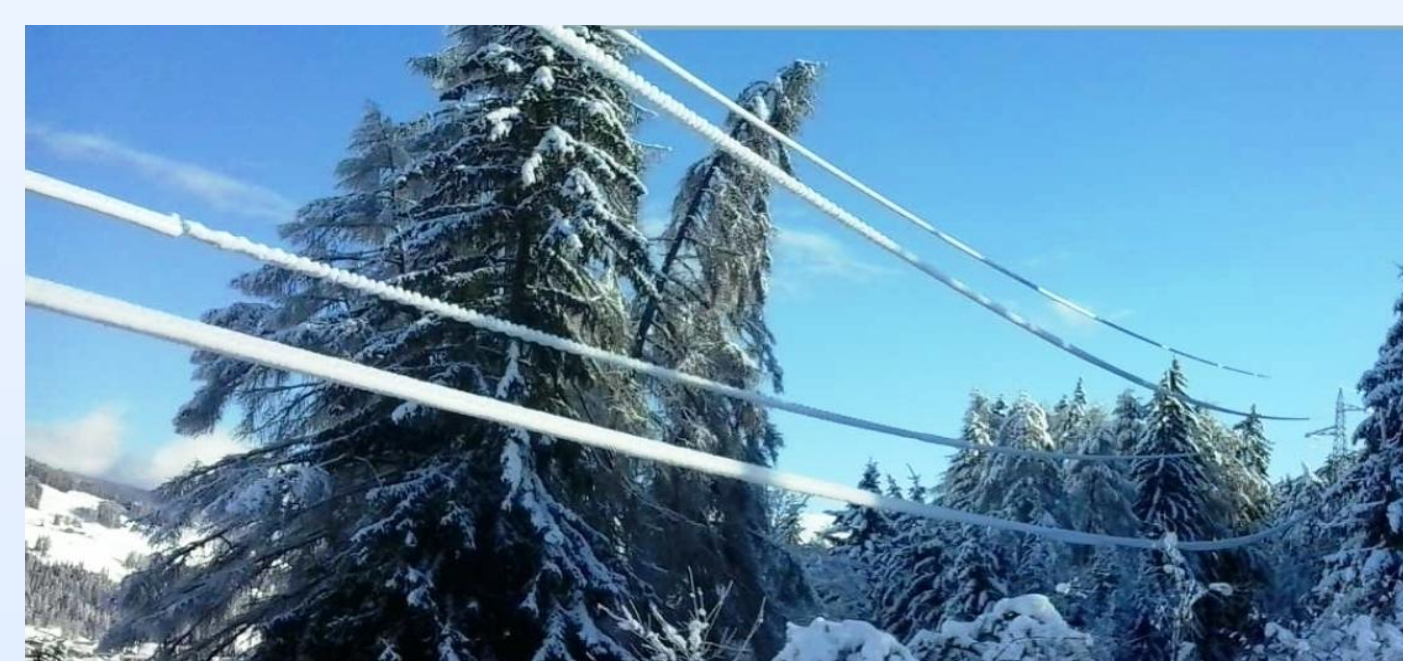


◆ Motivation

Strong wet-snowfall are the major cause of blackouts for the Italian Overhead Lines. The cost of damages is greater than **€200 million/year**. RSE, in collaboration with the Italian TSO TERNA, is carrying out a research activity on issues of prediction, monitoring and mitigation of the wet-snow formations for the overhead lines based on two primary strategies :

- **Predictive system.** Wet-snow Overload aLert and Forecasting –**WOLF**- is based on NWP, wet-snow accretion model and thermal models for the anti-icing current simulation.
- **Test site.** Wet snow Ice Laboratory Detection –**WILD**- has been designed for monitoring snow accretion on conductors, verification of weather forecast and testing innovative coatings.

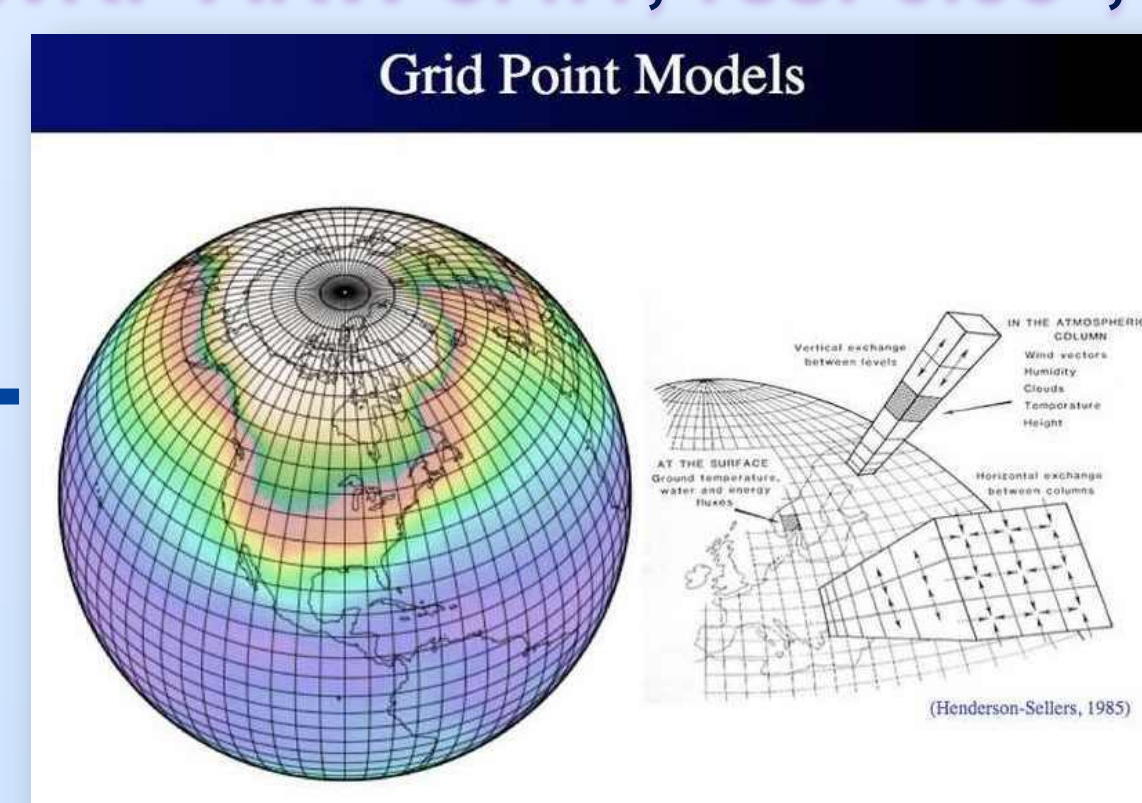


Wet-snow sleeve accretion on
132 KV Overhead Line

Northeast of the Alps
December 2014

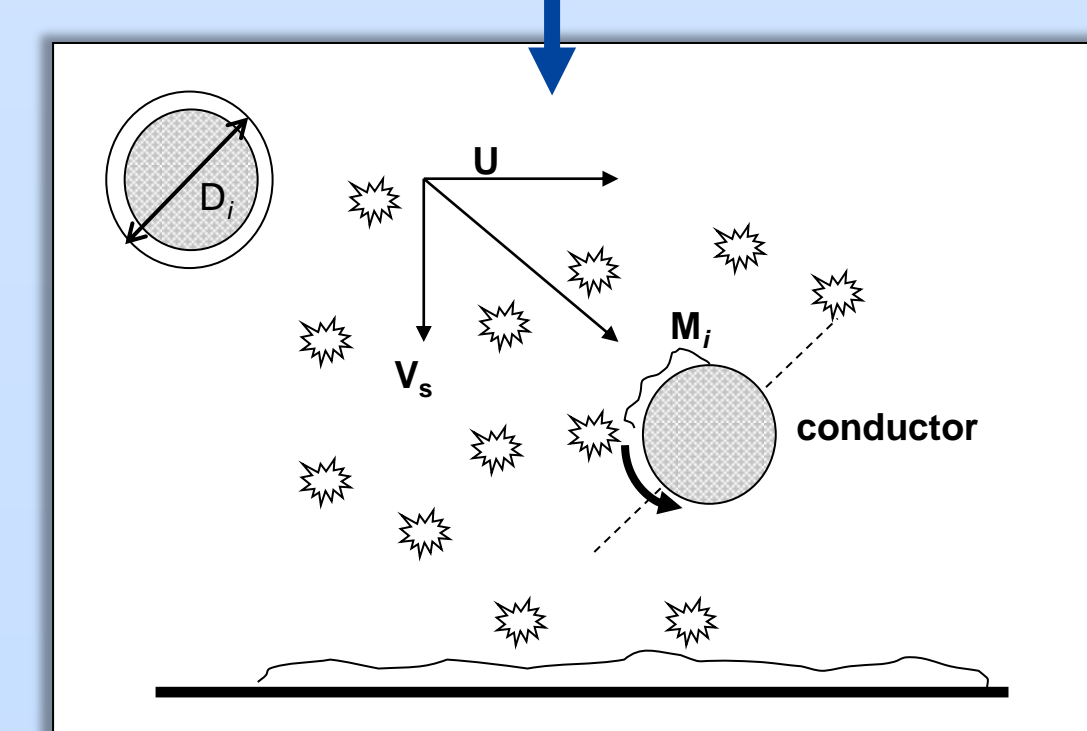
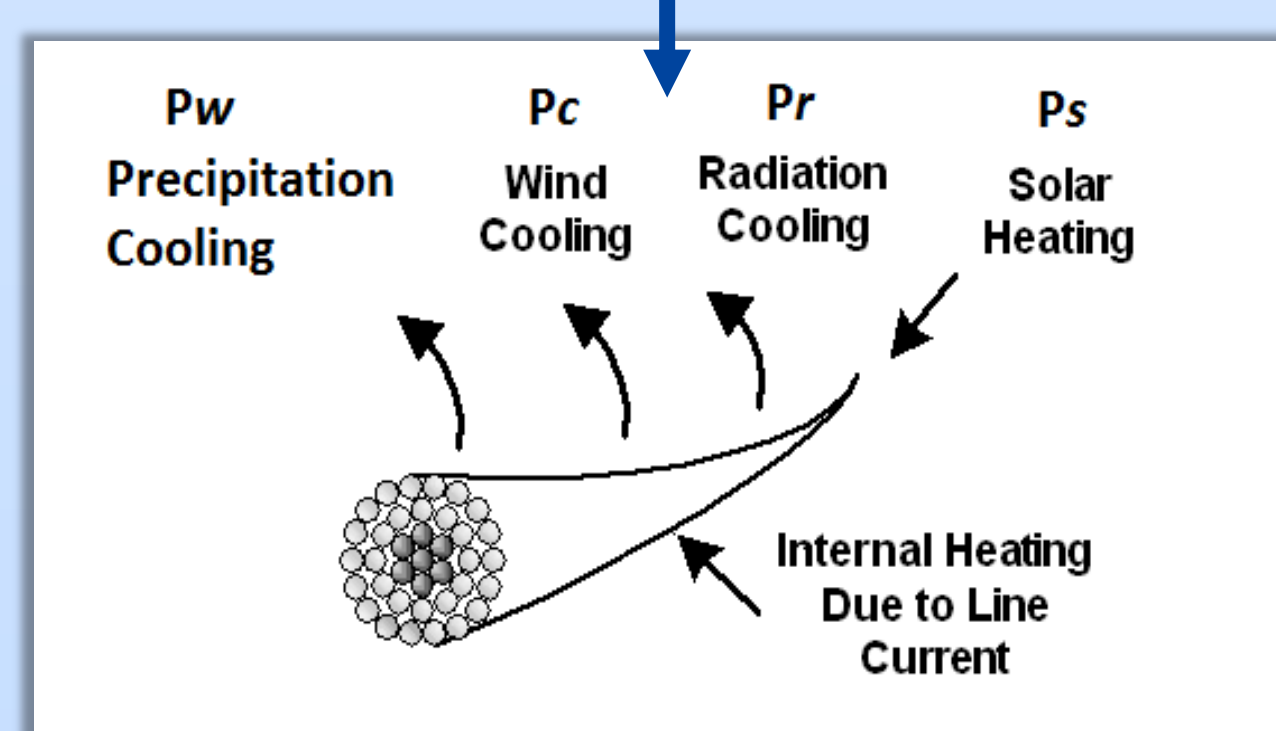
◆ WOLF structure

IC/BC: ECMWF, res:0.125°
RAMS ; WRF ARW 3.4.1; res: 0.05°; vert. lev: 36



Thermal Model
[Shurig & Frick]

Accretion Model
[ISO12494-2000]



$$I = \sqrt{\frac{P_c + P_w + P_r - P_s}{R}}$$

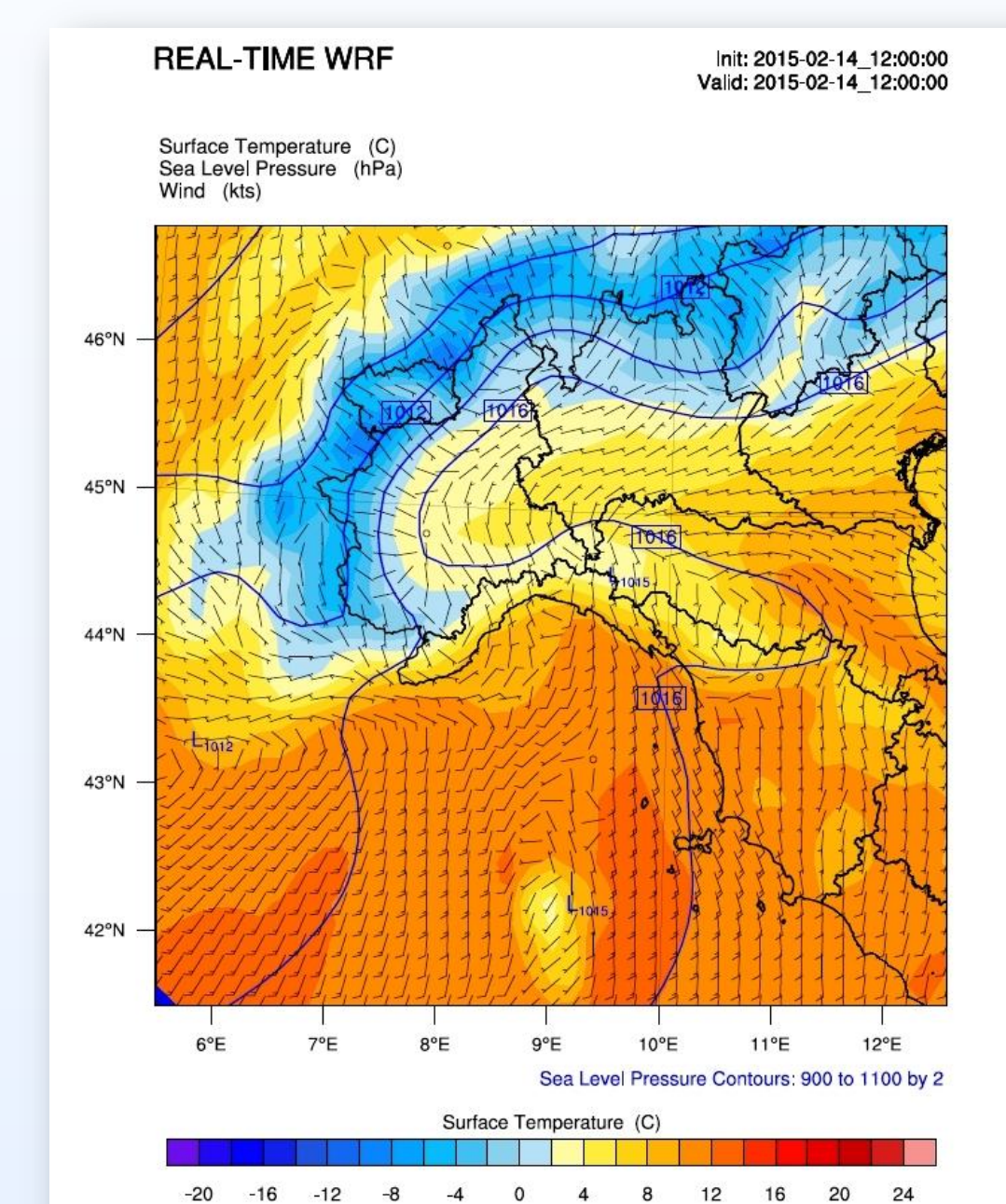
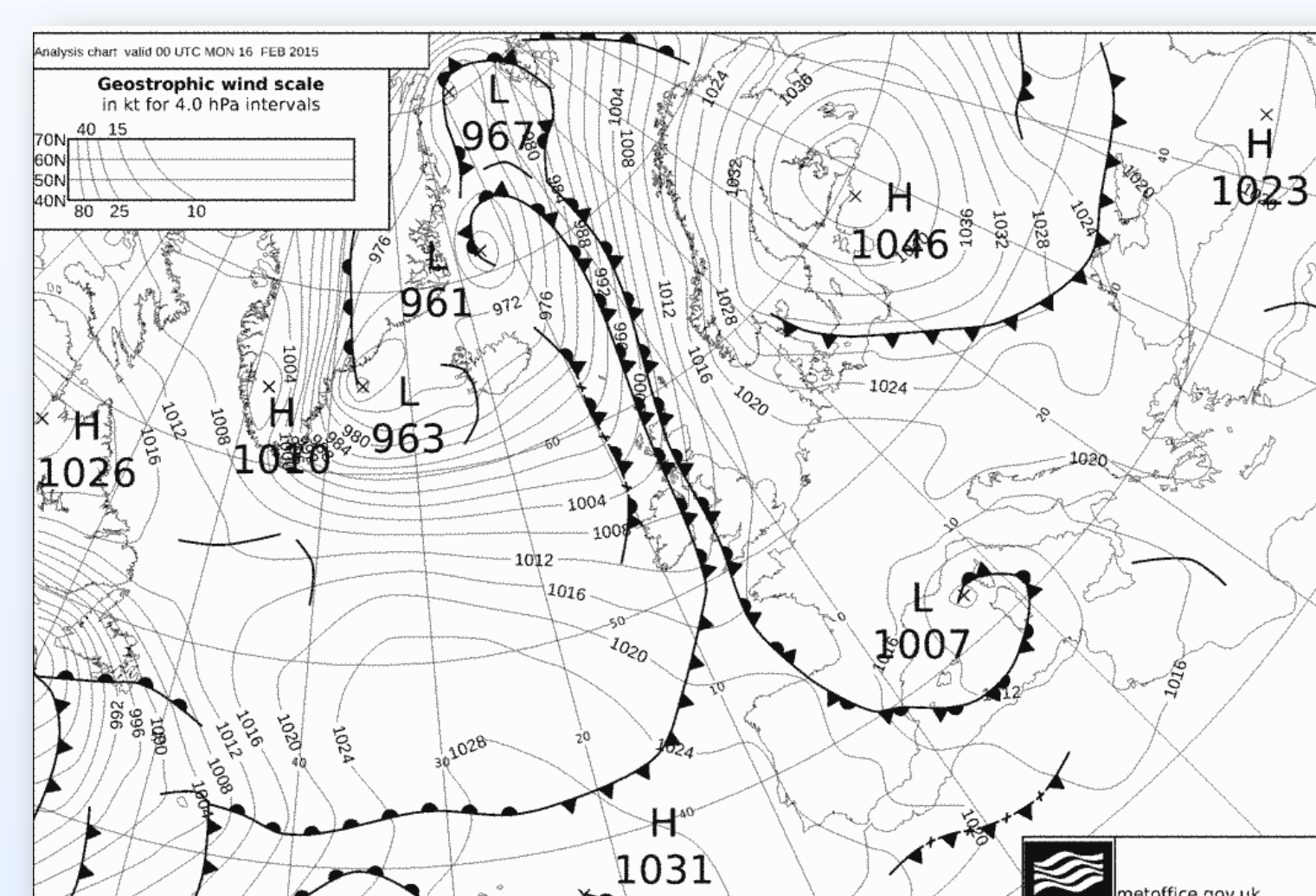
$$D_i = \left[\frac{4(M_i - M_{i-1})}{\pi \rho_s} + D_{i-1}^2 \right]^{1/2}$$

The two NWP models feed the cylindrical **wet-snow accretion model** for the evaluation of the wet-snow load and the **thermal model** for the anti-icing current simulation.

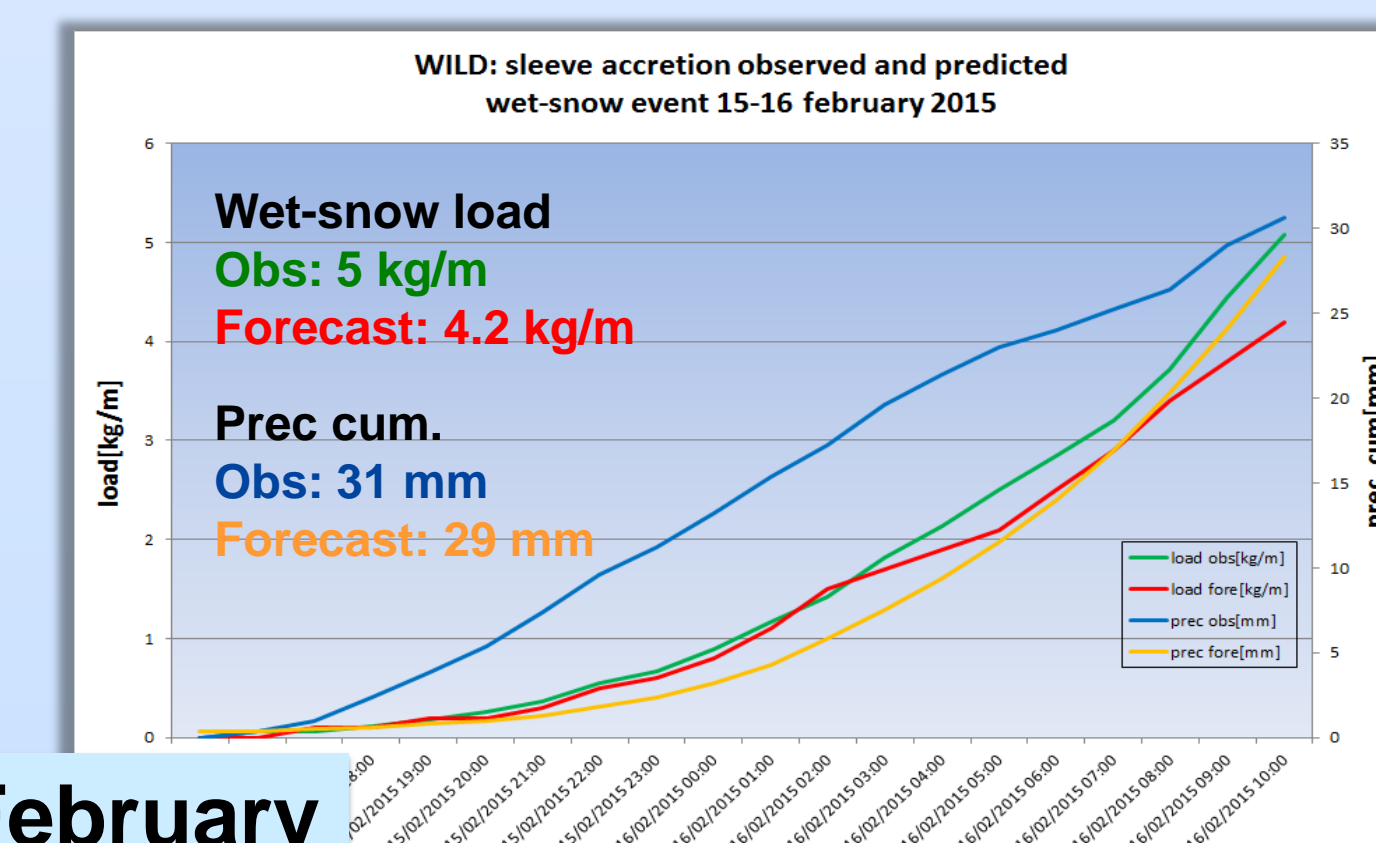
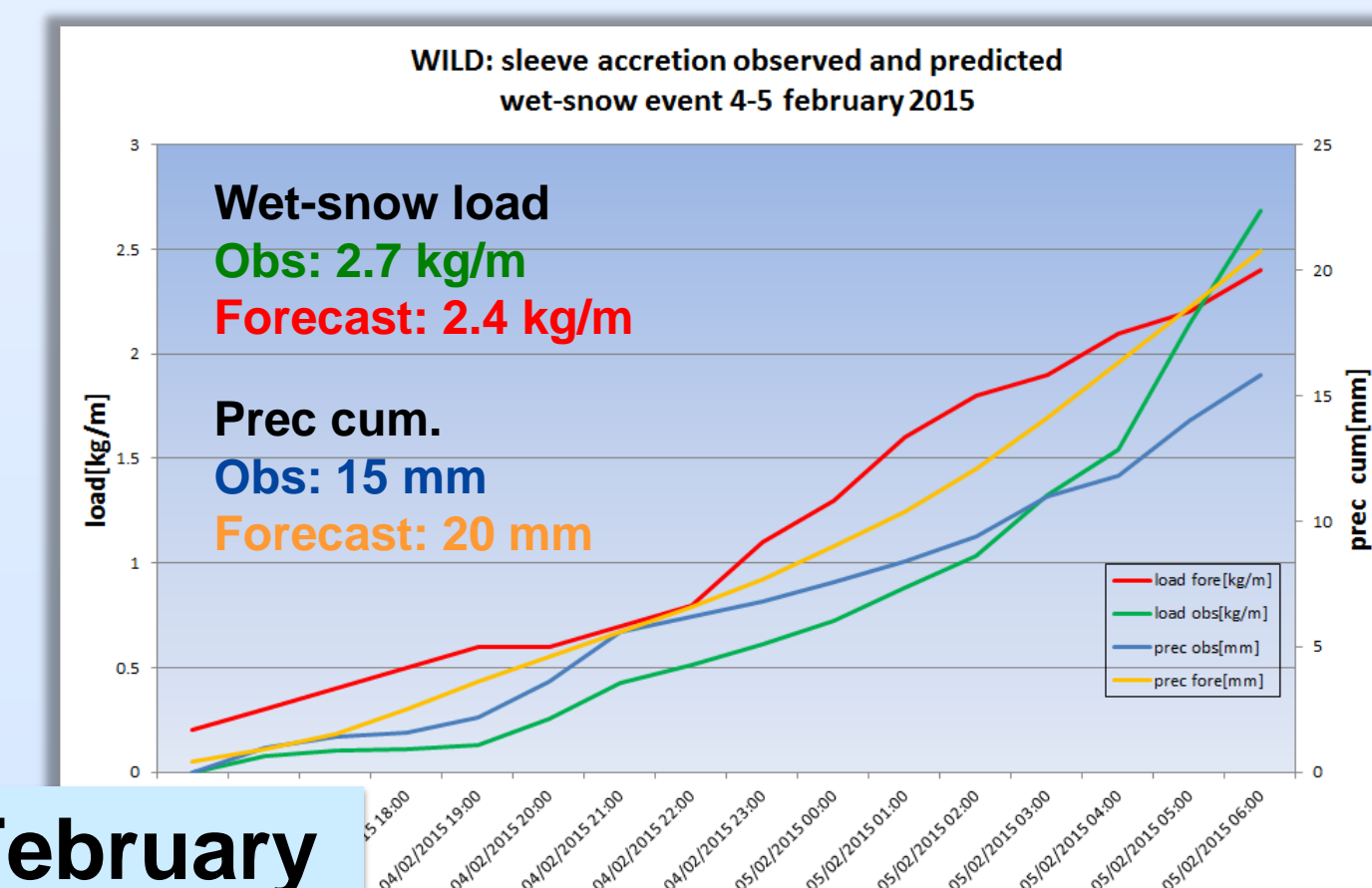
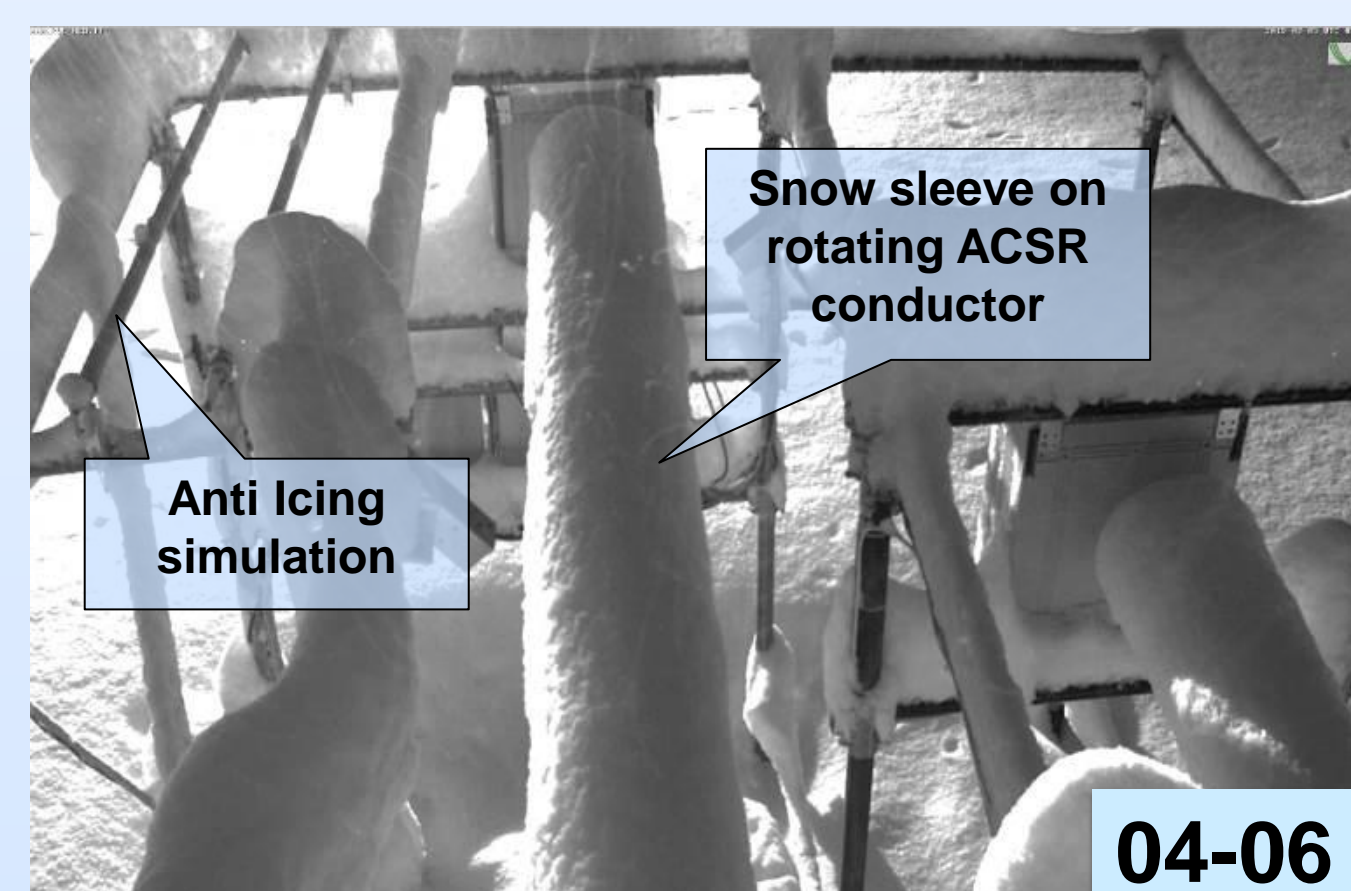
◆ Results

Results obtained from the models simulations are presented for the two case studies occurred on **4-6 February** and **15-16 February 2015** at the WILD test site.

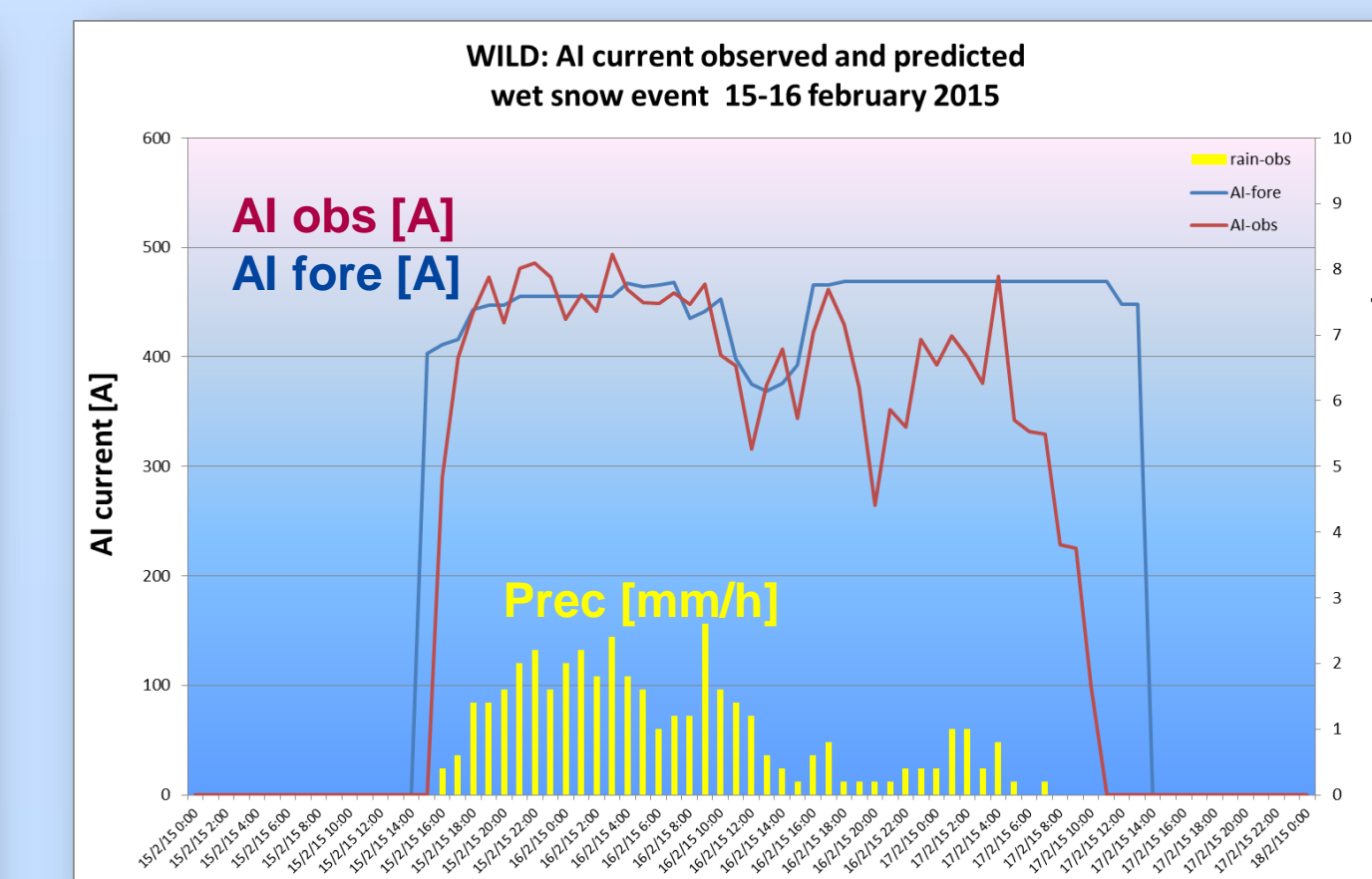
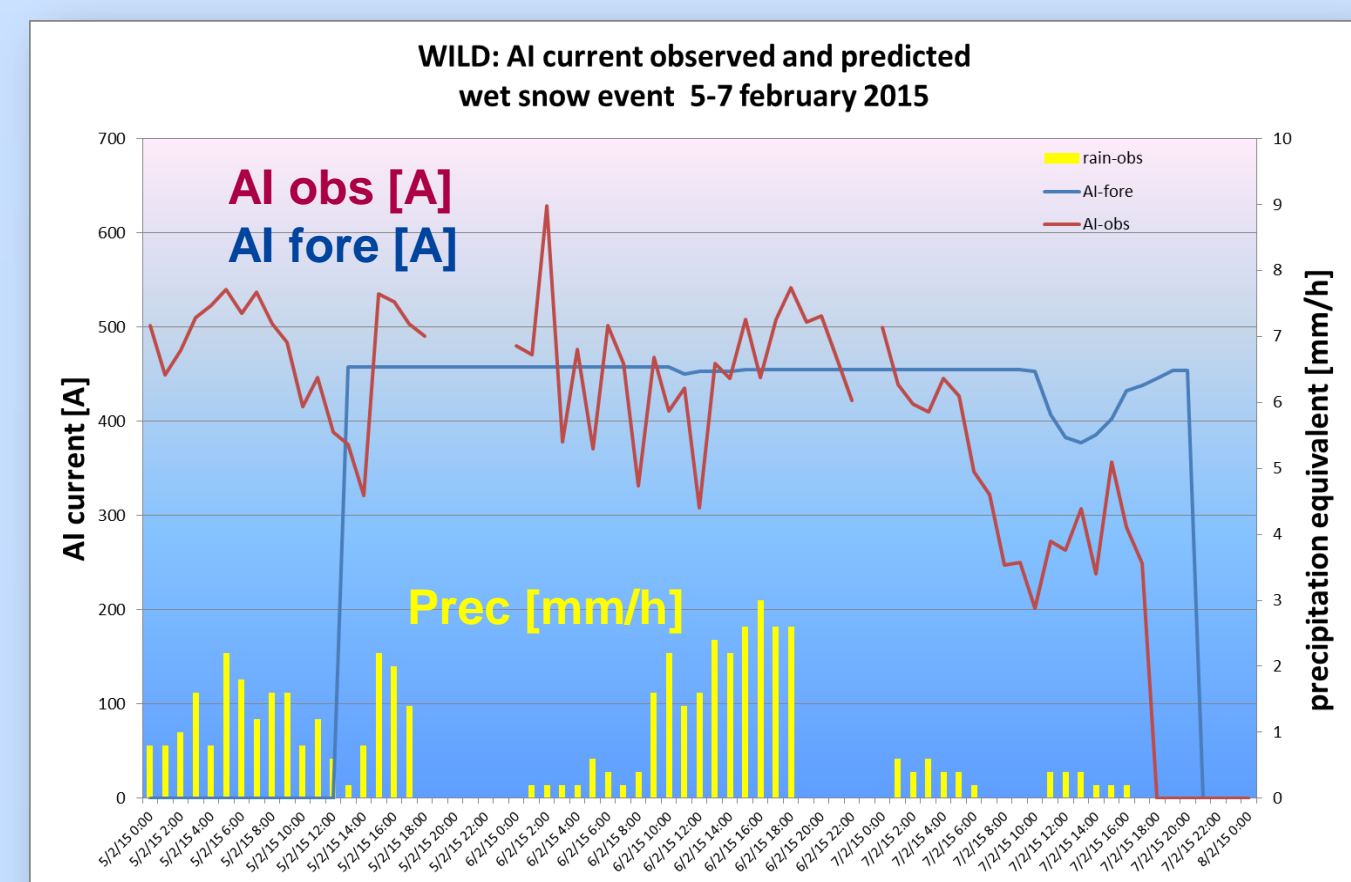
NWP simulation



Wet-snow accretion [obs vs forecast]

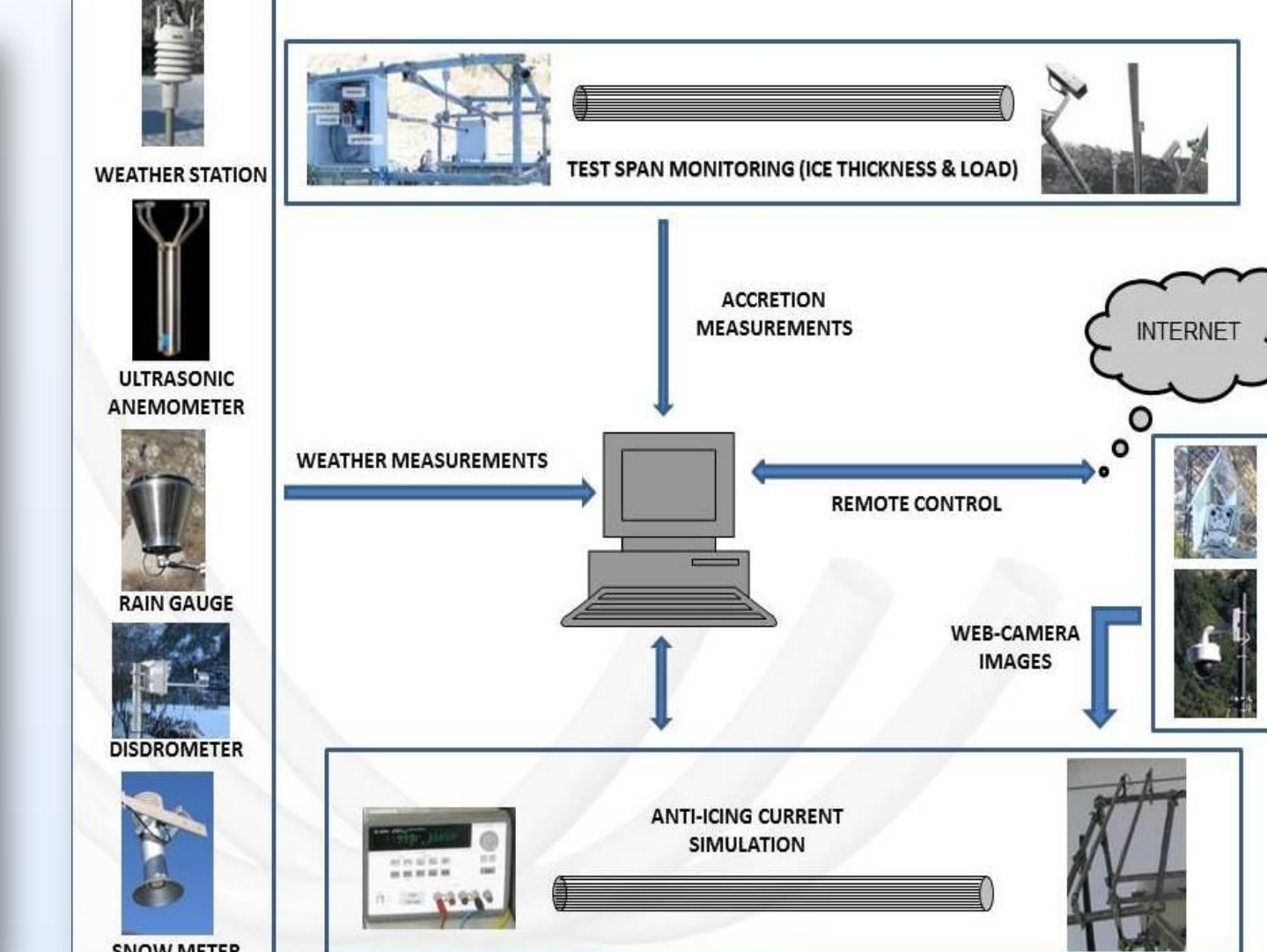


AI current [obs vs forecast]

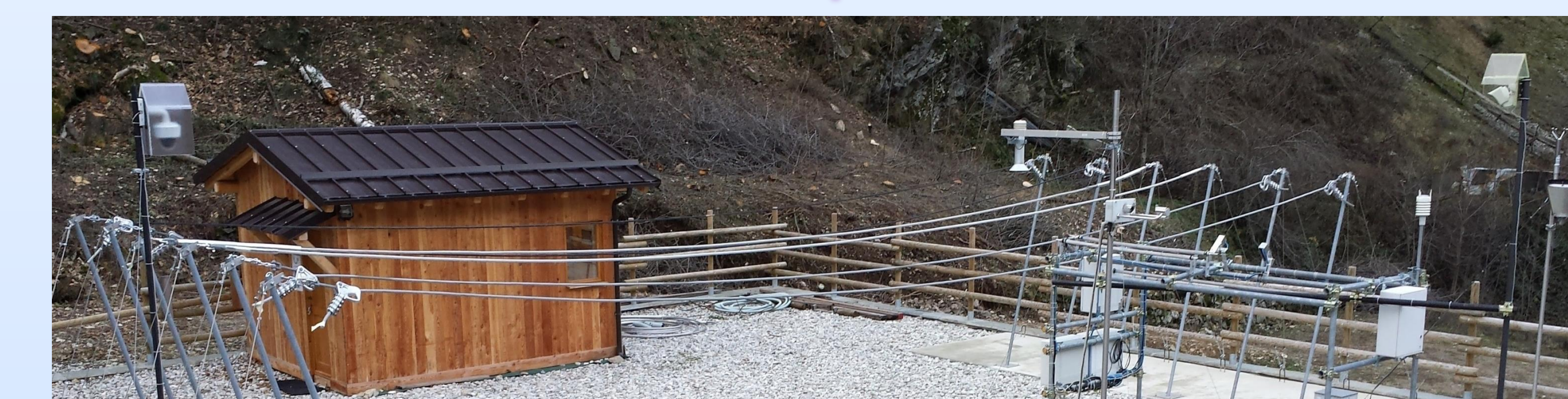


◆ Test site

WILD has been installed in the west part of the Alps in the municipality of Vinadio, at an altitude of 950 m asl. WILD is devoted to studying wet-snow effect on overhead conductors. The site allows to set-up 7 test span of about 14 meters in length to carry out qualitative comparative test of different type of conductors exposed to the same environmental condition.



View of the WILD experimental test site



◆ Conclusion

- It is evident that the successful simulation of wet-snow accumulation is critically dependent on detailed and correct atmospheric input data, and detailed and accurate wet-snow model. The monitoring system has well-reproduced the cylindrical snow sleeve accretion on ACSR conductors.
- The simulated AI current are in agreement with the Joule-effect reproduced by AI circuit that is able to maintain the conductors free of snow formations during the entire winter season. WILD is an ideal site for testing new type of conductors and innovative coatings.
- All results of the research activity provided the basis for the development of a customized forecast system for the whole Italian Transmission Lines.

◆ Acknowledgements

This work has been financed by the Research Fund for the Italian Electrical System under the Contract Agreement between RSE S.p.A. and the Ministry of Economic Development – General Directorate for Nuclear Energy, Renewable Energy and Energy Efficiency in compliance with the Decree of March 8, 2006.