Notes from HoloOptics

Testing T23β Clear-Ice Indicator™ as an icing Rate Sensor

Narvik, Norway

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Documentations number: UA30-2001.4-1023-002-1-En.doc

1. Introduction

The Narvik University used the T23 Clear-Ice Indicators™ beta version as icing rate sensor using the season 2005/2006.

The tests will continue during the 2006/2007 season.

Narvik, Norway is situated 400 km north of the polar circle close to the North Sea. The position makes it very prone to icing as mild winds with high moisture content reach the mountains coast.

2. T23 Clear-Ice Indicator™

The T23 Clear-Ice Indicator™ is a patented digital optronic ice-indicator that indicates the presence of atmospheric clear ice and/or rime ice. The indicator comprises of a head with an IR emitter and a photo detector and a probe. The probe is a changing its optical properties if it is covered with clear ice or rime ice.

The probe is mounted on an internally controlled probe heating. The probe heating is turned on when indicating. The probe heating is turned on without time delay.

After a period of time the ice is melted and the water is fallen off the probe. The indication will when stop and the probe heating is turned off.

The time it takes to melt the ice once the probe heating is on is dependent on many factors. Some are icing rate, air and surface temperature, melting power, wind speed and direction and type of ice.

As the probe is cooled ice may start to build up on the probe again. As the probe is covered with ice once more the indication and the heating is turned on.

This cycle is repeated for as long as ice is created on the probe surface, see figure 2.

The tested version of T23β Clear-Ice Indicator™ is a beta version with limited capacity.

3. Saturation

In severe icing conditions the icing rate is so higher that the probe heating melting capacity. This saturates the indicator.

The T23β Clear-Ice Indicator™ heating capacity is approx. 3 kg/m^{2}h of icing. This value is often exceeded at this location.

If saturated ice will start to build up on the probe. As atmospheric ice is no more present the ice on the probe will start to melt. The indication will stop only as the ice on the probe is melted. This may take several hours.

4. Test results

Figure 1 shows the actual indications and figure 2 the calculated icing rate.

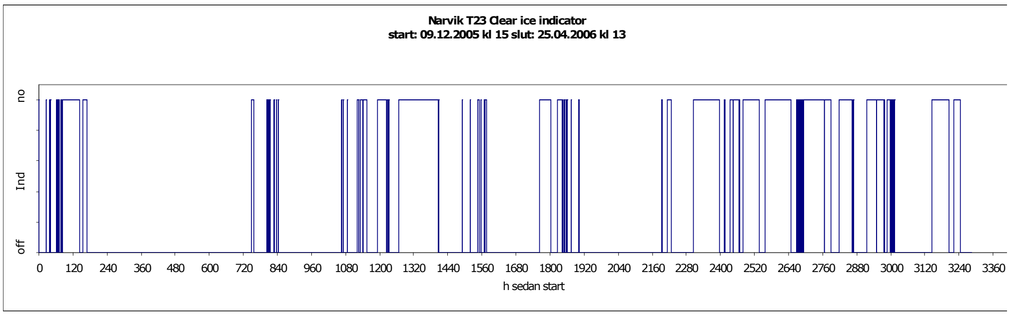

Figure 1 Indications during the test period

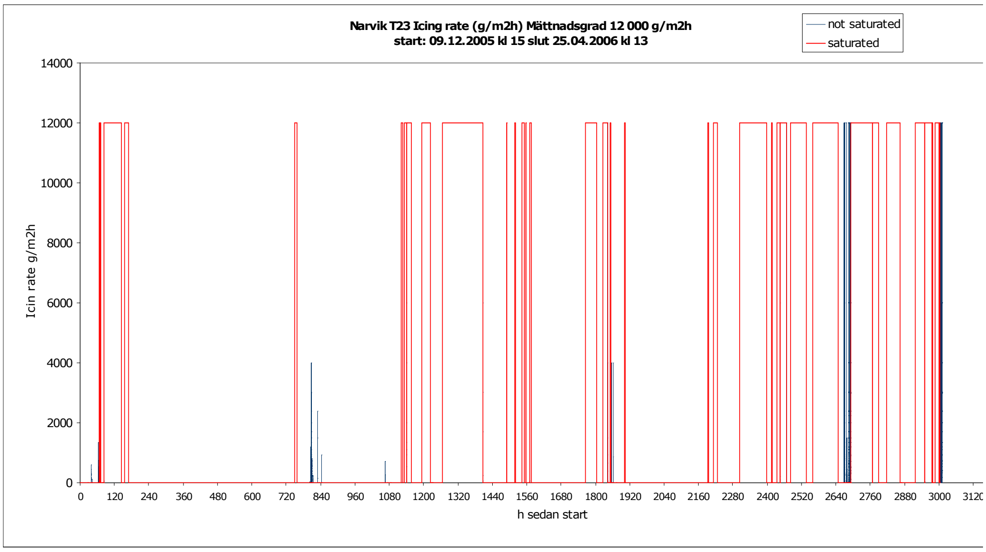

Figure 2 calculated momentary icing rate.

From figure 2 it is clear that saturation is common in this location.

Figure 3 and 4 shows indications and icing rate during a 24 hour period without severe saturation.

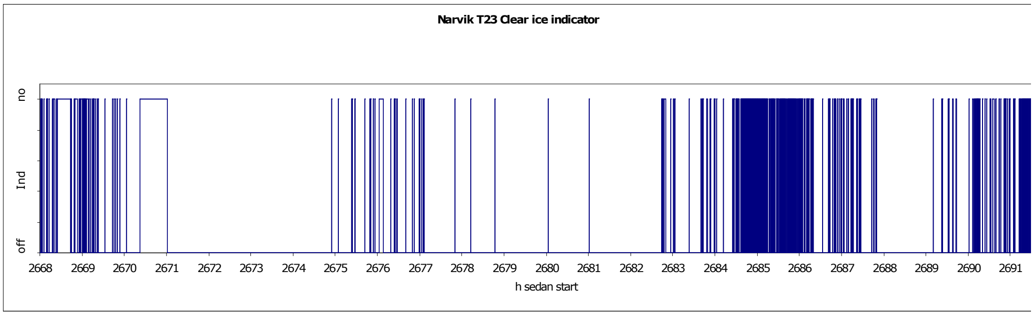

Figure 3 indication

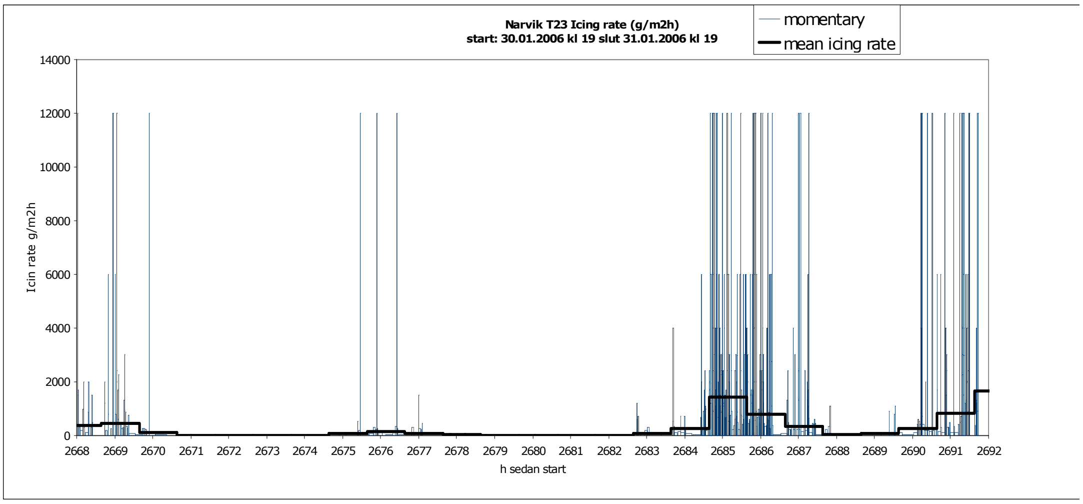

Figure 4 calculated icing rate

In figure 4 the momentary icing rate and one hour mean value is calculated.

5. Conclusions

The T23 Clear Ice indicator may be used as an icing rate sensor, but a substantial higher saturation level is needed, particularly on locations with severe icing.