Snow melting effect on L-band brightness temperature

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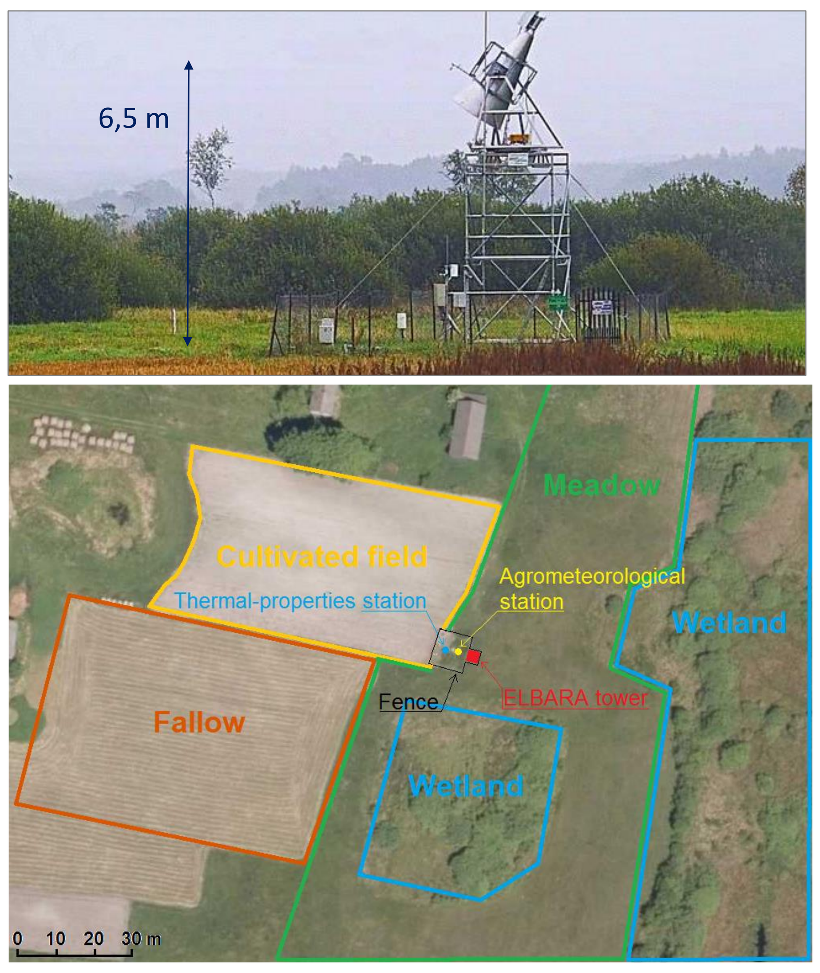
Research context

Several studies have showed that snow significantly impacts the L-Band signal in winter (Leduc-Leballeur et al., 2017; Lemmetyinen et al., 2016; Pellarin et al., 2016; Roy et al., 2017 a, Roy et al., 2017 b)

- Pellarin et al. (2016) reported **decrease** by about 20 K in the afternoon of brightness temperature in horizontal polarization in snow melting conditions
- Leduc-Leballeur et al. (2017) observed that the brightness temperature (TB) in horizontal polarization was influenced mainly by the snow properties of **the first centimeters** in spite of the large penetration depth at L-band
- The brightness temperature in horizontal polarization (TB_HP) **varied more** with an accumulation of a low-density snow layer than the brightness temperature in vertical polarization (TB_VP) (Leduc-Leballeur et al., 2017)

Research goals

- To analyze how snow melting affects B-band brightness temperature (TB)
- To compare variation of vertical and horizontal polarizations



ELBARA III (ESA L-Band Radiometer)

- works at ~ 1420 MHz
- is set in a unique place – near a natural swamp called Bubnow wetland (easter Poland)
- since April 2016 ELBARA data has been used in calibration and validation of the SMOS satellite mission
- measures brightness temperature (TB) in horizontal (HP) and vertical (VP) polarization 4 times per day at elevation angles 35° – 90° (every 5°) and azimuth angles 0° – 350° (every 10°)
- adjacents to an agrometeorological station (i.a. air temp., precipitation, soil moisture, soil temperature)

Fig. 1. ELBARA tower (upper left), its surroundings (lower left) with indicated land cover type and agrometeorological station (right)

Method

- Analysis of ELBARA data from 16 – 25 February 2017 with **intensive snow melting** observed on 20 – 21 February 2017
- Data from **4 azimuths** related to different land cover (0°, 90°, 180°, 270°) with **2 elevation angels** (40°, 60°) have been selected
- Comparison with **ground photos**, which precisely indicate the melting period, and with data from **agrometeorological station** (air temperature, precipitation, soil temperature, soil moisture)

Fig. 2. Snow melting registered at ELBARA tower (20 Feb – 21 Feb 2017) for azimuth: 0°

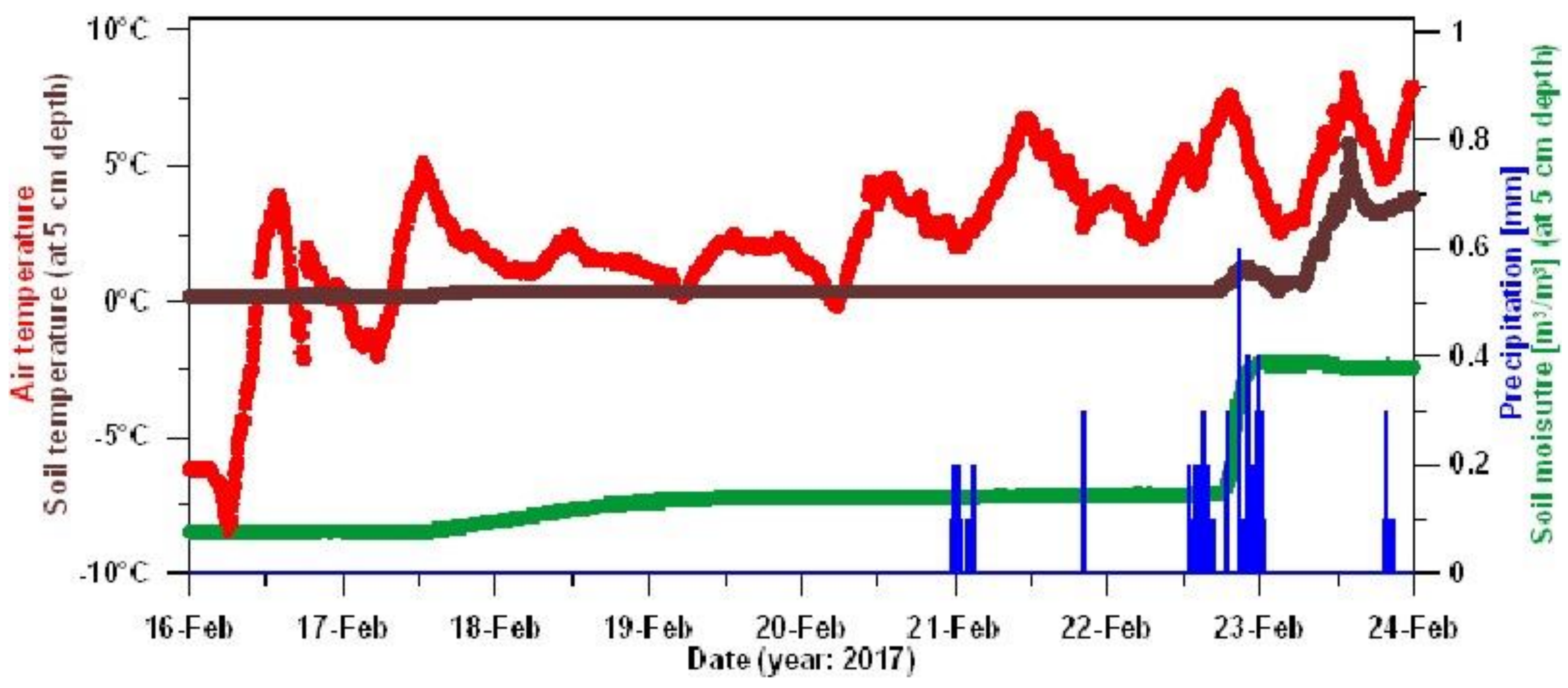


Fig. 3.Data registered at the agrometeorological station located near the ELBARA for 16 – 24 Feb 2017 (air temperature, precipitation, soil temperature, soil moisture)

Results

- For all selected azimuths and elevation angels we observed a **significant decrease of TB**, in at least one polarisation, during the period of the intensive snow melting
- In most cases, **differences of TB** in horizontal polarisation (HP) and vertical polarisation (VP) during the time of the intensive snow melting were **smaller** comparing to the previous period.
- For the elevation angle 60° for the three of the four selected azimuths (0°, 90°, 180°) we observed **higher TB_HP variability** comparing to TB_VP, similarly as shown in Leduc-Leballeur et al. (2017)
- Because of too short period of the intensive snow melting it was not possible to check variations of the daily TB trend described in Pellarin et al. (2016)

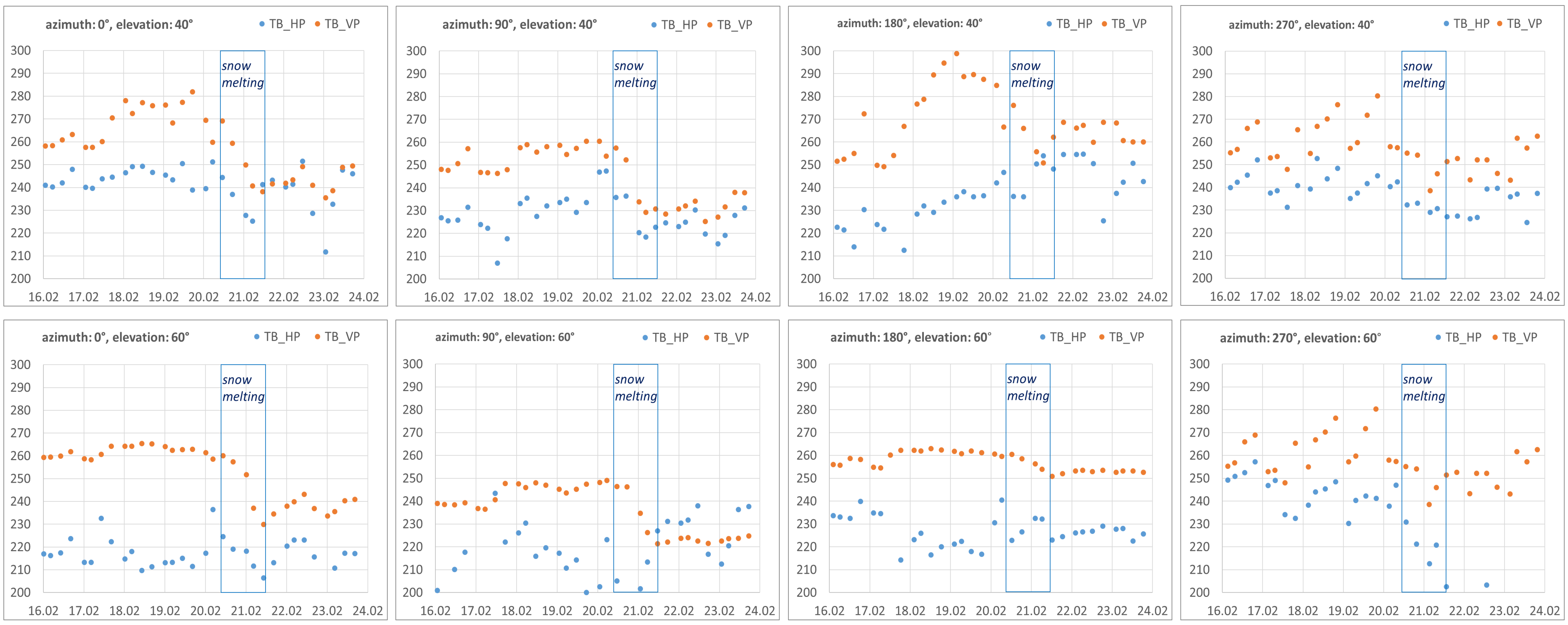


Fig. 4. Brightness temperature (TB) in K for 16 Feb – 24 Feb 2017; HP – horizontal polarization; VP – vertical polarization

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Acknowledgements

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