

Final response to the reviews of 'NYTEFOX - The NY-Ålesund Turbulence Fiber Optic eXperiment investigating the Arctic boundary layer, Svalbard' on behalf of all authors

Dear referees,

thank you for your thorough reviews helping to improve our manuscript! We considered all requested changes very useful and implemented the following revisions:

Responding to **referee #1**, we added three columns to Table 1, stating the accuracy of each quantity observed by the respective observing system as follows:

**Table 1.** Specifications of the measurement techniques: sampling rate, temporal resolution and averaging, spatial averaging and accuracy of the measurements. The accuracy of the MiniSodar and CSAT3 wind measurements were taken from their manuals. The accuracy of the CSAT3 temperature measurements was calculated by Fritz et al. (2021). Accuracy of temperature measured by FODS is based on the readings in the calibration baths: the bias is defined as the standard deviation of the daily averaged differences between the fiber- and reference (PT100) temperatures in each bath; the precision is defined as the median of the daily spatial standard deviation of fiber temperatures within each bath. The accuracy of the fiber wind speed is computed as the standard deviation of the fractional absolute deviation of the fiber readings from those of the reference (CSAT3) instrument aggregated to 30 s. The bias depends systematically on location along the fiber and ranges from 8 % underestimation to 13 % overestimation with an average overestimation of 4 %.

| measurement         | sensing direction | sampling rate (s) | temporal resolution (s) | temporal averaging (s) | spatial averaging (m) | temp. accuracy (K)            | wind speed accuracy          | wind dir. accuracy (°) |
|---------------------|-------------------|-------------------|-------------------------|------------------------|-----------------------|-------------------------------|------------------------------|------------------------|
| metal encased fiber | horiz/vert        | 3                 | 9                       | 6                      | 0.127                 | bias: 0.04<br>precision: 0.36 | 16 %                         | -                      |
| PVC fiber           | vertical          | 3                 | 9                       | 3                      | 0.30                  | bias: 0.03<br>precision: 0.28 | -                            | -                      |
| CSAT3               | -                 | 0.05              | -                       | 120<br>600             | 0.116                 | <0.2                          | 2 to 6 %                     | 0.7                    |
| miniSodar           | vertical          | 10                | -                       | 600                    | 5.0                   | -                             | 0.1 to 0.3 m s <sup>-1</sup> | <1.5                   |

In response to the review by **Ian Brooks** the following editorial changes were made:

- Line 4: '... transport in temperatures, wind...' -> '...transport of temperature, wind...'
- Line 17: '...role in Earth system...' -> '...role in the Earth system...'
- Line 23: '...as the rate of warming affects the Arctic more than twice as fast as global average...' -> '...as the rate of warming in the Arctic is more than twice as fast as the global average...'
- Line 27: AWIPEV Station -> 'joint French-German AWIPEV-Station operated by the Alfred Wegener Institute (AWI) and the Polar Institute Paul Emile Victor (IPEV)'
- Line 28: 'Located at 79°N in the Arctic ocean it...' -> 'Located at 79°N it...'
- Line 45: '...high temporal (9 s) and spatial (0.127 m) scales.' -> '...high temporal (9 s) and spatial (0.127 m) resolution.'

- Line 55: ‘to close the observational gap between point measurements of the operational infrastructure at AWIPEV...’ -> ‘to close the observational gap between point measurements made by the operational infrastructure at AWIPEV...’
- Line 63: ‘The experiment was conducted in Ny-Ålesund (78°55′24″N,11°55′15″O), one of the ...’ -> ‘The experiment was conducted for a period of 14 days from 26 February to 10 March 2020 in Ny-Ålesund (78°55′24″N,11°55′15″E). Ny-Ålesund is one of the ...’
- Lines 88-100: Caption figure 2: ‘Schematic setup and picture of setup from the Zeppelin mountain from south. The fiber-optic array has a length of 700m. The letters a-i refer to the same elements.’ → ‘Schematic setup and picture of setup from the Zeppelin mountain from south. The fiber-optic array has a length of 700m. The letters refer to the locations of a: FODS device; b, c, g, h: road crossings; d, e, i: 10m towers and f: MiniSodar. The letters a-i refer to the same elements in both pictures.’
- Line 161: ‘(referred as low-resolution...’ -> ‘(referred to as low-resolution...’
- Line 253: ‘...temperature instationarities...’ → ‘After the breakdown of the strong winds around 13:15 UTC and first meandering at this time it takes almost two hours for the temperature to drop and characteristic weak wind, submeso-scale structures to dominate. The latter appear as oscillating wind direction and strong temperature non-stationarities which start around 15 UTC.’
- Line 259: ‘The visualization proofs...’ -> ‘The visualization proves...’

As requested by the **topical editor**, the DOI, referring to the publicly available dataset on Zenodo was replaced (‘Abstract’) and supplemented (‘Data availability’) by the full link, simplifying the accessibility for the reader.

In addition, figure 9 showing the availability of the different data sets was updated and one sentence explaining the reliability of the heated FODS data set was included in the section “dataavailability”.