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Supplementary Materials

A Three-Year Climatology of the Wind Field Structure at Cape Baranova (Severnaya Zemlya, Siberia) from SODAR Observations and High-Resolution Regional Climate Model Simulations during YOPP

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Figure S1. Research Station "Ice Base Cape Baranova" and its surroundings from a height of 200 meters (courtesy A. Makshtas). The location of the meteorological tower is marked.

Figure S2. Meteorological station at Cape Baranova (courtesy A. Makshtas).

Figure S3. The phased-array antenna of the SODAR (left, photo: G. Heinemann) and the SODAR/RASS installation without enclosure during October 2017 (right, view in west direction, photo V. Kustov).

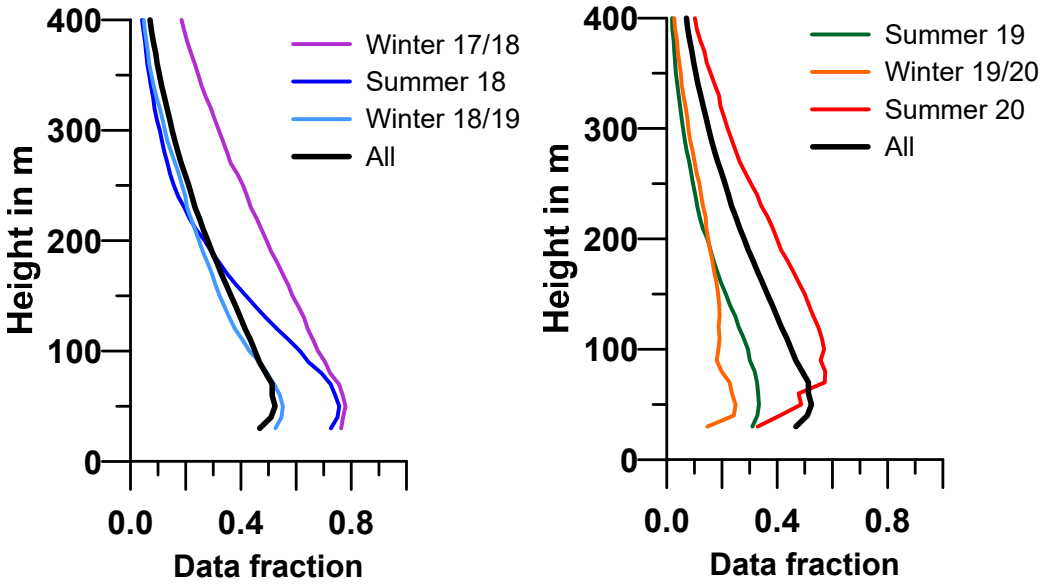

Figure S4. Profiles of the availability of SODAR data for different seasons (winter: October–April, summer May–September) and for the whole period (All).

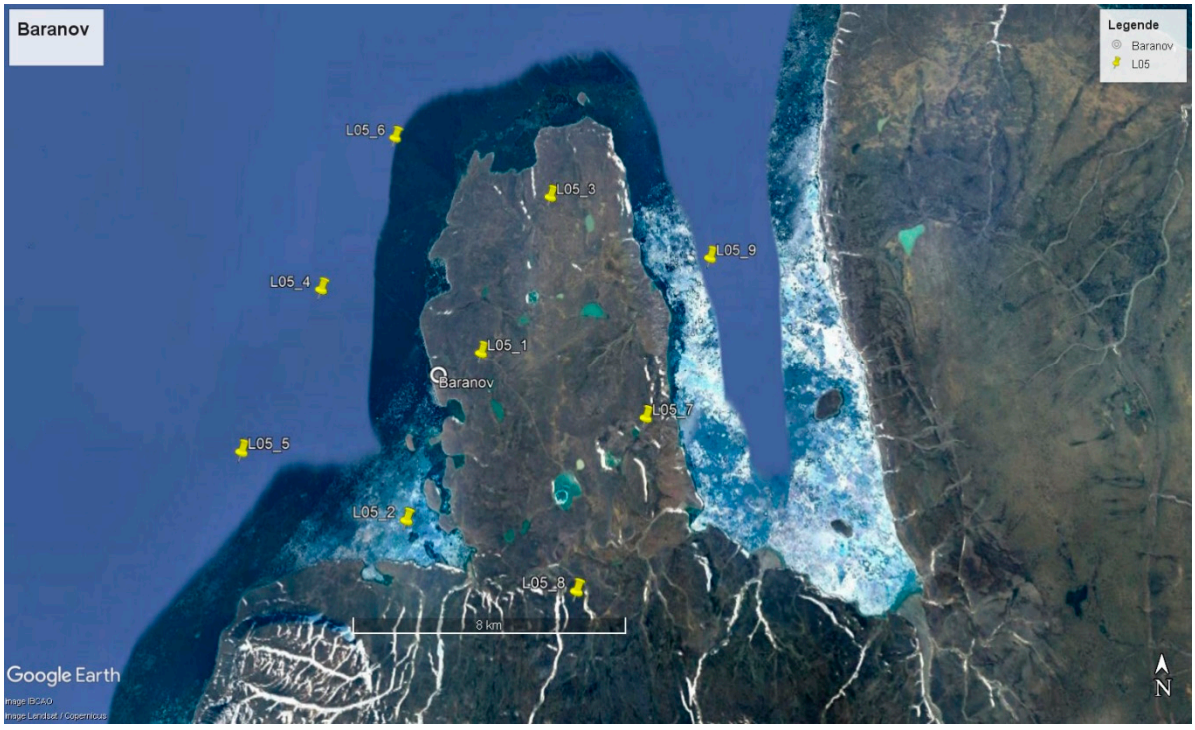

Figure S5. Location of the CCLM grid points (yellow marks) in the vicinity of Cape Baranova (marked by a white circle, Google Earth 2022).

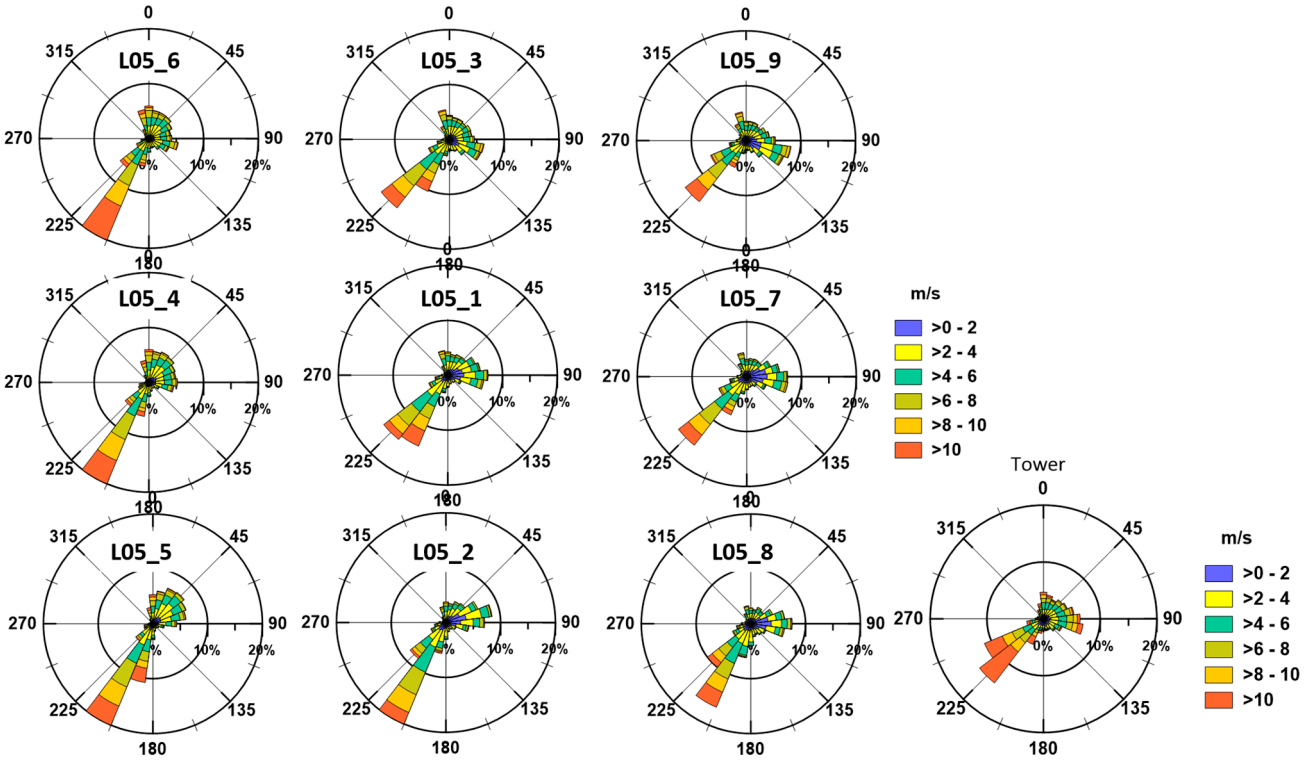

Figure S6. Wind roses for the 10m-wind at CCLM grid points in the vicinity of Cape Baranova (positions marked in Fig.S5) and for the measurements (tower).

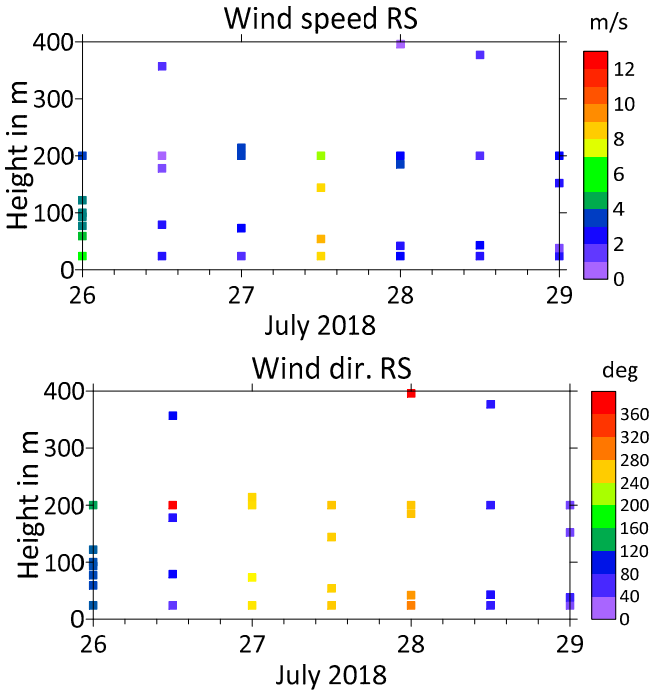

Figure S7. Time-height cross-sections of the wind speed (up) and direction (down) for 26 to 29 July 2018 for radiosonde data (data are shown as pixels (not interpolated)).

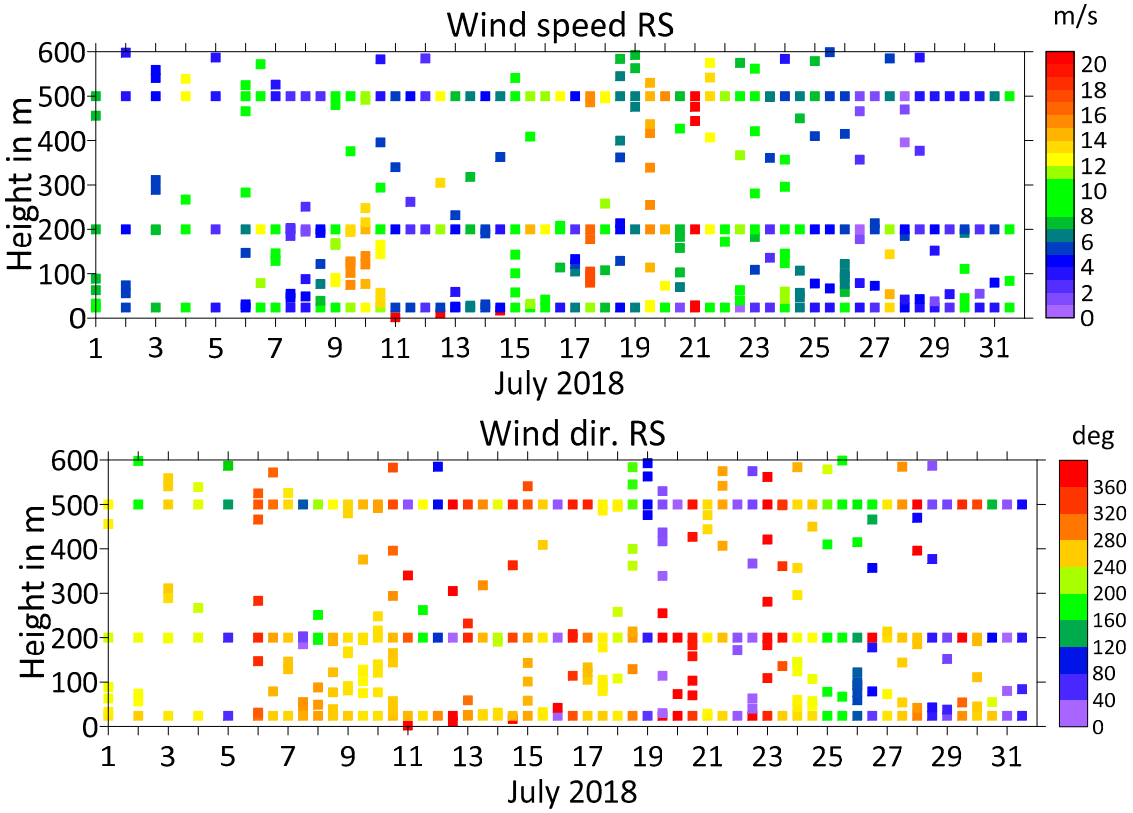

Figure S8. Time-height cross-sections of the wind speed (up) and direction (down) for July 2018 for radiosonde data (data are shown as pixels (not interpolated)).

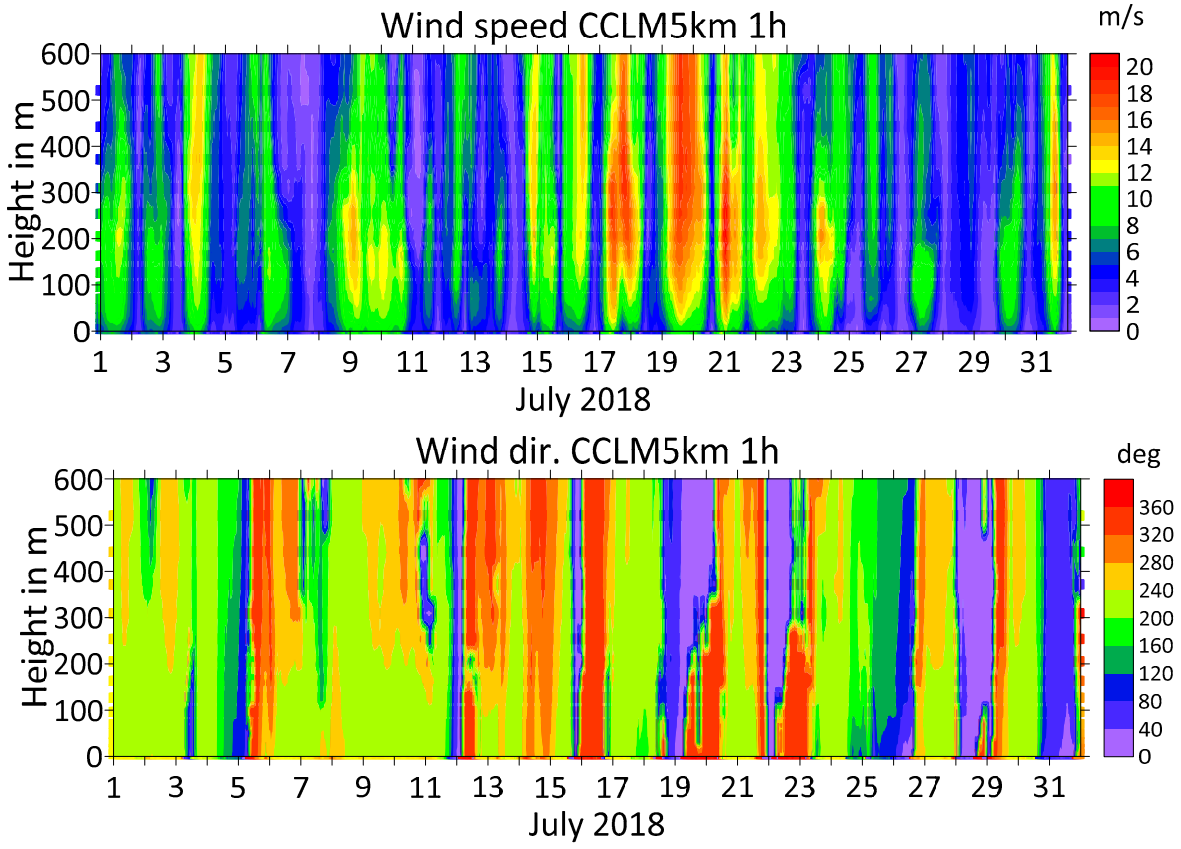

Figure S9. Time-height cross-sections of the wind speed (up) and direction (down) for July 2018 for CCLM simulations.

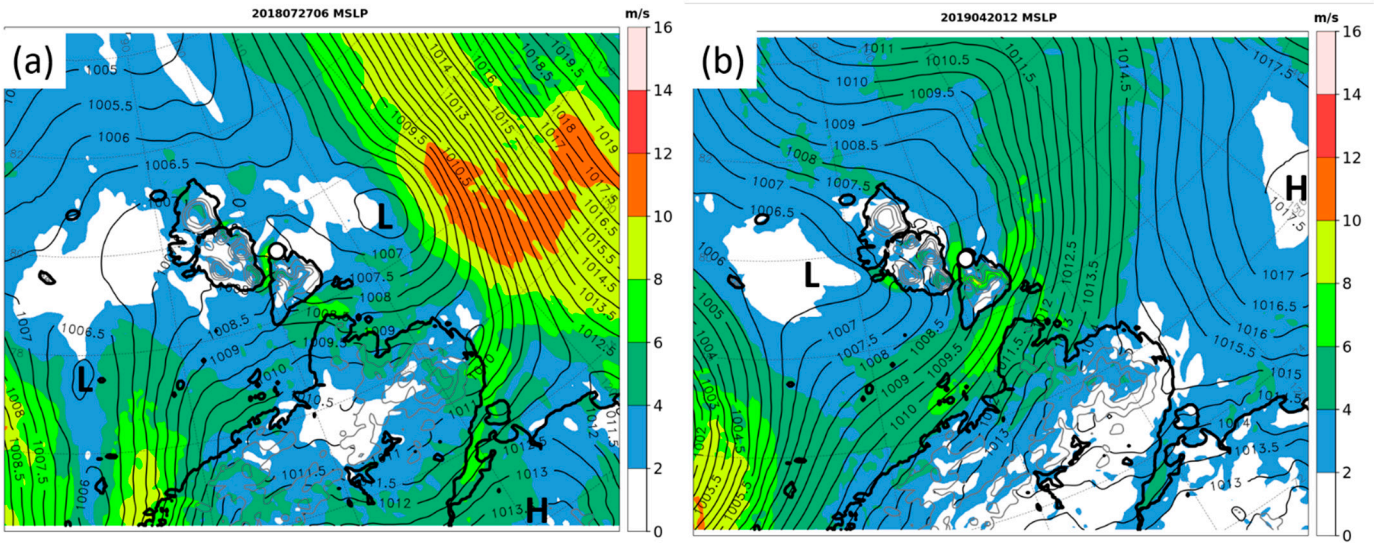

Figure S10. CCLM simulations with 5 km resolution of the mean sea level pressure (isolines every 0.5 hPa) and 10m-wind speed (shaded) for the area of the Kara and Laptev Sea: (**a**) 27 July 2018, 0600 UTC; (**b**) 20 April 2019, 1200 UTC. The position of Cape Baranova is marked by a white circle, topography is shown as gray isolines every 200 m.

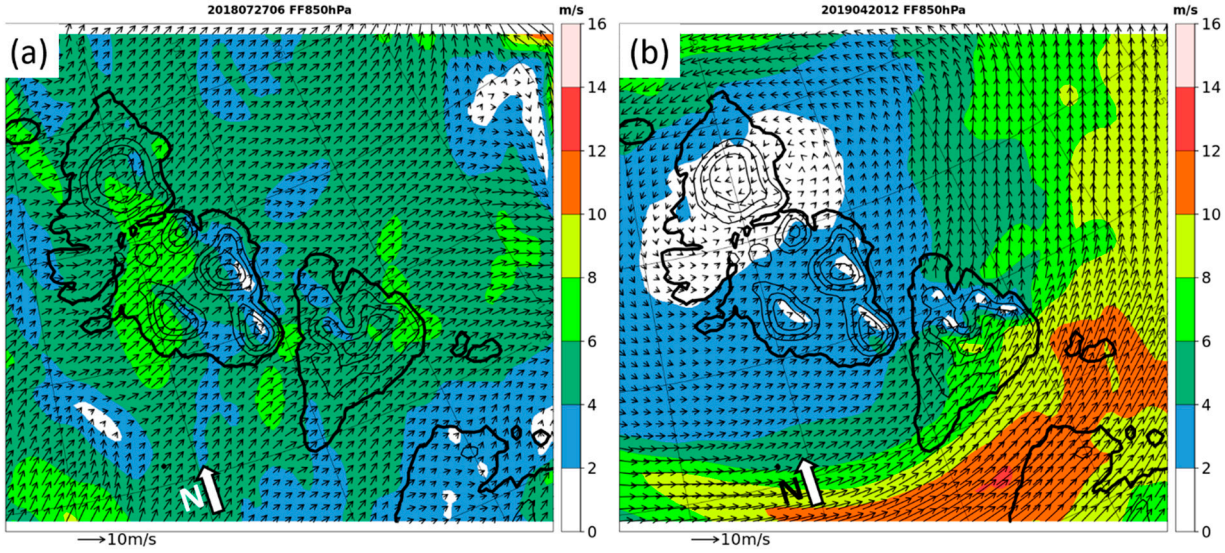

Figure S11. CCLM simulations with 5 km resolution of the wind speed (shaded) and wind vectors at 850 hPa (scale at the bottom) for the area of the Severnaya Zemlya Archipelago: (**a**) 27 July 2018, 0600 UTC; (**b**) 20 April 2019, 1200 UTC. Vectors are shown every second grid point, topography is shown as isolines every 200 m.

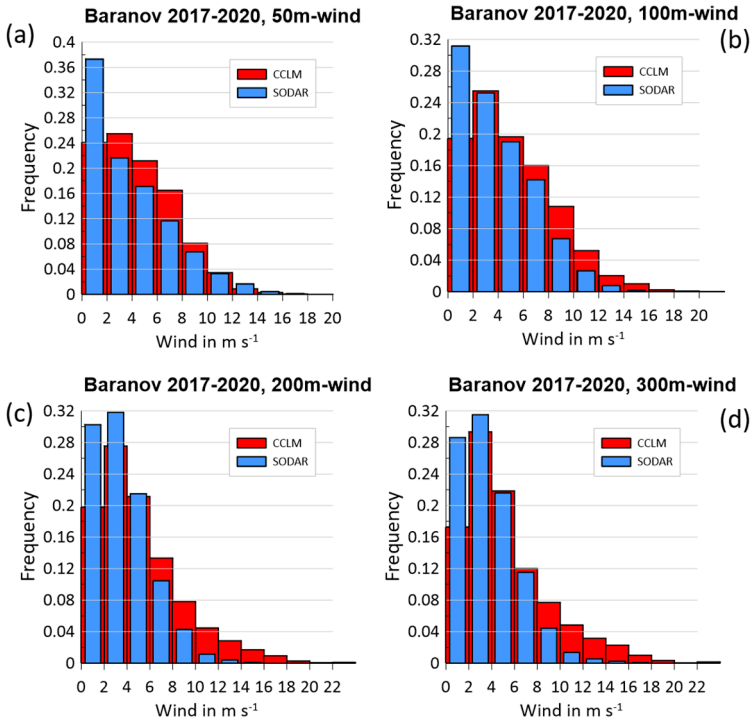

Figure S12. Wind speed distributions of SODAR and simulations at the times of available SODAR data (relative frequencies) at (**a**) 50 m, (**b**) 100 m, (**c**) 200 m and (**d**) 300 m. All statistics are based on 1h values for Oct. 2017-Aug. 2020.

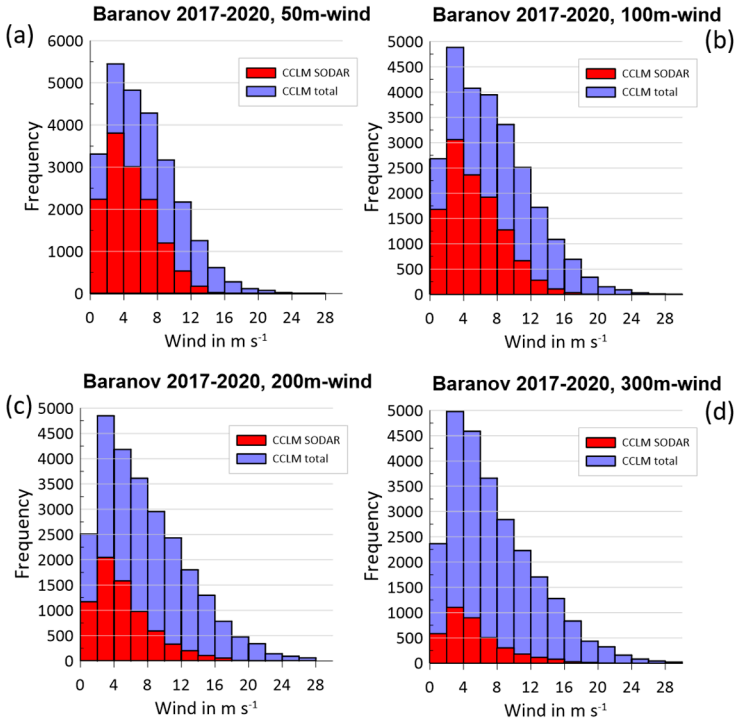

Figure S13. Wind speed distributions for CCLM data at the times of available SODAR data and for all CCLM data (absolute frequencies) at (**a**) 50 m, (**b**) 100 m, (**c**) 200 m and (**d**) 300 m. All statistics are based on 1h values for Oct. 2017-Aug. 2020.

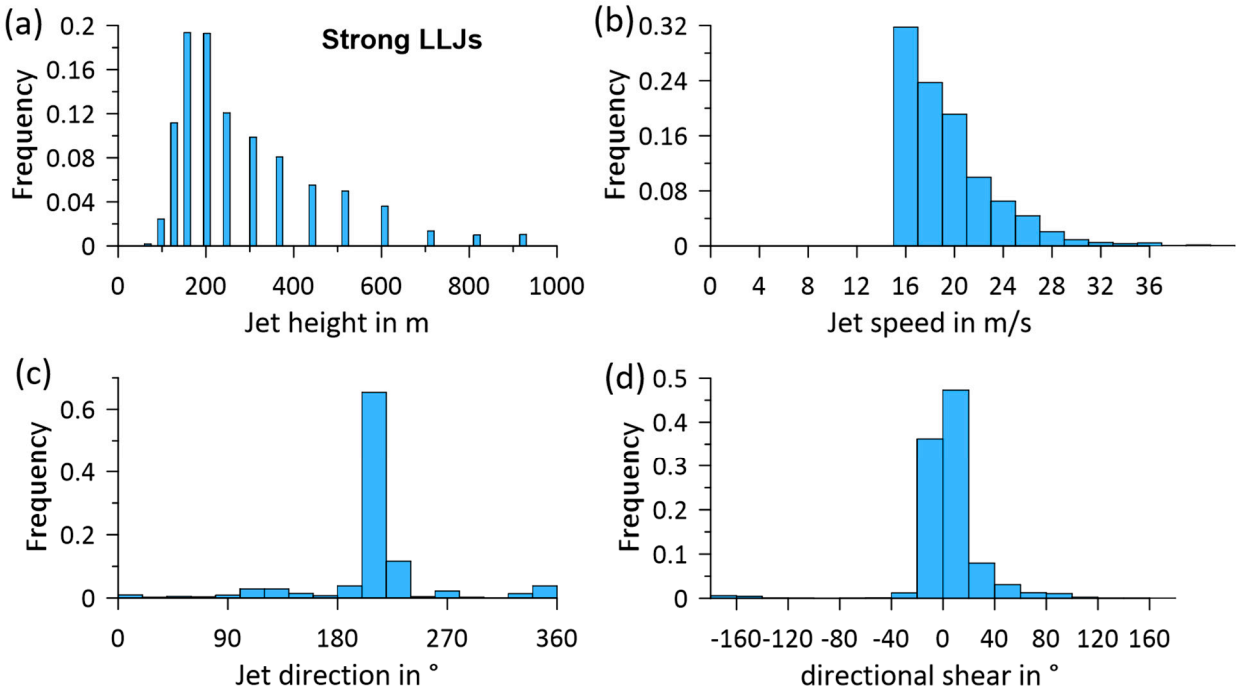

Figure S14. Statistics (relative frequencies) for strong LLJs (jet speed ≥ 15 m/s) from CCLM simulations at Cape Baranova of the (**a**) jet height, (**b**) jet speed, (**c**) jet direction and (**d**) directional shear (difference between the wind direction at the jet core and at a height of 5 m).

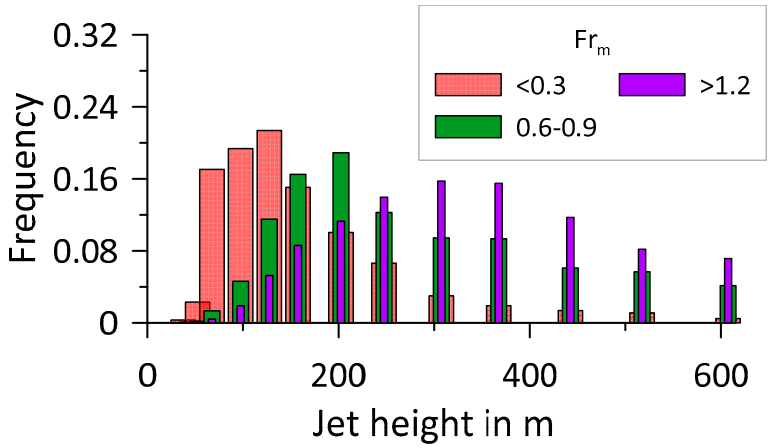

Figure S15. Statistics (relative frequencies) of the LLJ heights for channeled LLJs from CCLM simulations at Cape Baranova for different upstream mountain Froude number classes.

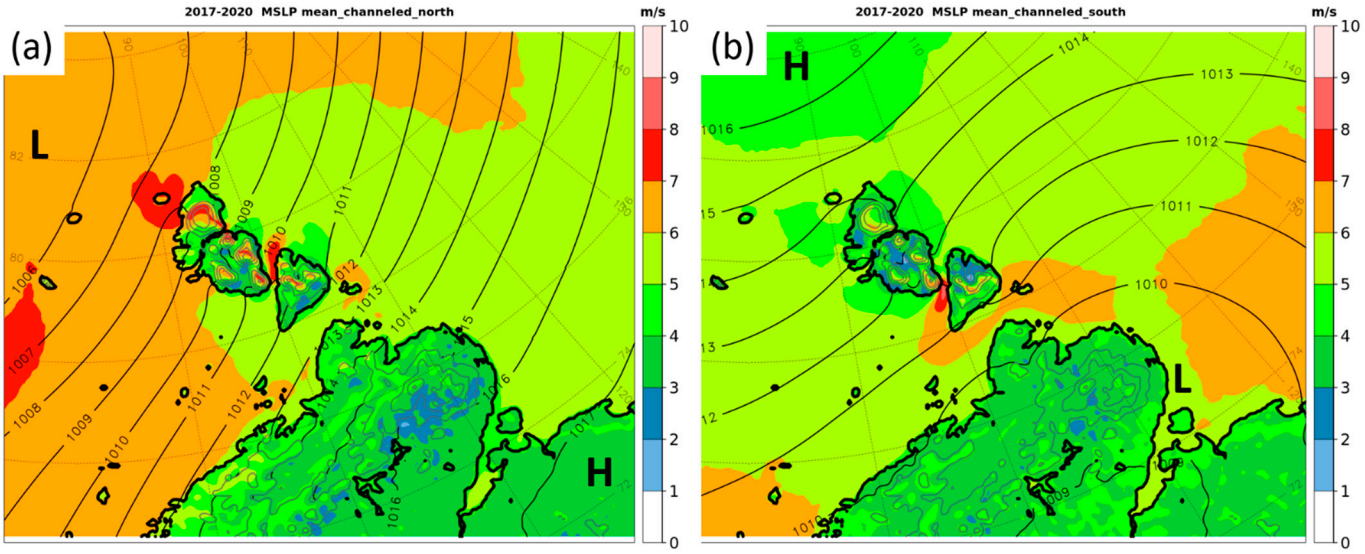

Figure S16. CCLM simulations with 5 km resolution of the mean sea level pressure (isolines every 1 hPa) and 10m-wind speed (shaded) for the area of the Kara and Laptev Sea for days with channeling events with a duration ≥ 12 h at 200 m height. (**a**) Channeling events at Cape Baranova; (**b**) channeling events at grid point Shokalsky south.

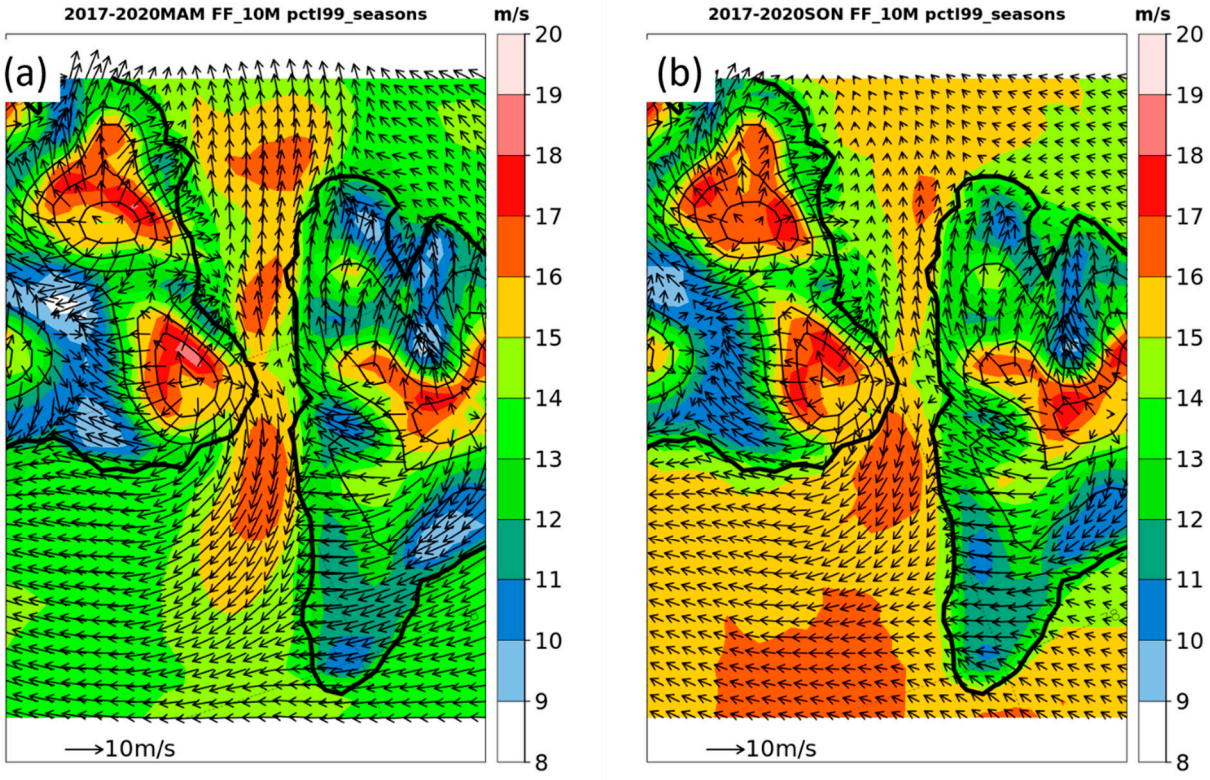

Figure S17. Simulated 99%-tile of the wind speed (shaded) and mean wind vectors for speeds exceeding 10 m/s based on hourly values for the area of Shokalsky Strait for different seasons 2017 – 2020. (**a**) March-May; (**b**) September - November. Vectors are shown every grid point, topography is shown as isolines every 200 m.