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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Low-level jet characteristics over the Arctic Ocean in spring and summer" *by* L. Jakobson et al.

Anonymous Referee #1

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In the manuscript, the authors present tethersonde observations of temperature and wind speed during the TARA expedition in 2007.They analyze the occurrence of low-level jets, including statistics on their frequency and providing potential generation mechanisms.

The paper is well written and structured. However, the scientific analysis of the tethersonde data needs to be put into a broader context of supporting observations. The results are compared to other studies, but the implications of the results remain unclear.

Since wind shear below a LLJ core may be the main source of turbulence (Mahrt, 2002; Mäkiranta et al., 2011), it is unfortunate that wind direction is not available from the tethersonde measurements.Surface meteorology data for the whole period may provide important background information on the synoptic situation of each tethersonde

launch. Surface pressure, temperature and wind direction also indicate the passage of frontal systems at the site. The temporal setting of the tethersonde profiles close to frontal passages may underline baroclinicity associated to transient cyclones as important LLJ forcing mechanism.

While a potential generation mechanism is provided for about half of the detected LLJs, the other half remains unexplained. Did those unexplained have any common characteristics ? How was their distribution over time, did they occur over a period of several days or rather in between periods of LLJs with obvious generation mechanism ?

Also in terms of the statistics, it would be helpful to have either a table or a timeline figure illustrating the launch time of the individual tethersonde profiles. Having no regularity for daily tethersonde launches, the statistics are biased. LLJs were detected on 18 of 39 days, but it would be wrong to extrapolate the resulting 46% to the whole period 25 April to 31 August. With 18 days of "LLJ detected" and thus 21 days of "no LLJ detected", the result could be anything between 14 % and 84 % LLJ-days over the entire period. Comparing with other studies, the representativeness of the data collection has to be proven.

In the majority of all soundings (54%), no LLJ was identified in the wind profile. Does this number change significantly when adjusting the criteria for Jet definition ? Is there a general difference between the days with and without LLJ regarding baroclinicity, trajectories, or cloud cover (from surface radiation data) ? Could the cases without LLJ even be more important for summertime Arctic atmospheric dynamics ? What do both the observed occurrence and the absence of LLJs on the drifting ice station Tara imply for the coupling of the boundary layer and the free troposphere over the Arctic ocean in spring and summer ?

Minor Comments:

Page 2128, lines 18-21: Andreas et al. (2000) studied LLJ using tethersonde data rather than airsonde data, because their airsonde did have a too coarse resolution for

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wind. In general, balloon-borne radiosondes with 1 sec time resolution and an ascent rate of 5 m/s easily provide vertical profiles of temperature, humidity, wind speed and wind direction with 5 m vertical resolution. Lacking data on wind direction and being limited in launch conditions by wind speed, I don't agree that tethersondes have a "superior applicability in LLJ studies compared to traditional radiosonde soundings".

Page 2129, lines 14/15: How many days during the whole period had to be excluded because of high wind speed ? Have the tethersonde measurements been limited by clouds ?

Figure 1: A few gridlines and the coordinates for the start and end point of the drift trajectory would help to pinpoint the measurement location.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 2125, 2013.