Reply to comments

Baseline characteristics of climate, permafrost, and land cover from a new permafrost observatory in the Lena River Delta, Siberia (1998–2011)

by J. Boike et al.

Anonymous Referee #2

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General comments: As stated in the paper, the purpose of this study is to summarize the characteristics of Samoylov Island with respect to its climate, vegetation, soils, permafrost, land cover and hydrology using data collected between 1998 and 2011. This could provide useful information for carrying out future studies not only on the island, but also on the entire Lena Delta. The authors also suggest that the data collected on this island are representative of the Northern Siberian tundra. This might not be the case since the environmental conditions for the tundra and uplands are quite different than conditions on the adjacent delta. I would suggest that the authors clearly explain why they think that Samoylov Island is representative of the Northern Siberian tundra, especially the more continental parts of Siberia.

We thank the reviewer for the valuable comments.

We agree with the reviewer and have clarified the representativeness of Samoylov with respect to other Arctic sites.

Please also refer to response to Reviewer #1.

Detailed comments: Page 13636, lines 4-6. I do not think the deposit should be called non-soil just because the surface is devoid of vegetation or has been flooded.

Section **3.3**.
We have accepted the reviewer's comment and changed the first paragraph as follows:

Most of the land surface area of Samoylov Island is characterised by permafrost within 1 m depth from the mineral soil surface, and most soils are therefore classified as Gelisols according to the US Soil Taxonomy (Soil Survey Staff, 2010). However, Entisols (more specifically Typic Gelaquents) that have neither permafrost nor gelic materials within 1 m depth from the soil surface, can also be found on the unvegetated banks of the Lena River.

Continuing with line 8: *The soils on the late-Holocene river terrace in the eastern part of the island and on the modern floodplain in the western part of the island have been affected by sustained fluvial and/or aeolian sedimentation processes, which have led to a stratified soil structure that consists of alternating layers of sands and silts, with varying contents of autochthonous and heterochthonous organic matter. Fluvial sedimentation is,…*

Page 13637, line 20. It would be useful to include photos of some of the representative soil profiles from the island.

We did not include another figure with soil profiles because the article was already very long. The published literature cited does, however, include photos of typical soil profiles on Samoylov:

Sanders, T., Fiencke, C., and Pfeiffer, E.-M.: Small-scale variability of dissolved inorganic nitrogen (DIN), C/N ratios and ammonia oxidizing capacities in various permafrost affected soils of Samoylov Island, Lena River Delta, Northeast Siberia, Polarforschung, 80, 23–35, 2010.
Zubrzycki, S., Kutzbach, L., and Pfeiffer, E.-M.: Böden in Permafrostgebieten der Arktis als Kohlenstoffsenke und Kohlenstoffquelle (Soils in arctic permafrost regions as carbon sink and source), Polarforschung, 81, 33–46, 2012a.

It appears that the dominant soils are Orthels. This would also suggest that this island is typical for the delta, but not for outside of the delta, where most of the soils are probably Turbels.

It is true that the dominant soils of the modern floodplain are Orthels. However, the soils of the polygonal tundra on the late-Holocene river terrace are dominated by a soil complex comprising Glacic Aquitubels and Typic Historthels. Since the elevated rims of the polygons, where the Aquiturbels are located, cover a larger area than the polygon centres, where the Historthels are found, the Turbels are indeed equally or more representative than the Historthels of the polygonal tundra on the late-Holocene river terrace. The type of cryoturbation that is observed on the elevated polygon rims is very much related to the formation of low-centred ice wedge polygons which is typical of many tundra lowlands in the circum-Arctic.

Table 3. I would suggest that the origin of the parent material (alluvium, eolian, etc.) for these soils be included.

As stated in Section **3.3** "The soils on the late-Holocene river terrace in the eastern part of the island and the modern floodplain in the western part of the island have been affected by sustained fluvial and/or Aeolian sedimentation processes, ..."

The soil parent material on the island is a mixture of fluvial and eolian sediments in variable proportions. We have not performed a quantitative analysis to determine the origin of the parent material and are therefore unable to add quantitative information to the table.

Figures 8 and 9.Soil temperatures were taken at depths of 0.21 m (Fig 8b) and 0.09 m, 0.06 m, 0.47 m and 0.51 m (Fig 9). These are very odd depths and are probably of little use for future studies. I would suggest that, in the future, soil temperatures should be taken at standard, internationally recommended depths.

The instruments were positioned according to the soil horizons, i.e. the instruments were installed more or less in the center of each horizon. It is not advisable to install sensors at the borders of soil horizons, because of the physical edge affects that can occur (for example, due to textural changes, which can induce changes in water content). Furthermore, there is to date no international recommendation available for installation depths in permafrost; discussions on this topic have, however, already been instigated (pers.com. V. Romanovsky). The CALM protocol (http://www.gwu.edu/~calm/research/temperature-data.html) suggests thermistor depths at 0.5, 1.0, 1.5 and 2.0 m. The near-surface probe should be located at the base of the living plants-duff interface, typically 2-3 cm below the surface.

Page 13652, lines 9-12. It is interesting that no clear warming is detected in the upper 1 m although the winter air temperatures in recent years have not been as cold as in previous years. An increase of 1o C was also detected in permafrost at the 10.7 m depth. Is it possible that there is some problem with your soil temperature measurements?

The soil temperature sensors reported correct data within the given uncertainty ranges. The warming trend is also visible in winter temperatures closer to the surface, but warming in the upper layers tends to be concealed by the ground's latent heat fluxes whereas at greater depths, in the continuously frozen soils, the signal is more clearly visible since no phase change occurs. The data record from the surface is, unfortunately, not continuous due to datalogger failures, and the data is therefore not suitable for a statistical trend analysis.

Section 8, Outlook: Samoylov Island – a new Arctic Observatory. In this section it would be useful to explain where improvement of data collection methods are needed and the new types of data to be collected in the future. One item I could recommend now would be to collect soil temperatures at internationally recognized standardised depths.

Improvements in data collection would include maintenance of long term data collection with as few gaps as possible. High quality, year-round data on energy, water, and carbon flux monitoring should then be fed into international databases (such as GNTP, FLUXNET, PANGEA). Future additional observations and installations could include enhanced atmospheric observations (chemistry, clouds, boundary layer physics) as well as ecosystem monitoring (water-chemistry, hydro-biology).Since no international standards are available to date we will, for the time being, follow the CALM protocol's suggestion for installation depths (see above). Data to be collected in future will include remote sensing data for observations of large-scale surface characteristics and their changes, such as for water bodies. We will in future include the collection of high resolution remote sensing radar data (Terra SAR-X data) provided by the DLR (http://sss.terrasar-x.dlr.de/) to detect changes over a specific area (or region). Satellite remote sensing may be the only practical means to bridge the gap between in situ point measurements and areal averages, eventually expanded to regional scale studies.

Added to Section **8**:

Improvements in data collection would include the maintenance of high quality, year-round data on energy, water, and carbon flux monitoring, with the data then being fed into international database. The use of high resolution remote sensing radar data (http://sss.terrasar-x.dlr.de/) to detect future changes over this area has already been instigated.