Introduction
Since 1998, northeast Siberian permafrost sequences have been analyzed as frozen paleoenvironmental archives of the last about 200,000 years in the context of the joint Russian-German science cooperation “SYSTEM LAPTEV SEA”. Organic matter (OM) properties were used as an important paleo proxy.
This study summarizes regional datasets on the quality and quantity of fossil OM in permafrost sequences of NE Siberia, in order to show the permafrost carbon pool heterogeneity related to paleoenvironmental dynamics, and the improved estimation of permafrost organic carbon stocks.
OM distribution in the upper permafrost zone up to 100 m depth in the Northeastern Siberian Arctic indicates considerable variability of OM between different stratigraphical units, between the same stratigraphical unit at different study sites, and even within stratigraphical units at the same site.

Study sites
Western Laptev Sea: (1) Cape Miamontov Khyk, Lena Delta: (2) Turakh Sise Island, (3) Ebe Sise Island (Nagym), (4) Khadang Island, (5) Kurungnak Sise Island
Central Laptev Sea: (6) Bykovsky Peninsula, (7) Muostakh Island
New Siberian Archipelago: (8) Stolbovoy Island, (9) Baikalovsky Island, (10) Kotelfy Island (Capa Anis), (11) Kotelfy Island (Khomuzhanskii River), (12) Bunge Land (low terrace), (13) Bunge Land (high terrace), (14) Novaya Sibe Island, (15) Mali Ilyakhovsky Island
Dmitry Laptev Strait: (16) Boishoi Ilyakhovsky Island (Vaninka-river mouth), (17) Boishoi Ilyakhovsky Island (Zimov’s river mouth), (18) Cape Svyatoy Nos, (19) Oyogos Yar coast
Indigirka-Kolyma lowland: (20) Kytak (Berekekh I.), (21) Pilshodok (Kolyma Delta) (23) Duuvanyar Yar (Lower Kolyma I.).

Methods
Ice content – gravimetrically measured
→ ice-rich (> 50 %), ice-bearing (25-50 %), ice-poor (< 25 %)
→ Syngentic formation, thawing & refreezing (tabular)
→ Total mass balance calculation, bulk density estimation
TC, TN, TOC – CMS analyzer (Elementar Vario EL III)
TOC → Variations in OM accumulation and degradation
TC/TOC → Decomposition degree, microbial activities
→ Low ratios: strongly decomposed;
→ High ratios: less decomposed
TC-TOC → TC inorganic carbon (e.g. fossil shells)
Δ13C (TOC) – Finnigan DELTA S mass spectrometer
→ OM origin (marine, terrestrial; subaerial/aquatic)
→ Composition of plant material
→ Isotopic fractionation during carbon mobilization
→ Decomposition degree (low δ13C less, high δ13C strongly)

Exposure examples from different study sites: a - Cape Miamontov Khyk (1) Western Laptev Sea, b - Kurungnak Sise Island (5) Lena delta, c - Oyogos Yar coast (19) Dmitry Laptev Strait, d - Stolbovoy Island (8) New Siberian Archipelago

Compilation of ice content and OM signatures at the Mamontov Khayata site showing the heterogeneity permafrost profiles according to stratigraphic units

General scheme of the stratigraphical segments of the permafrost zone, and several components of artic periglacial landscapes

Carbon inventory estimates

Conclusion
Carbon contents, OM qualities and decomposition degrees are highly variable and connected to changing paleo-environmental conditions
- Interglacial & interstadial periods: High TOC contents, high C/N, low δ13C -> less-decomposed OM accumulated under wet, anaerobic soil conditions
- Glacial & stadial periods: Less variable, low TOC, low C/N, high δ13C values indicating stable environments with reduced bioproducivity and stronger OM decomposition under dryer, aerobic soil conditions.

OM release to the ocean, to lakes and rivers and to the atmosphere due to permafrost degradation (e.g. thermokarst, thermal erosions, coastal erosion) and microbial decomposition
- The landscape average is likely about 30 % lower than previously published permafrost carbon inventories.
- Still large uncertainties in carbon estimations/calculations
- Detailed mapping of permafrost deposits especially of Ice Complex (Yedoma-type) and thermokarst deposits (Alas-type), their distribution and thickness are essential and in progress
- Analyses of OM available for decomposition are necessary.