

Ground subsidence/heave observations on Kurungnakh Island

In permafrost areas, seasonal freeze-thaw cycles of active layer result in upward and downward movements of the ground. Additionally, relatively uniform thawing of the ice-rich layer at the permafrost table can contribute to net long-term surface lowering. We use a simple method to quantify surface lowering (subsidence) and uplift (heave) in a yedoma area of the Lena River Delta, Siberian Arctic (Kurungnakh Island) (Fig. 1), using reference rods (metal pipes and fiberglass rods) installed deeply in permafrost. The metal pipes were 2 m long and 3 cm in diameter and were anchored at least 1 m below the typical active layer (Fig. 2a). The fiberglass rods were 2 m long and 1 cm in diameter and were anchored at least 70 m below the typical active layer (Fig. 2b). We assume, therefore, that the rods were motionless relative to the permafrost. The plexiglass plate with a size of 10 by 10 cm was fixed in its horizontal position by the rod but could move freely with the surface vertically along the rod. We repeatedly measured distance between the top of a rod and a plexiglass plate resting on the ground surface (Fig. 3). Several distance measurements around each rod were taken at each visit and averaged. Altogether 12 metal pipes were installed at the study site in April 2013 (station IDs: north-1 and -2, mid-1 and -2, south-1 and -2, 4, 5, 6, 7, 8, 9) and 19 fiberglass rods were installed in April 2014 (station IDs: 7-1, 7-2, 7-3, 7-4, 8-1, 8-2, 8-3, 8-4, 9-1, 9-2, 9-3, 9-4, 10, 11, 12, 13, 14, 15, 16). Four fiberglass rods were installed around metal stations 7, 8, and 9 (Fig. 4) and seven fiberglass rods were installed as a transect between metal stations 8 and 9 (Fig. 1). Measurements were conducted during field campaigns from spring 2013 to summer 2017 with some gaps. We provide here the measured distances between the top of a rod and a plexiglass plate. To obtain the ground displacement, the user have to define the period of interest and calculate the displacement.

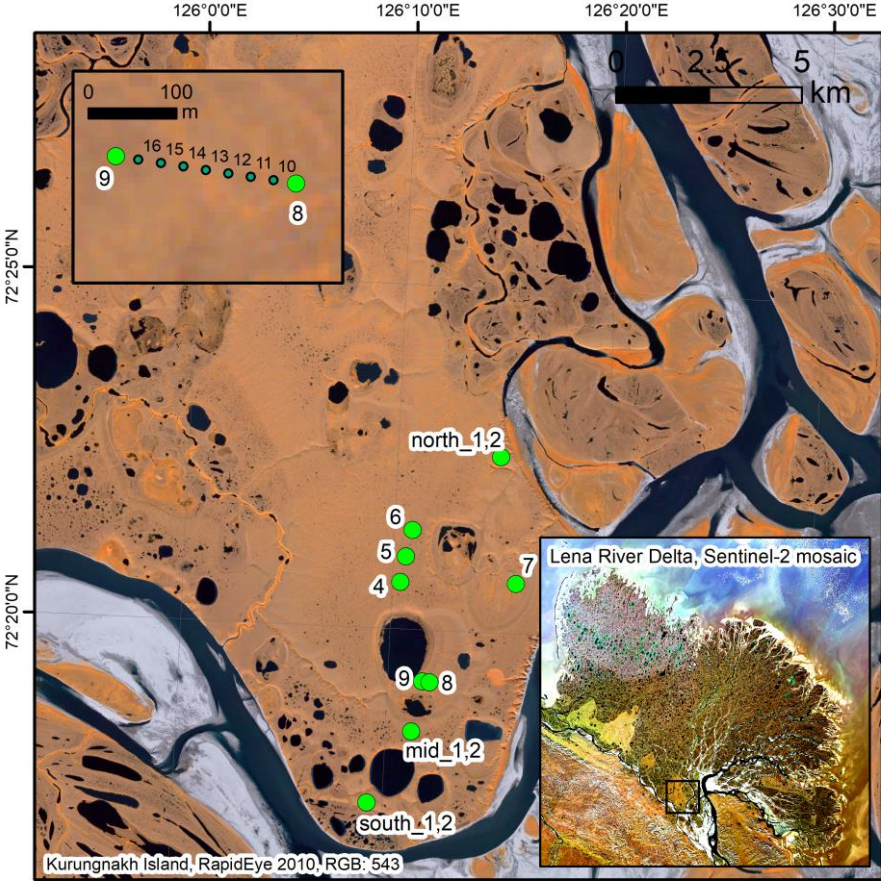


Figure 1. Measurement locations on Kurungnakh Island



Figure 2. a) Metal pipe, anchored in permafrost; b) fiberglass rod, anchored in permafrost.

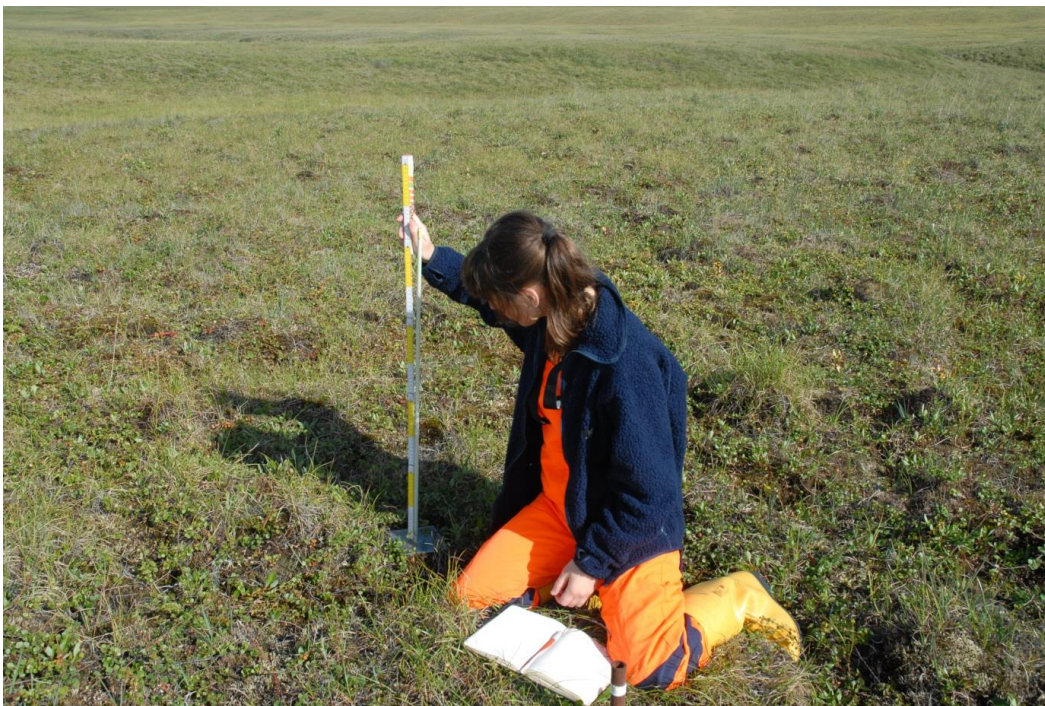


Figure 3. Measurements of the distance between the top of a rod and a plexiglass plate resting on the ground surface with a ruler.

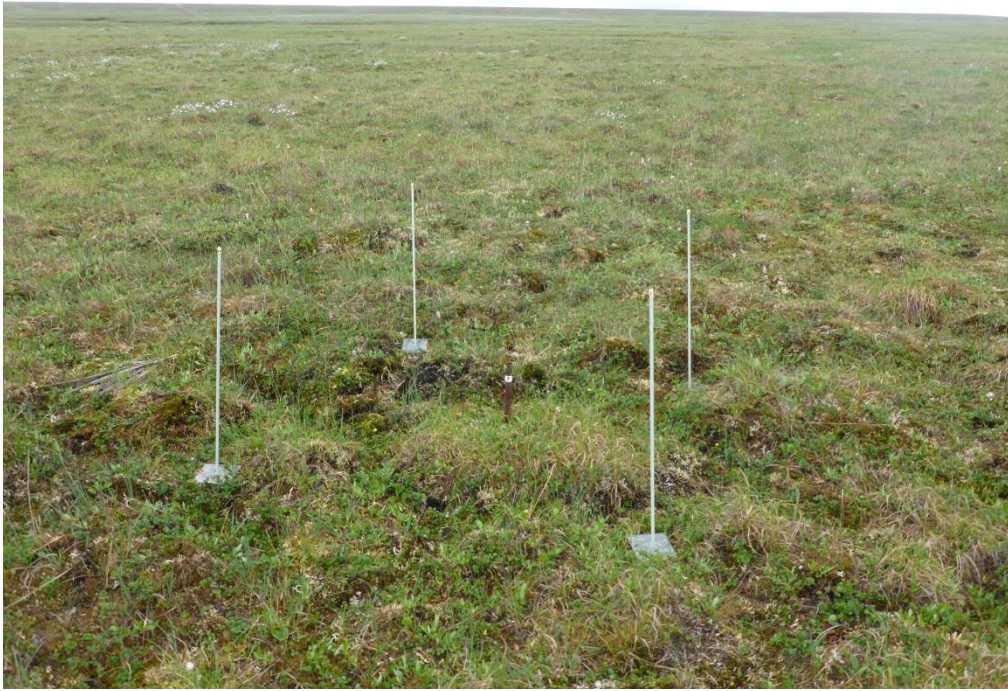


Figure 4. Setup of four fiberglass rods installed around a metal station.