Urban measurements (part 2)

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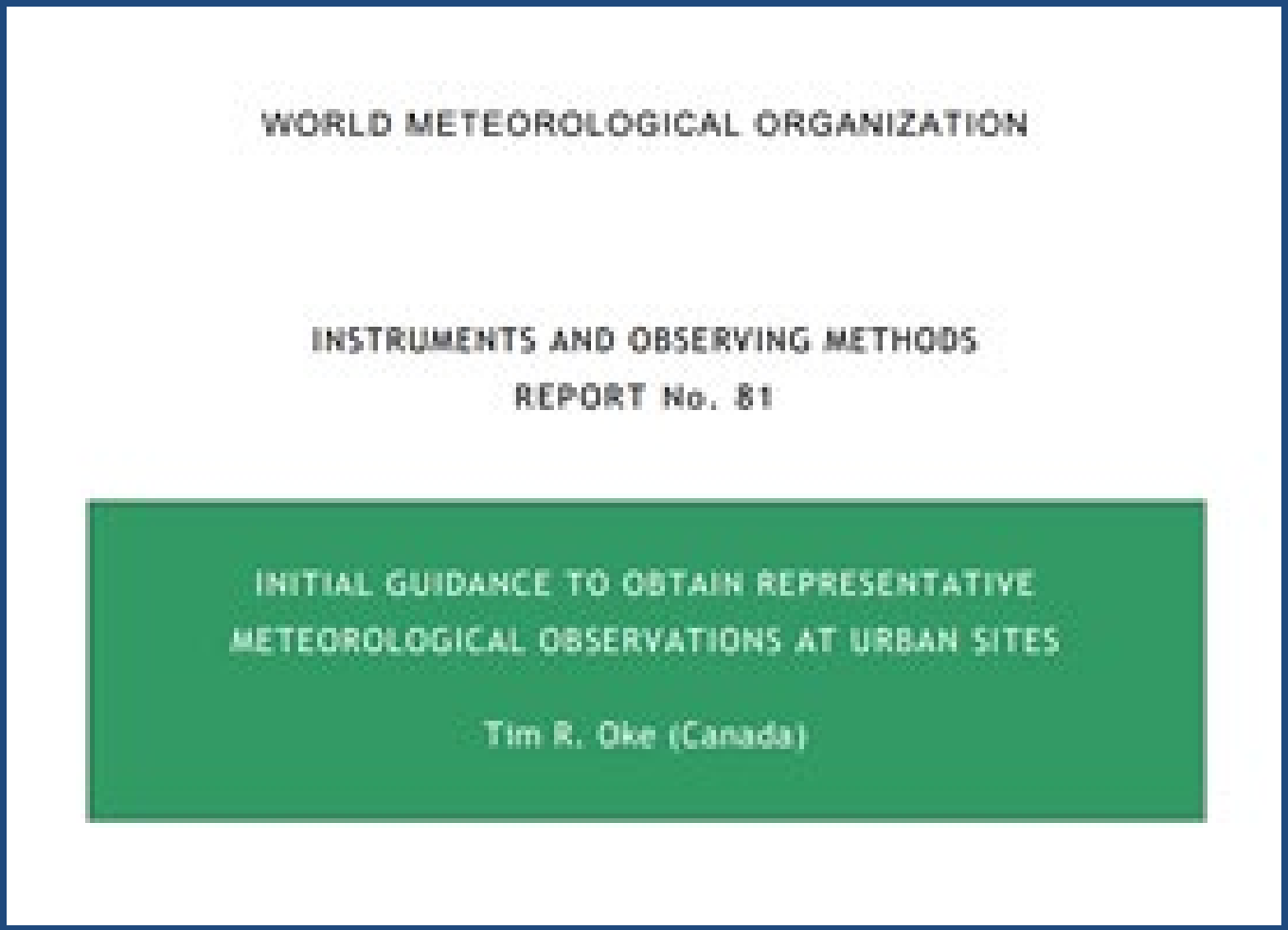
https://library.wmo.int/doc_num.php?explnum_id=9286



WORLD METEOROLOGICAL ORGANIZATION

INSTRUMENTS AND OBSERVING METHODS
REPORT No. 81

INITIAL GUIDANCE TO OBTAIN REPRESENTATIVE METEOROLOGICAL OBSERVATIONS AT URBAN SITES

Tim R. Oke (Canada)

Problem with WMO stations in "Urban landscape"

First case-study of 4 biggest Arctic cities:

1. First complex experimental study of temporal and spatial characteristics of Urban Heat Island in 4 biggest polar cities in the world (in Russia).
2. We used 3 different measurements techniques for obtaining good data quality,
3. Evaluation of possible economical effect of UHI at polar city heating system

Measurement techniques:

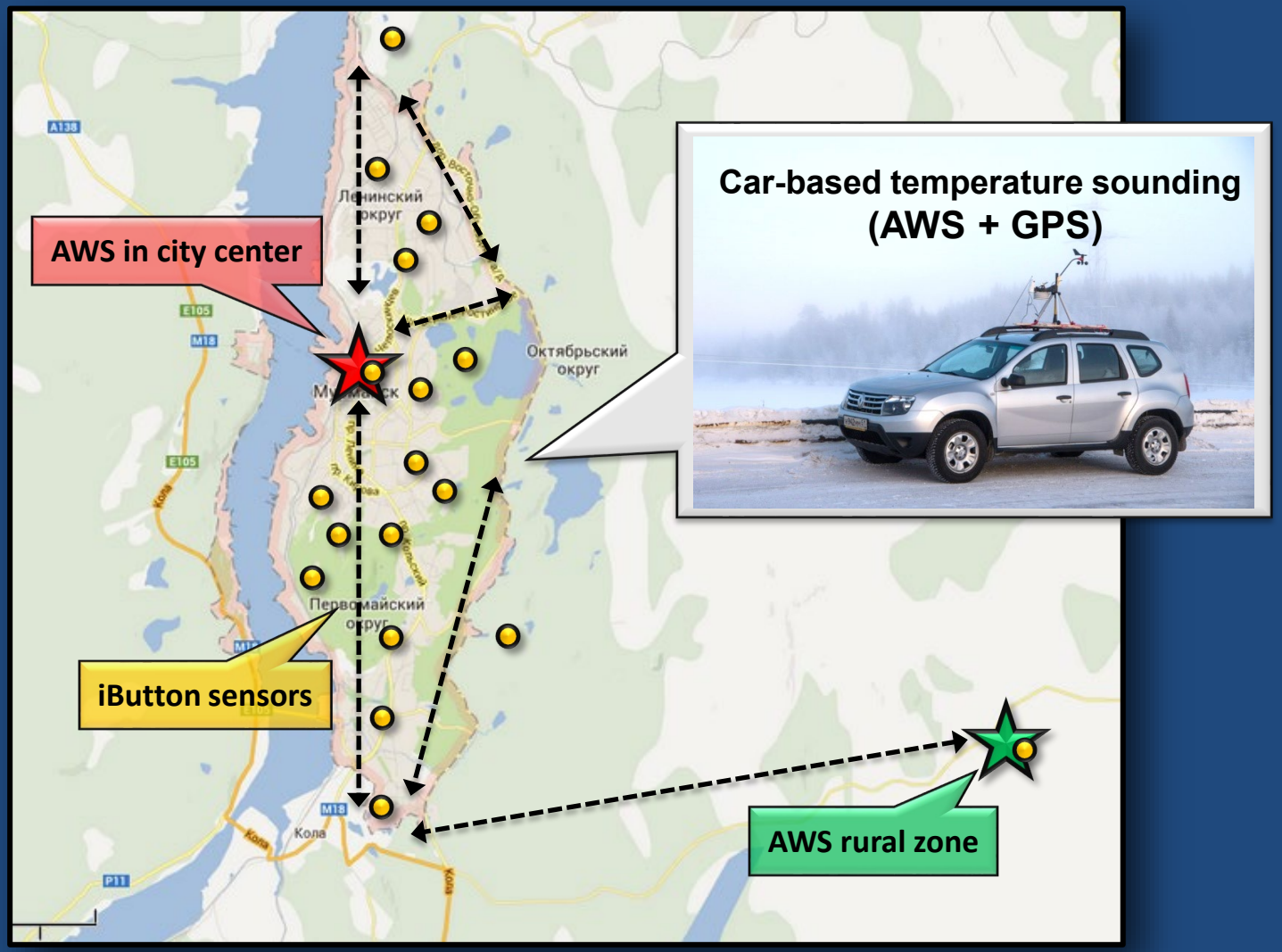
Stationary automatic weather stations (AWS)	Mobile weather station	Low-cost compact temperature sensors (iButton)	MTP-5 microwave temperature profiler (Norilsk only)
			

In situ measurements

Post-processing of the raw data (synchronization, quality-control, correction)

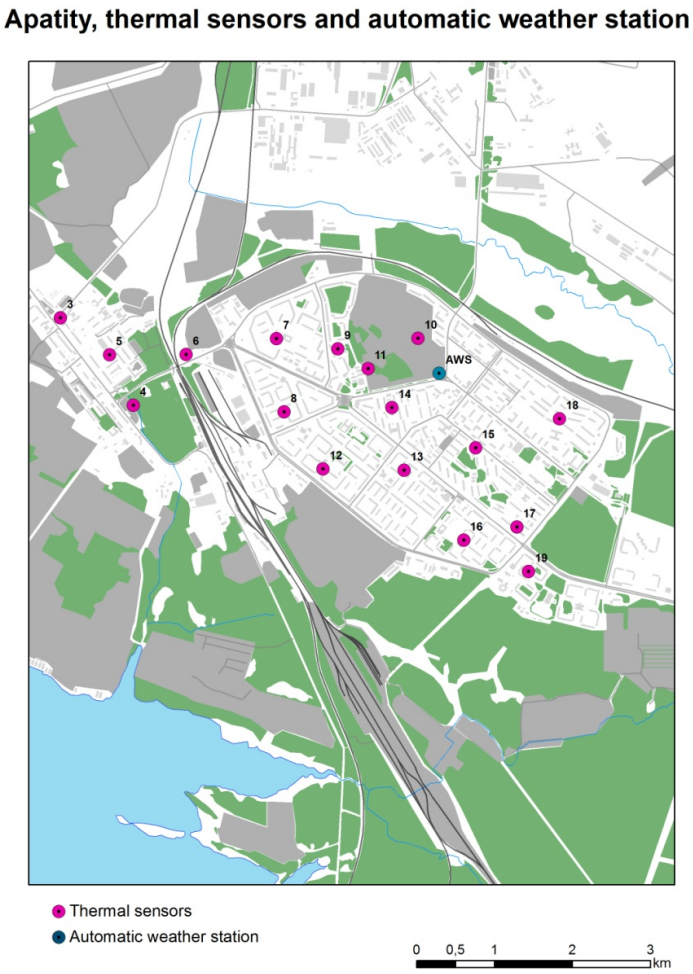
Building 2D temperature fields (geostatistical modelling)

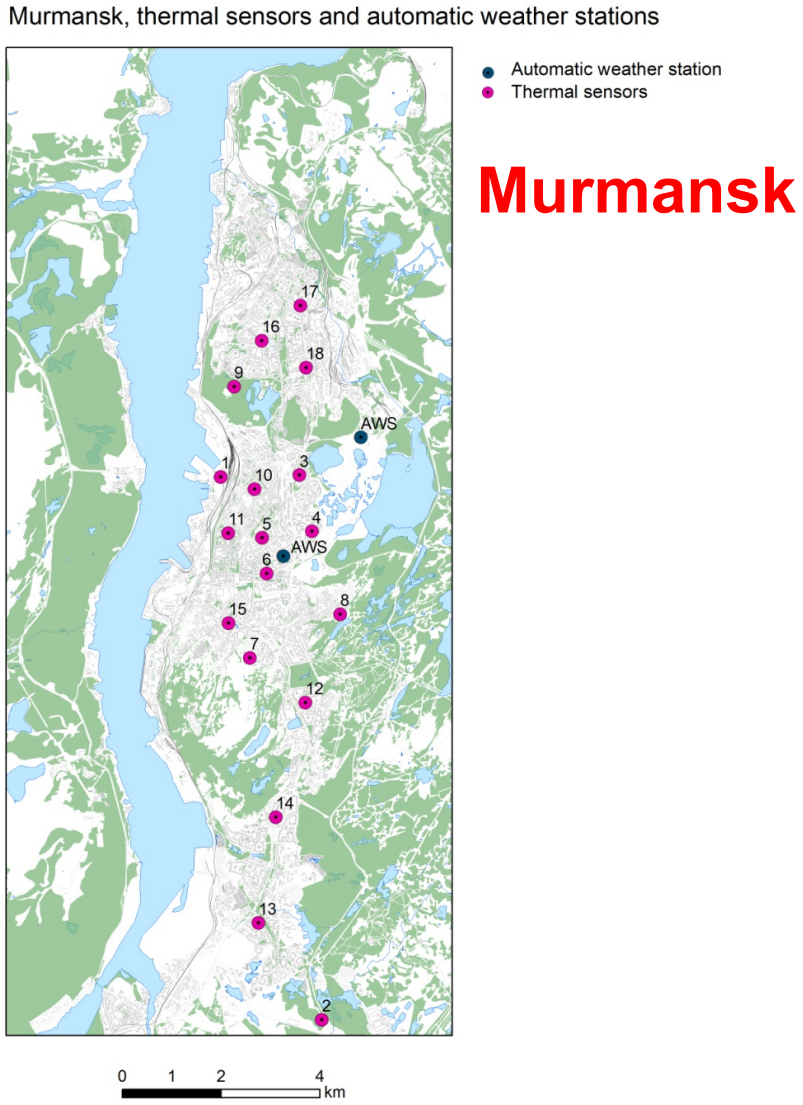
Measurement techniques:



Measurements network:

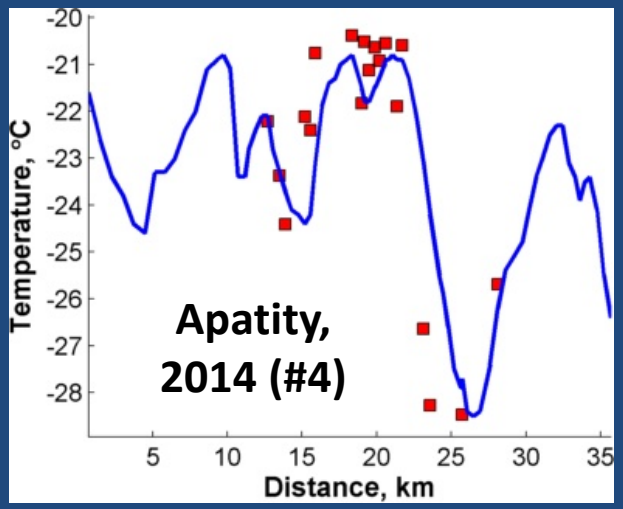
Apatity (2014)

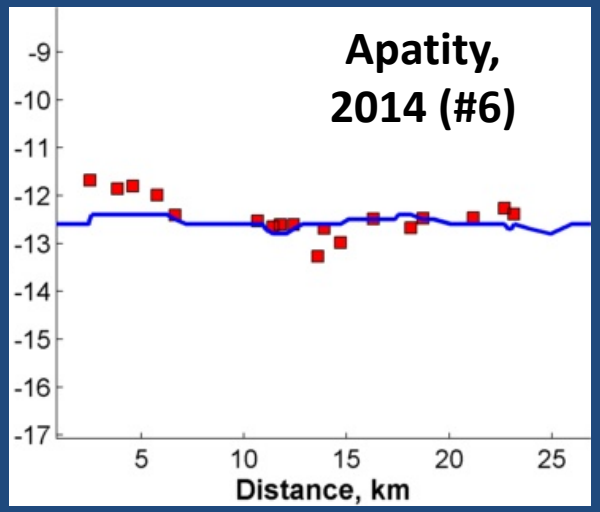


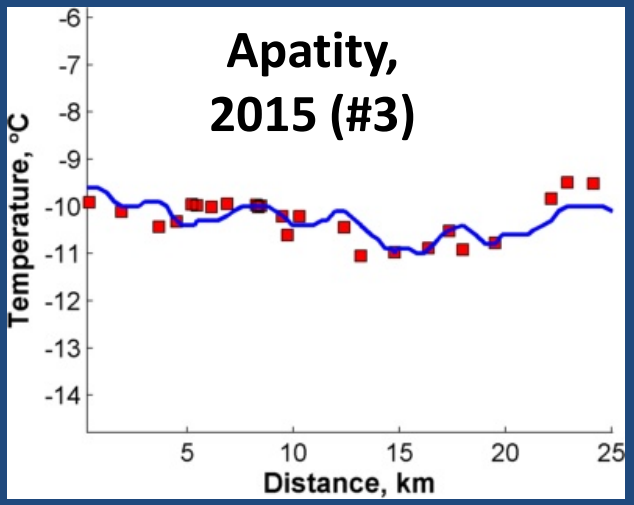


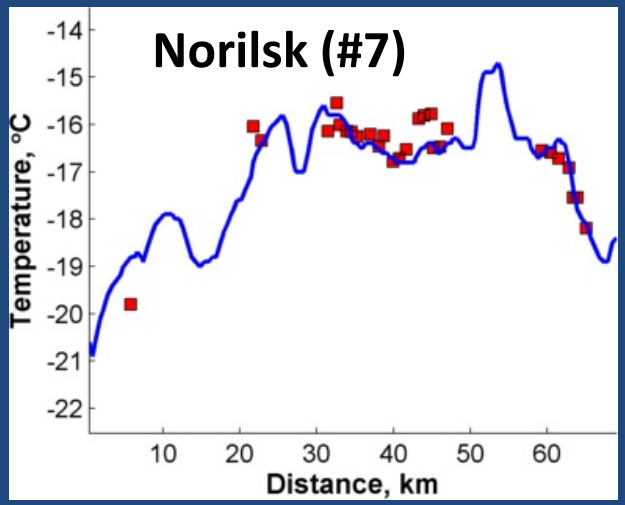
Murmansk

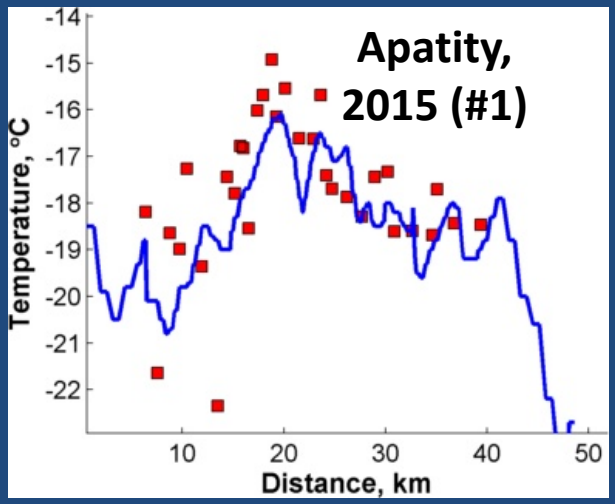
Mobile measurements
vs
stationary sensors





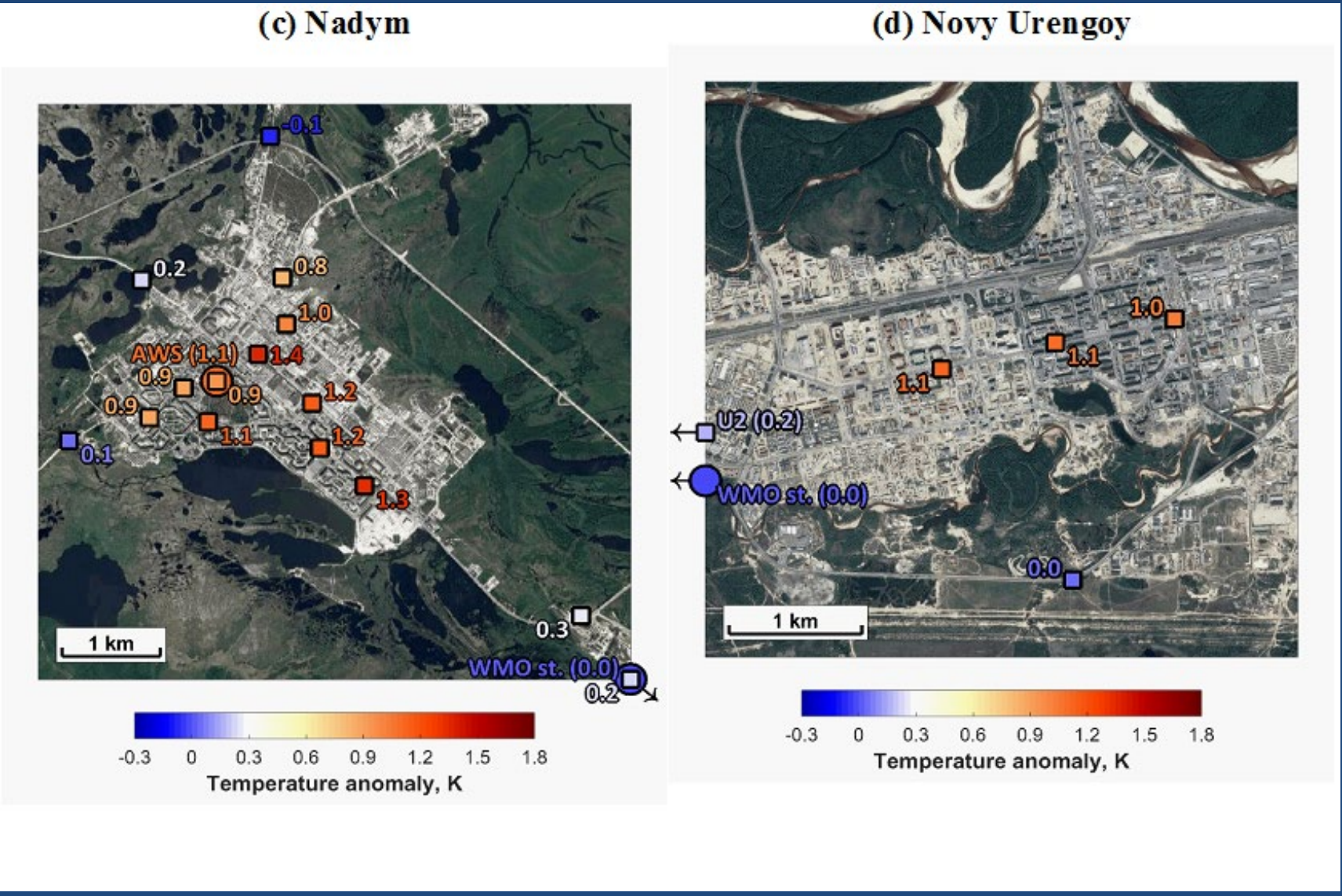






First UHIARC's long-term measurement system results

UHI in Nadym & Novy Urengoy



Ground-level thermal Inversions monitoring

Nadym

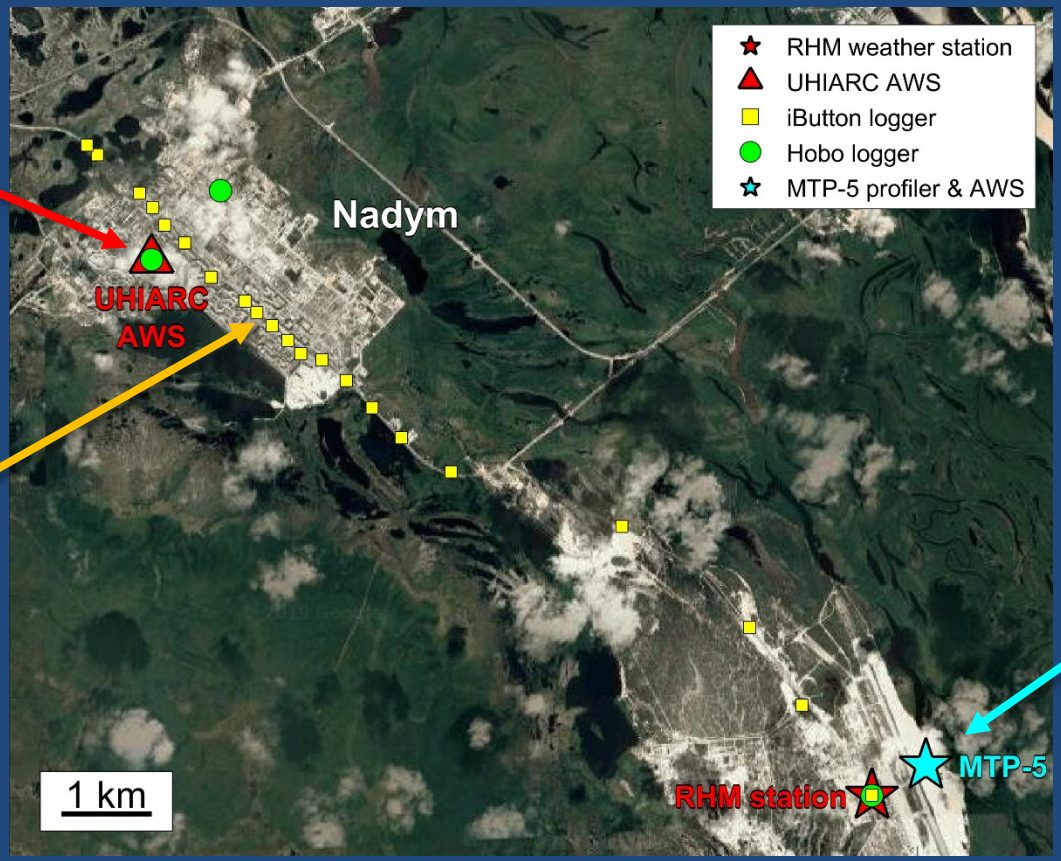
Apatity

Intensive campaign in Nadym

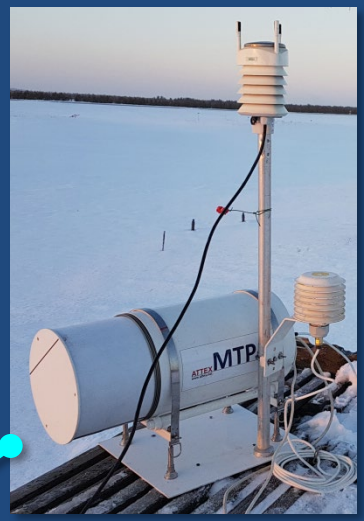
Aim of the research is to investigate the ABL behavior over the Arctic city in winter, under strongly stable atmospheric stratification

UHIARC AWS in the city center

Quadcopter-based vertical temperature sounding over the city



22 iButton & Hobo temperature loggers



MTP-5 microwave temperature profiler

Boundary Layer Inversions Measuring campaign in 2019 Russia. Kola Peninsula. Drones.

Motivation

Boundary layer inversions are closely connected with urban air quality

Materials and methods

Traditional AWS

Car-based sounding

Low-cost sensors iButton

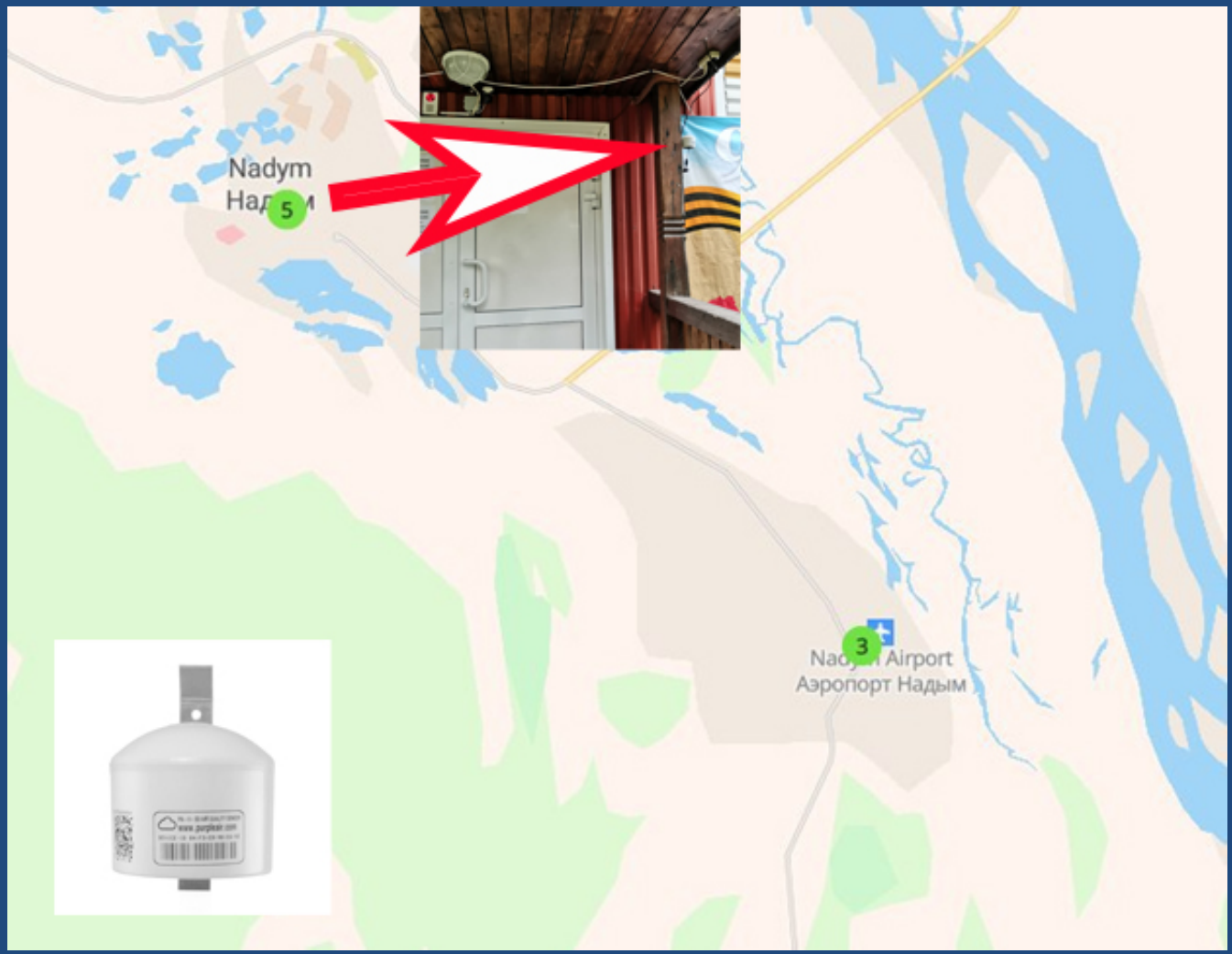
Dron-based sounding

Netatmo-sensors

Gradient measurements with HOBO

AIR QUALITY

Purple air PM2.5 и PM10



UHIARC NADYM PM2.5 (winter 2020-2021) :