P 189 URBAN CLIMATE RESEARCH IN ARCTIC: METHODOLOGY OF MEASURING URBAN HEAT ISLAND INTENSITY AND COMPLEX ANALYSIS OF PHENOMENON

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Since 2010, more than one half of Earth population lives in urbanizes areas. So, the problem of land-use and microclimate changes in city area becomes more important in the context of inhabitants‘ long-term quality of life.

The heat island for cities in tropical and temperate latitudes by now has been studied quite well. (Oke, 1987). According to (Oke, 1987; Ryu, Baik, 2012), one of the major reasons for its occurrence is considered to be more effective absorption and accumulation of solar heat in the town.

However, the formation of heat islands in the polar cities is scarcely explored: such work was carried out only in towns in Alaska (Magee et.al., 1999). In Eurasian big cities principal possibility of formation of heat islands in the polar night isn‘t still described well.

That‘s why in this report, we plan to discuss developed methodology of the UHI experimental research in big Russian Cities located to the north from the Arctic Circle and first results.

During our field trips in 2014-2016 we used a different measurements techniques:

1. Installation of two automatic weather stations (AWS) in rural zone and city center.
2. Installation of small temperature sensors (iButton) network in the city and suburbs.
3. Regular car-based temperature sounding of the city with AWS (on photo).
4. Using MTP-5 microwave temperature profiler.

Analysis of the collected data showed the existence of significant UHI with the difference between city center and surrounding landscape up to 5-8ºC

References:

1. Magee N., Curtis J., Wendler G., The Urban Heat Island Effect at Fairbanks, Alaska// Theor. Appl. Climatol. 1999. V. 64, pp 39-47.
2. Oke, Timothy R. Boundary layer climates - 2nd ed., London: Routledge. 1987.
3. Ryu, Y.-H., and J.-J. Baik, 2012: Quantitative analysis of factors contributing to urban heat island intensity. Journal of Applied Meteorology and Climatology, 51, 842−854.

P 195 URBAN HEAT ISLAND IN HETEROGENEOUS TERRAIN DURING UNDER CONDITIONS OF THE ARCTIC WINTER: ANTHROPOGENIC EFFECT OR INFLUENCE OF THE RELIEF?

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Experimental measurements in Apatity town in Kola peninsula in Russia (which is 5th biggest town, located to the north from the Arctic circle, with population about 56000) during winter seasons in 2014-2015 years has shown existence of the strong temperature anomaly around the town: temperature difference between town and weather station, located in few kilometers from it, reached values up to 10°C (Konstantinov et al., 2015) with mean value about 2 °C. However, understanding the nature of such anomaly is quite complicated. On the one hand, it could be caused by urban heat island effect, which is well-studied for the cities in moderate and tropical climate zones, but poorly investigated for high latitudes. On the other hand, possible contribution of the topography should also be taken into consideration, because town is located at the top of the hill, and weather station - at lower point near basement of this hill, where cold air could accumulated under conditions of the stable stratification. In our study contribution of these two factors was analyzed with application of newest experimental measurements, remote sensing data and numerical experiments with regional climate model COSMO-CLM, extended by specific urban parametrization. Finally, three independent approaches show approximately equal contribution of relief and anthropogenic effect to the genesis of observed anomaly. Accordingly, mean intensity of urban heat island effect, created by the town itself during the winter season, could be roughly estimated as 1°C , and its maximum values - as 5-6 °C, which is also significant in terms of house heating and meteorological comfort.

Reference: Konstantinov P.I. et al. Mapping urban heat islands of Arctic cities using combined data on field measurements and satellite images based on the example of the city of Apatity (Murmansk oblast)//Izvestiya - Atmospheric and Oceanic Physics. 2015. Vol. 51, N. 9. P. 992-998.

P 191 THE BIOLOGICAL ACTIVITY OF WEST SIBERIA SOIL IN RESPONSE TO LONG-TERM PERMAFROST DEGRADATION

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Permafrost ecosystems are sensitive indicators of environmental change. Anthropogenic impact disturbs the balance of natural ecosystems functioning, first of all soil and vegetation significant changes undergoes.

The aim is to estimate the response of soil and northern West Siberia permafrost ecosystems on permafrost thawing as a result of forty years exploitations of the pipeline. Ten transects, from the pipeline to a natural ecosystem area, of 50 meters in length with sampling points every 5 meters in different natural zones were investigated. The active layer of soil, the power of organic horizons, hydrothermal regime of soils were measured, also greenhouse gas emissions was studied. In the laboratory we studied the content of labile carbon and microbial biomass carbon (C mic), pH, basal (BR) and substrate-induced respiration were measured.

As a result of gas pipelines construction the permafrost thawing take place, ecosystem functioning, the temperature increases, moisture slightly decreases. The largest changes are seen for the vegetation: the part of vascular plants grows (from 20 to 70 %). For CO_2 fluxes nonsignificant increase is inherent, but in the case of flooding a significant increase in CH_4 emissions is noted.

Major changes are set for soil properties: there are increasing of soil temperature (from 4,5 to 13,5 ° C) and pH (from 3,5 to 5,3). The total and labile carbon (from 1,4 to 0.6 (mg C / g soil)) decreases. Microbiological activity is also decreases: BR (from 3 to 1 (C-CO_2 g / g of soil • h)), C mic (from 2,3 to 0,3 (mg C / g soil)).