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Comparison of Surface Temperature at Tunkinskaya Hollow with the Use of Data of In-situ Measurements and Landsat Space Images

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Recently the methods of remote evaluation of land and ocean surface temperature with the use of space images are developing. It makes possible detailed investigation of temperature field at a territory. Ground measurements of temperature at meteorological stations and during field works don't give such possibilities.
Outgoing radiation fixed on space images depend on temperature of the surface and its emissive ability. Usually during the process of images at conversion of brightness to values of a temperature, the emissive ability is not taking into account. It leads to appreciable distortions.
The aim of this study is the development of the method of calculation of surface and air temperature with the use of data of in-situ measurements and Landsat space images, taking into account emissive ability of different types of the Earth surface.
Electronic temperature sensors (thermochrones) were used for measurement of air and soil temperature (Tf) in the field. The sensors recorded air temperature every 3 hours simultaneously with routine measurements at meteorological stations. About 20 sensors were placed in 2009 at the key areas in the Tunkinskaya Hollow located 200 km to the west from Lake Baikal. Choice of key areas was made taking into account the landscapes characteristics. We study a cross-section through the Tunkinskaya Hollow that includes the bottom of the Hollow and its mountainous border - southern exposure of the Tunkinskiy Ridge. The thermochrones are located at altitudes from 806 to 2119 m a.s.l. The complex landscape study had being conducted along the meteorological observations.
Space images Landsat (far-infrared band 10.4-12.5 μm) were used for remote measurement of a temperature (Tr). Algorithm of temperature calculation with the use of Landsat images has the following stages. At the first stage for the points of location of thermochrones and the time of space survey Tr and Tf are defined. For Tr calculation the typical algorithm of calibration is used. Then the coefficient of proportionality k= Tr/Tf is calculated. For the test images k vary from 0,7 to 1,15.
At the next stage the coefficients of linear dependence and correlation between k and characteristics of brightness in different channels of Landsat image are calculated. In some works a correlation between k and NDVI was shown. For the test images, k correlates with the 7-th band (middle infra-red range). Then for the whole area of space image k and Tf = Tr/k are computed.
For the test images the Tf and Tr are differ. Interrelation between Tf and Tr are complicated and depend on emissive ability, season and character of microclimate of a territory. For example, for the forest territory Tr< Tf, as its emissive ability less than unity. For the territory with bare soil mantle Tr > Tf, as a soil are warmed higher than air. It is necessary to create a unified algorithm for computing the air and soil temperature with the use of the space images Landsat, with individual coefficients for each location and the time.