COMPARISON OF METHODS FOR THE GROUND THERMOGRAPHIC MEASUREMENTS: THE CASE OF COAL-WASTE DUMPS

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Ground thermography measurements are currently used for many environmental expertises, which are related to the land management or threats counteracting. The ground is measured in various areas - more and more often at the waste disposal sites. Coal-waste dumps are the objects, on which thermal monitoring is carried out with the highest care. The uncontrolled spontaneous self-ignition of stored material is a huge hazard to the environment and local residents. The prevention of hazard relies primarily on regular and complex monitoring, but there is no flawless method, so it is very difficult to predict the direction and strength of fire development [1].

It was decided to choose the effective way of measurement of the temperature distribution on the surface of coal-waste dumps. We consider three methods currently used for the thermography measurements: digital pyrometer with one meter probe and laser, handheld IR thermal camera and unmanned aerial vehicle with IR thermal camera. They are all common, easy to carry out, non-invasive and do not require a large financial outlay [2].

The aim of this presentation is comparison of thermal measurements' methods using digital pyrometer, handheld IR thermal camera and drone with IR thermal camera. Tests were executed on a small 25-year-old coal-waste dump in Ruda Śląska (Czarny Las district) in Upper Silesian Coal Basin, which has been burning since 1995. In the area of 6 hectares, 30 measuring points were placed (everyone received accurate coordinates). The temperature was measured there by a pyrometer and a thermal imaging IR camera. At a height of 50 meters, a drone with a thermal imaging camera made a flight and took almost 300 photos which then created a mosaic. Obtained measurements ranged from -10 to almost 500 Celsius degrees. The collected measurements were calibrated with each other and with the current environmental conditions. The data from the pyrometer was obtained in a vector format, while the data from the cameras were rasters. All data has been carefully analyzed for the location of hot spots and temperature values in the ArcGIS software.

The final aim of the analysis is choice of more reliable method which is less affected by error. The advantages and disadvantages of each method were noticed, proving that none of them is perfect.

[1] G.B. Stracher, A. Prakash, E.V. Sokol., Coal and Peat Fires: A Global Perspective: Volume 3: Case Studies – Coal Fires, ISBN 0444595112 (2014).

[2] J. Korski, Termowizja w monitoringu i zwalczaniu pożarów składowisk pogórniczych, Górnictwo i geologia, 5, 91-103 (2010).