Geophysical Research Abstracts
Vol. 17, EGU2015-1255, 2015
EGU General Assembly 2015

Quantifying of the Thermal Dynamic Characteristics of the Combustion System for Underground Coal Fire and its Impact on Environment in Xinjiang region, China

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Underground Coal fire (UCF) is one disaster associated with coal mining activities around the world. The UCF not only burns up the coal reservoir, but also causes serious environmental problems, such as the pollution to air, the damage to soils, and the contamination to surface and underground water and consequently the health problem to human beings. In the present paper, the authors attempts to quantify the thermal dynamic characteristics of the combustion system for UCF and its impact on environment by modeling, including delineating the physical boundary of UCF zone, modeling of the capacity of the oxygen supply to UCF, modeling the intensity of heat generation from UCF and modeling the process of heat transfer within UCF and its surrounding environment. From this research, results were obtained as follows: First of all, based on the rock control theory, a model was proposed to depict the physical boundary of UCF zone which is important for coal fire research. Secondly, with analyzing the characteristics of air and smoke flow within UCF zone, an air/smoke flow model was proposed and consequently a method was put forward to calculate the capacity of oxygen supply to the UCF. Thirdly, with analyzing the characteristics of coal combustion within UCF zone, a method of calculating the intensity of heat generation from UCF, i.e. the heat source models, was established. Heat transfer with UCF zone includes the heat conductivity within UCF zone, the heat dissipation by radiation from the surface of fire zone, and the heat dissipation by convection as well as the heat loss taken away by mass transport. The authors also made an effort to depict the process of heat transfer by quantitative methods. Finally, an example of Shuixigou coal fire was given to illustrate parts of above models. Further more, UCF's impact on environment, such as the heavy metals contamination to surface soil of fire zone and the characteristics of gaseous pollutants emission from the UCF also was studied.