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Underground Coal-Fires in Xinjiang, China: Assessment of Fire Dynamics from Surface Measurements and Modeling

Manfred W. Wuttke (1), Qiang Zeng (2), David C. Tanner (1), Matthias Halisch (1), Zhong-yong Cai (3), and Chunli Wang (4)

(1) Leibniz Institute for Applied Geophysics (LIAG), Geothermics and Information-Systems, Hannover, Germany (manfred.wuttke@liag-hannover.de), (2) Xinjiang Coal Research Institute, Urumqi, Xinjiang, China, (3) Xinjiang Coal Fire Fighting Bureau, Urumqi, Xinjiang, China, (4) Xinjiang Agricultural University, Urumqi, Xinjiang, China

Spontaneous uncontrolled coal seam fires are a well known phenomenon that causes severe environmental problems and severe impact on natural coal reserves. Coal fires are a worldwide phenomenon, but in particular in Xinjiang, that covers 17.3 % of Chinas area and hosts approx 42 % of its coal resources. The Xinjiang Coalfield Fire Fighting Bureau (XJCFB) has developed technologies and methods to deal with any known fire. Many fires have been extinguished already, but the problem is still there if not even growing. This problem is not only a problem for China due to the loss of valuable energy resources, but it is also a worldwide threat because of the generation of substantial amounts of greenhouse gases.

In this contribution we describe the latest results from a new conjoint project between China and Germany where on the basis of field investigations and laboratory measurements realistic dynamical models of fire-zones are constructed to increase the understanding of particular coal-fires, to interpret the surface signatures of the coal-fire in terms of location and propagation and to estimate the output of hazardous exhaust products to evaluate the economic benefit of fire extinction.

For two exemplary fire-locations, coarse digital terrain models have been produced. These models serve as basis for a detailed surface exploration by terrestrial laser scanning which shall deliver a detailed fracture inventory. Samples of rock and coal have been taken in the field and are characterized in LIAG's petrophysical laboratory in terms of transport properties. All these data serve as input for our detailed numerical fire models. Repeated measurements of the surface changes together with thermal images reveal the dynamics of fire propagation. The numerical models are calibrated by such data and can later be used to quantify the emissions from such a fire zone.