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MONITORING ENVIRONMENTAL EFFECTS OF HYDRAULIC FRACTURING USING REMOTE SENSING: TRACKING FRACKING

Abstract

The combination of increasing energy demand, interest in expanding domestic supplies, and new hydraulic fracturing technology has resulted in a drilling boom in the United States. In many parts of the country, induced hydraulic fracturing or 'fracking' used for petroleum and natural gas extraction has been extensively explored. Fracking is also now a worldwide topic, with the biggest pro and con debates taking place in Europe and China. As shale gas reserves have been proven to exist worldwide, fracking could become the biggest environmental hazard in developing nations eager for increased income from gas production. Emissions from fracking operations have the potential to cause a wide range of environmental impacts. For example, fugitive methane emissions in shale gas production are a growing concern. Methane is a greenhouse gas with climate change potential exceeding that of carbon dioxide. Fracking operations have also been implicated in triggering earthquakes, ground water contamination, soil erosion, and spills due to pipe failures and loss of containment ponds.

Using ground based monitoring systems to detect emissions from fracking operations is a difficult task because of the large number of well sites in remote locations dispersed over large geographic areas. However, remote sensing of atmospheric pollutants can provide key information on the effects of emissions on air quality related to fracking activities. Remote sensing data from aircraft as well as space-borne instruments can provide information to evaluate pollutant emissions over large areas. For example, aircraft flights using infrared cameras have been used to identify significant emissions from fracking operations in the Barnett Shale. In addition, satellite measurements have been used to identify "hot spots" associated with methane plumes.

Applications for satellite instruments are varied and cover a broad range of research including epidemiological studies, atmospheric modeling, and climate change. However, the use of Satellite assets for identifying emissions from fracking operations is a new frontier. Sensors on board various satellites can estimate atmospheric levels of key species resulting from fracking operations. This paper will present the results of the International Space University Space Studies Program 2015 team project including an assessment of current methodologies to monitor and track environmental changes that result from fracking operations, ways to use airborne and space-based assets to provide data and information to yield more insight into the overall environmental affects of fracking operations, and the results of a case study focused on fracking operations in Ohio, USA.