



## Satellite active fire data validation using drones: Protocols and initial results from prescribed fires in Brazil

Wilfrid Schroeder<sup>1</sup>, Fabiano Morelli<sup>2</sup>, Heber Passos<sup>2\*</sup>, Joana Nogueira<sup>2</sup>, Renata Libonati<sup>3</sup>, Paulo Victorino<sup>2</sup>, André Lima<sup>4</sup>, Guilherme Martins<sup>2</sup>, Marcelo Romão<sup>2</sup>, João Neves Silva<sup>5</sup>, Duarte Oom<sup>5</sup>, Leonardo Peres<sup>4</sup>, Filippe Lemos<sup>4</sup>, Alberto Setzer<sup>2</sup>

**ABSTRACT**– Global biomass burning impacts millions of hectares annually resulting in high social, environmental and economic costs. Satellite-based active fire detection products provide key information in support of land management and science applications and are available routinely from a variety of sources. Data validation is an important aspect guiding product development and characterization and is addressed in this study with the use of miniaturized sensors paired to unmanned airborne vehicles, or drones. Specifically, we deployed a custom-made broadband spectral radiometer along with a commercial off-the-shelf infrared camera (FLIR Zenmuse XT) mounted to small consumer drones (DJI's Phantom3 and Inspire) flown over small prescribed burns implemented so as to coincide with the overpass times of different earth observing satellites (e.g., NASA Terra & Aqua, NOAA/NASA S-NPP, USGS Landsat-8, and ESA Sentinel-2). Near-simultaneous fire radiative power retrievals were obtained using the airborne and spaceborne data acquired during prescribed fires conducted in grasslands and savannas plots in the Brazilian states of Rio de Janeiro, Tocantins and Mato Grosso do Sul between July 2017 and September 2018. A set of standard operating procedures were defined with attention to satellite active fire data validation requirements (e.g., reference data calibration) and subsequently adopted for each of the fires sampled. Airborne and spaceborne observations were co-located and temporally paired to within 2sec, and path transmittances calculated in order to account for atmospheric attenuation of fire retrievals. Our results showed good agreement (differences as low as 5%) between drone and satellite-based fire retrievals while also serving to demonstrate the potential for fully reproducible satellite data validation protocols using small sensor and drone technologies.

**Keywords:** Active fires; remote sensing; drones; prescribed fires

---

<sup>1</sup>NOAA/NESDIS, USA, <sup>2</sup>Instituto Nacional de Pesquisas Espaciais (INPE), Programa Queimadas, São José dos Campos-SP, Brazil, <sup>3</sup>Universidade Federal do Rio de Janeiro, Instituto de Geociências, Departamento de Meteorologia, Brazil <sup>4</sup>University of Maryland, USA, <sup>5</sup>Centro de Estudos Florestais, Universidade de Lisboa, Lisboa, Portugal. E-mail para contato: [wilfrid.schroeder@noaa.gov](mailto:wilfrid.schroeder@noaa.gov).