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Gas flare characterisation with Sentinel-3

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Gas Flaring (GF) is the process of burning waste gases at the tip of a stack. It is widely used in the upstream oil and gas industry. It is a contributor to the imbalance of the greenhouse gases (GHG) concentration in the earth's atmosphere, which prompts global warming. Besides GHG, GF also emits black carbon (BC), a known carcinogen and climate active species. At higher latitudes, GF has been estimated as the main input of atmospheric BC, alongside vegetation fires.
The consideration of GF as a source to global budgets has been hindered by technical difficulties of in-situ measurements and the inexistence of a systematic reporting system. Remote sensing offers the possibility of a continuous, global and systematic monitoring of GF over extended periods.
Being a high temperature process, GF can be detected from space using measurements at appropriate wavelengths. Considering 1800K as a typical GF temperature and Wien's displacement law, the peak emission will be in the short-wave infrared region. This spectral region is observed by two channels (S5 and S6) of the SLSTR instrument aboard ESA's newly launched Sentinel-3 satellite. Because of solar contamination, only night-time observations are used. In order to characterise the identified gas flares in terms of temperature and area, two Planck curves are fitted to SLSTR radiance observations in five spectral channels (S5 through S9, with F1 and F2).
In this work, we present the methodology in detail as well as results for known flaring regions around the world. A comparison with VIIRS on Suomi-NPP and with HSRS on TET-1 over known GF locations is also considered.