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The RST-FLARE algorithm for gas flaring characterization by satellite data: the case of Niger Delta region

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There are several issues surrounding gas flaring and its huge impacts on humans, the environment and the economy. All governments, international institutions and operating companies recognized the gas flaring as a foremost anthropogenic source for greenhouse and/or precursor gases, particulate matter and black carbon that pollute the air, soil and water, at local, regional and global scale as well as a waste of a non-renewable resource. The main challenge faced in the effective characterization of gas flaring is the lack of systematic, complete and reliable data on its magnitude and spatial distribution.
Since few decades, satellite data have been exploited to provide independent information on gas flaring activity at global, national and local scale. In particular, the analysis of long series of satellite imagery, with different spatial and spectral resolutions, demonstrated the effective usefulness of these data to recognize flaring affected areas, monitor their evolution both in space and in time, and determine how much emission is released by oil&gas plants at different spatial scales.
Among the few techniques developed ad hoc for gas flaring investigation, the RST-FLARE algorithm, based on the processing of multi-year time series of nighttime infrared MODIS data, showed a good level of accuracy and reliability in i) identifying flaring sites, ii) computing the amount of burned associated gas and iii) following their changes over space and time, when applied at both local and national scale.
This work is focused on the discussion of the RST-FLARE performances when investigating the gas flaring in the Niger Delta region, one of the top five gas flaring areas in the world, in years 2000-2016. The achievements carried out for this study case are in a very good agreement with independent data, provided by other satellite techniques and national/international organizations, both in terms of flaring sites localization (95% of spatial match) and volume estimates (mean bias between in 16% and 20%, at annual scale and 2–9% in the long period). Outcomes of this work seem to indicate that RST-FLARE can be used to provide, at different geographic scales, quite accurate data on gas flaring, suitable for monitoring purposes for governments and local authorities.
Exploiting the RST independence of the investigated signal/sensor, work in progress are focusing on the development of a VIIRS-based RST-FLARE configuration to further improve its ability in quantitatively characterizing flaring sites (e.g., area, temperature, emission power, flared volumes).