EPSC Abstracts
Vol. 12, EPSC2018-701, 2018
European Planetary Science Congress 2018
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Mass loss during outbursts on comet 67P

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Abstract

During its 2.5-year mission at comet 67P/Churyumov-Gerasimenko, instruments on board the European Space Agency's Rosetta spacecraft frequently observed outbursts of activity on various scales. The events typically lasted for less than a few hours and were characterised by the emission of gas and/or dust in quantities higher than typical for the given region and local time. The vast majority of these outbursts was too small to be detectable by Earth-based telescopes, and seemed to originate from confined small areas on the surface [1]. Possible causes of cometary outbursts include collapsing cliffs [2], exposure of supervolatiles to sunlight in expanding fractures [3], cryovolcanism driven by the crystallisation of amorphous ice [4], and the collapse of sub-surface cavities [5, 6].

The amount of dust produced during an outburst can be constrained both from the measurements of in situ dust instruments (GIADA and COSIMA) and from the light scattered by the dust (as observed e.g. with the cameras OSIRIS and NAVCAM). The gas production rate can be constrained from measurements of the gas instrument (ROSINA), and indirectly from the area on the surface affected by an outburst [7, 8].

We here study a sample of outbursts on 67P for which at least two complementary measurements are available, to address whether a given event can have been driven by the free sublimation of H_2O, CO_2 or CO ice, or whether energy stored in the cometary (sub-)surface must have played a role.

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