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# Optical properties of smoke aerosols over clouds: combining the strengths of satellite imagers and spectrometers

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Aerosols are particles in the atmosphere that affect the Earth's radiative budget in different ways: directly, by scattering and absorbing radiation; and indirectly, e.g. by influencing cloud properties. An important source of aerosols is biomass burning. Large fires can cause smoke plumes to rise high into the atmosphere, in many cases over lower-lying clouds.

The properties of aerosol layers over clouds are most suitably studied from space. However, the effect of clouds on satellite measurements is usually much larger than the effect of aerosols, and scenes contaminated by clouds are generally discarded.

We here present a method to determine optical properties of aerosols above clouds, taking advantage of the specific strengths of two types of passive satellite instruments: the high spatial resolution of imagers and the relatively high spectral resolution of spectrometers. First, cloud properties are determined from an imager, either MERIS or AVHRR. The cloud information is then combined with UV-visible spectra from SCIAMACHY or GOME-2 and results from simulations to obtain aerosol optical parameters.

The method will be demonstrated in two case studies: a high-altitude pyro-convective smoke plume observed during the 2010 Russian wildfires, and an elevated smoke plume over a persistent stratocumulus cloud deck over the Gulf of Guinea.