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What is the physical limit for the spatial resolution of satellite observations in the UV, vis, and NIR spectral range?

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Since 1995 satellite instruments are in orbit, which observe the sun light scattered back from the Earth with moderate spectral resolution. From these observations, global maps of many important atmospheric trace gases can be derived. While the spatial resolution of the first instrument (GOME-1) was rather coarse (320 x 40 km^2) it has strongly improved in recent years (e.g. OMI: 13 x 24 km^2) and will be improved further in the near future (Sentinel 5P: 3.5 x 7 km^2). These improvements were mainly driven by technical development of the satellite instruments and the available data rates for downlinking the measured spectra. Nevertheless, the ultimate limit for the spatial resolution results from requirements on the signal to noise ratio of the measured spectra, which depend on the wavelength range, observatiom geometry and atmospheric composition (e.g. clouds), but also on the size of the detector and the spectral resolution and coverage of the satellite instruments. In this presentation we discuss these dependencies and estimate the best achievable spatial resolution for different species measured in different spectral ranges by UV, vis, NIR satellite instruments.