

# Glory from space

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The glory is an optical phenomenon, consisting of concentric coloured rings of a few degrees in diameter. It can be observed by looking down on water clouds around the antisolar point, which is the point on the cloud where the shadow of an observer's head would be.

The first scientific reports of glories were made in the eighteenth century by Antonio de Ulloa, a captain of the Spanish Navy, from Mt Pambamarca in Ecuador (Lynch and Futterman, 1991). In those days the only possibility for an observer to be above the clouds was in mountainous areas or near the steam of geysers and warm water springs. The number of possible viewpoints then grew century-by-century:

- In the nineteenth century glories were seen from incidentally-operating hot air balloons, like the one of the French meteorologist and aviator Gaston Tissandier.
- In the twentieth century the glory became a rather commonly-observed phenomenon, frequently from aircraft.
- In the twenty-first century glories can even be observed from space as they sometimes appear on satellite imagery.

Glory rings observed from space were detected on a photograph taken from an altitude of 278 kilometres on 28 January 2003 by a Xybian radiometric camera on board the space shuttle Colombia (Laven, 2005; Israelevich *et al.*, 2009). However, most imagery from space is based on data from instruments that scan the earth's surface and the clouds above it from an altitude of about 700 kilometres in swaths perpendicular to the projection of the path followed by the satellite. Instead of circular rings, as seen by an observer or taken by a camera, an individual swath gives a horizontal cross-section through the glory circle, containing two coloured areas. The previous and next swaths do the same. As a result, a glory on satellite imagery in natural colours will typically consist of two elongated, coloured bands parallel to the projection of the path of the satellite.

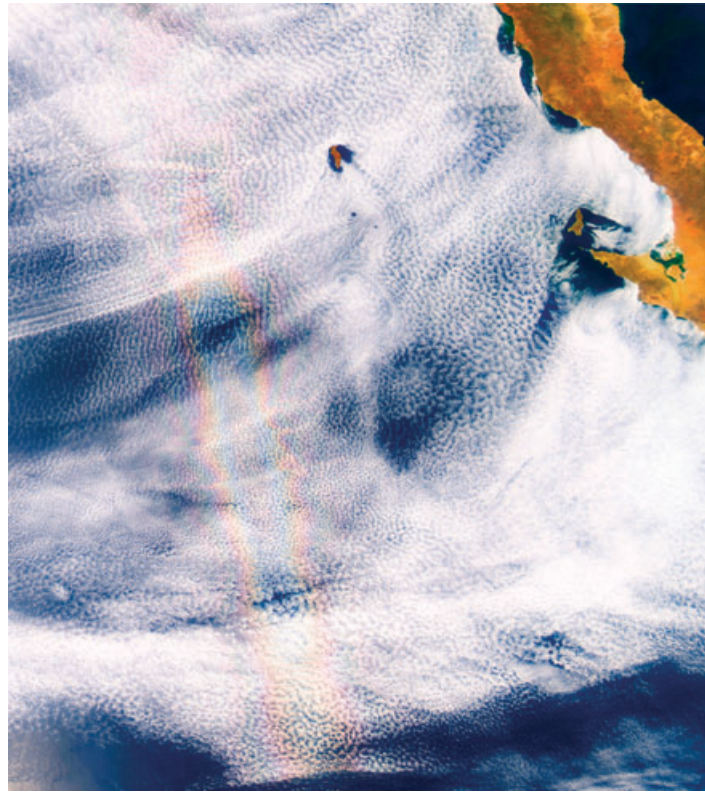


Figure 1. Glory on stratocumulus clouds over the Pacific Ocean, west of Baja California, Mexico, observed from space on 20 May 2008 by MODIS on the Aqua satellite. The image in natural colour was saturation-enhanced to make the glory effect better visible. Von Kármán vortices can be seen downwind from Isla de Guadalupe. (Courtesy NASA's Earth Observatory.)

Figure 1 shows a glory observed from space by the Moderate Resolution Imaging Spectroradiometer (MODIS) on the Aqua satellite. More examples are available from <http://rapidfire.sci.gsfc.nasa.gov/cgi-bin/imagery/gallery.cgi> (keyword = glory).

The observations of glories from space show that the distance from the observer to the clouds is not important. The phenomenon can be seen from a viewing distance of a few metres – e.g. in the steam of geysers and warm water springs – to one of 700 kilometres on satellite imagery in natural colours.

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## References

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