

## 4.2 Albedo

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Albedo is the proportion of the total solar incident radiation that is reflected by the Earth's surface. Surfaces such as snow reflect most of the incident radiation and have a high albedo. Surfaces that absorb most of the incident radiation, such as dense forest and water bodies, have low albedo. The average Earth albedo is 0.3 on a scale from 0.0 to 1.0. However, this changes regionally and seasonally. Monitoring of albedo is important as changes of the Earth's surface due to natural and human causes influence the energy balance and hence climate. This is particularly important in polar, sub-arctic and glaciated regions.



Photo: © Karl Jordan

Artist's impression of Envisat. Source: ESA



### Measurements

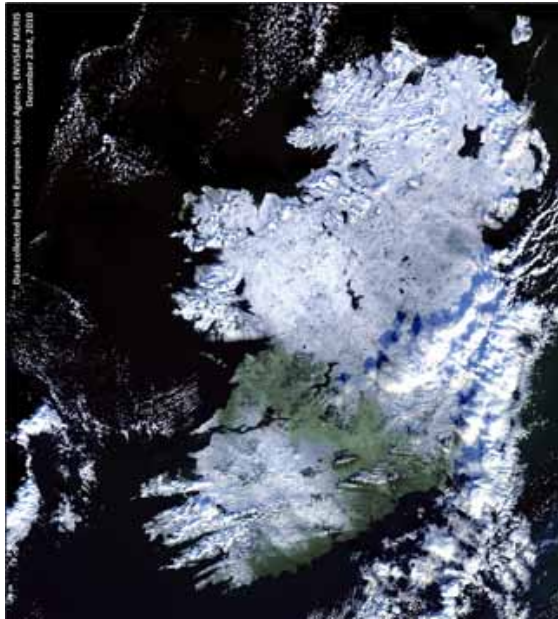
Ground-based measurements are made at local scales and for research studies. Regional albedo measurements are generally made by satellite sensors, which have the ability to measure the total radiation reflected by the Earth's surface on a regular basis. There is very good continuity of satellite observations since the 1980s from which albedo estimates can be inferred.

'An analysis of global satellite data for the period 2000 to 2008 shows a slight increase in land surface albedo in the northern hemisphere and a slight decrease in the southern hemisphere.'

## Time-series and Trends

An analysis of global satellite data for the period 2000 to 2008 found that in the northern hemisphere there was a small decrease in land-surface albedo of about 0.01 while in the southern hemisphere there was an increase of about 0.01 over the period. Hence, from a global perspective the land surface annual albedo appears

quite stable. No specific analysis over Ireland has been carried out. [Figure 4.4](#) shows two images of Ireland captured by the *ENVISAT* MERIS sensor in January (a) and February (b) 2011. In January, most of the country is covered in snow resulting in a high albedo whereas there is a much lower albedo from the vegetated surfaces in February. Note that clouds also have a high albedo.

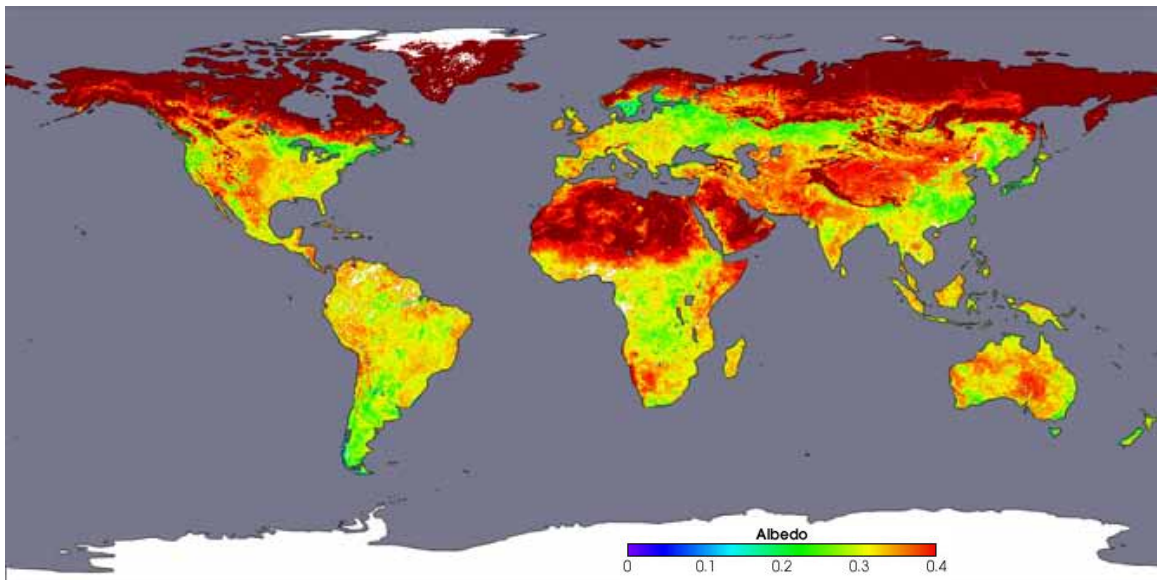


(a)



(b)

**Figure 4.4.** Satellite images of Ireland captured by the *ENVISAT* MERIS sensor, January (a), February (b) 2011. Images: © European Space Agency.



**Figure 4.5** Global albedo inferred from measurements from the MODIS sensor (April 2002).

Figure 4.5 shows an example of a global albedo product for April 2002 inferred from measurements from the MODIS sensor. Albedo is high over deserts and snow-covered boreal regions. The albedo over Ireland is approximately 0.35.

'Ireland's requirements with regard to albedo analysis should be determined.'

## Maintaining the Observations

Current and future satellite sensors will continue to gather the radiation reflected from the Earth's surface from which albedo can be calculated. Ireland's requirements with regard to albedo analysis should be determined. Regular cloud cover over Ireland could limit the use of *in situ* observations for validation of satellite data.

### Further Information and Data Sources

Loeb, N.G. Wielicki, B.A., Su, W., Loukachine, K., Sun, W., Wong, T., Priestly, K.J., Matthews, G., Miller, W.F. and Davies, R. (2007) Multi-instrument comparison of top-of-atmosphere reflected solar radiation, *Journal of Climate*, Vol. 20, pp. 575–91, doi: <http://dx.doi.org/10.1175/JCLI4018.1>

Zhang, X., Liang, S., Wang, K., Li, L. and Gui, S. (2010) Analysis of global land surface shortwave broadband albedo from multiple data Sources, *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, Vol. 3, No. 3, pp. 296–305.

General information on albedo:

<http://www.eoearth.org/article/Albedo?topic=54300>

Albedo products from the MODIS sensor:

<http://modis-atmos.gsfc.nasa.gov/ALBEDO/>

Albedo products can be accessed via the EU's GMES Geoland Service:

<http://www.gmes-geoland.info/>