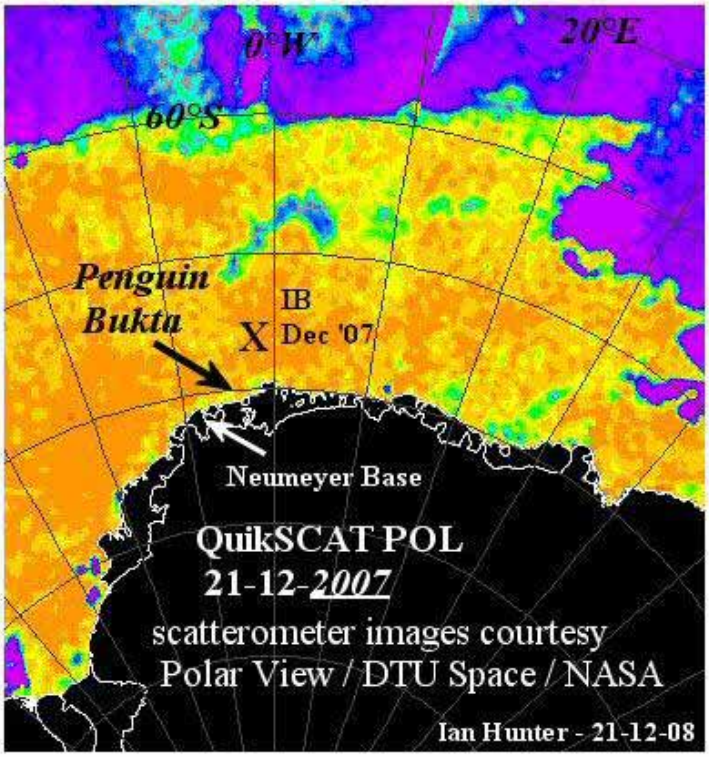
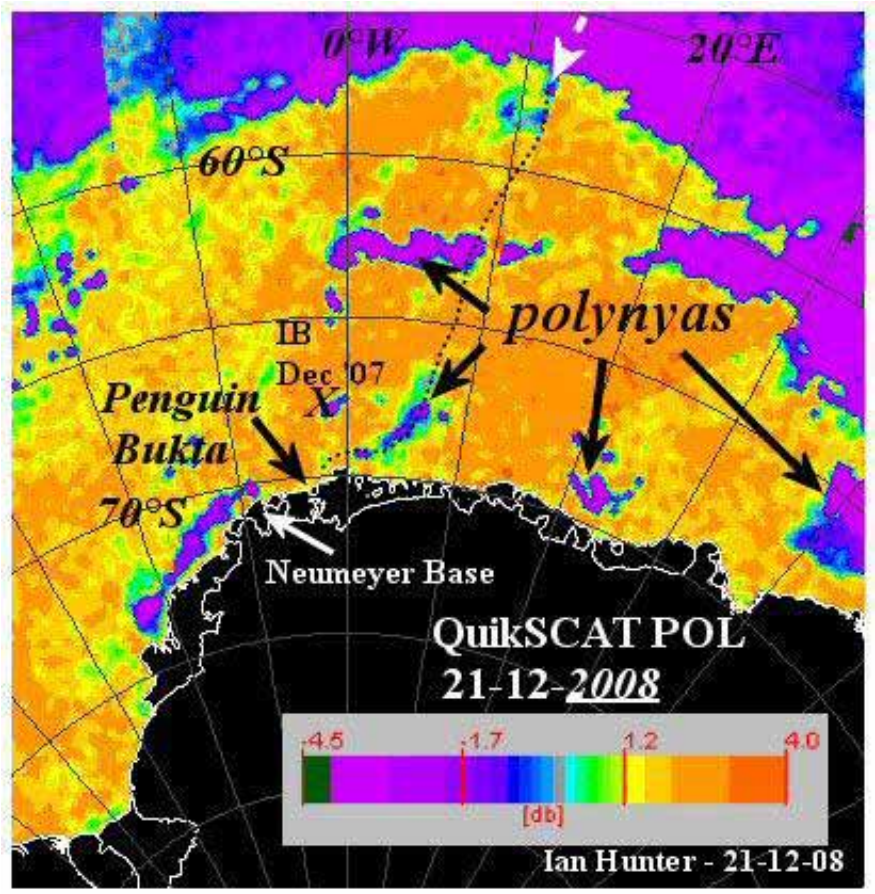
Heavy swell awaiting the *SA Agulhas*, but much reduced pack ice

Spare a thought for those poor folk 'sans sea legs' on the *SA Agulhas* which left Cape Town yesterday afternoon 23 December 2008 for Antarctica. A tight SW'ly fetch stretching down into the Southern Ocean ensured that she was rolling and pitching heavily by evening. In a swell of over 5m and increasing steadily. ..

Last year the vessel spent 6 days ice bound in the region **X IB – Dec '07** indicated on the graphic below. As a result, the departure date was moved a further 18 days into December.



However, ice concentrations are also significantly down on last year (excepting the initial part of the ice passage). Note below, the present positions of the polynyas (gaps or weaknesses in the pack ice) as compared with roughly the same time last year - particularly the semi-permanent polynya which *normally* forms in November at ~ 63°S and just east of Greenwich each year. The *'Agulhas* was beset from 20 to 25 December 2007. The dotted track is simply an example, showing how the polynyas can be used to ease a vessel's ice passage.



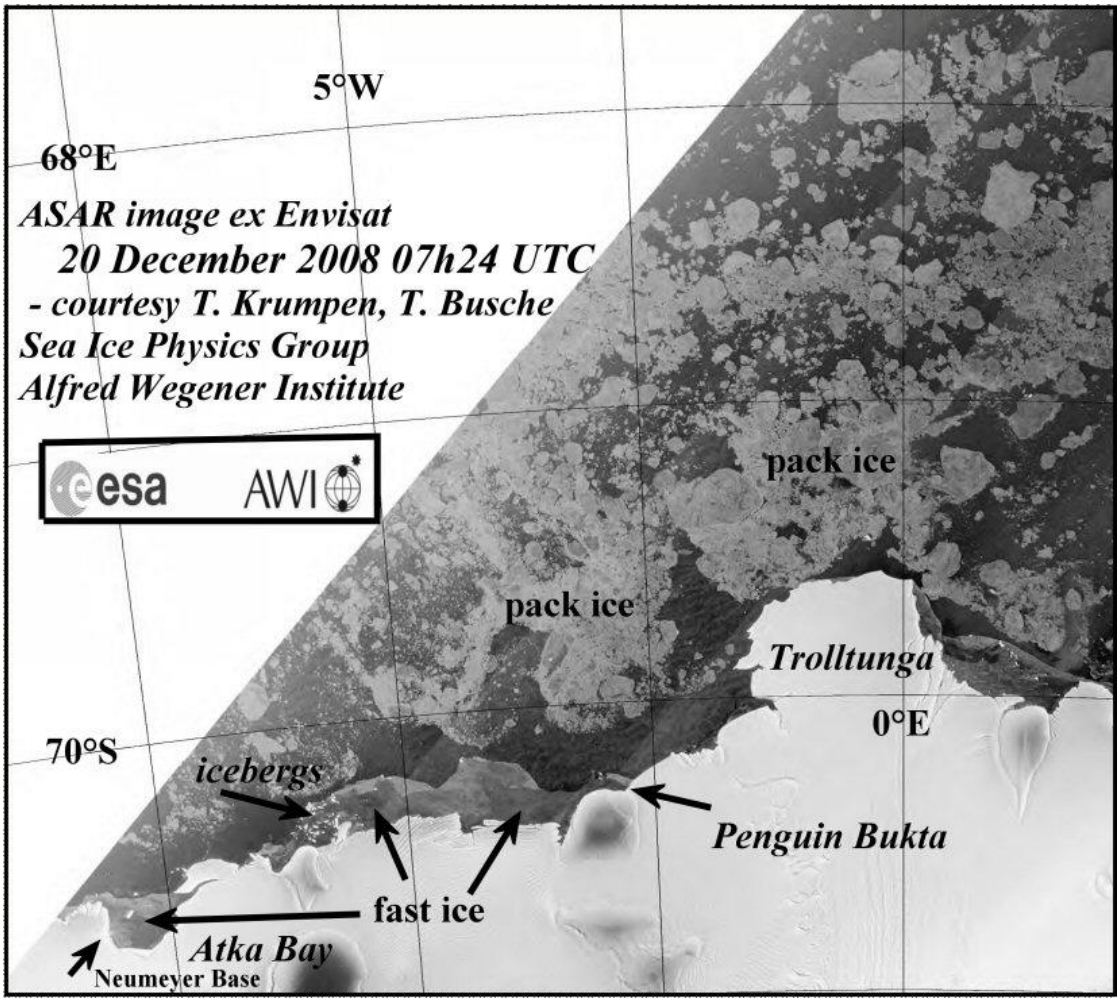
The microwave scatterometer onboard QuikSCAT (better known for its ocean surface wind products) is relatively coarse (highest resolution 12.5 km). For example it cannot resolve the coastal polynyas (see ASAR and MODIS images below). However, with a swath width of 1 800 km coverage is very good, particularly at high latitudes (> 2 passes per day per location)

Satellite-borne synthetic aperture radar (SAR) on the other hand has a much higher resolution - but a lower return period. The Advanced Synthetic Aperture Radar (ASAR) on ESA's Envisat has a spatial resolution of 150x150m - in wide swath (400 km) mode. Good enough to detect medium-sized and even smaller icebergs. It is also possible to do a rough analysis of ice *type*. However, SAR imagery is by no means easy to analyse. The return signal from sea and glacial (land origin) ice is also a factor of satellite elevation, certain atmospheric and oceanic effects (e.g. internal waves) - etc

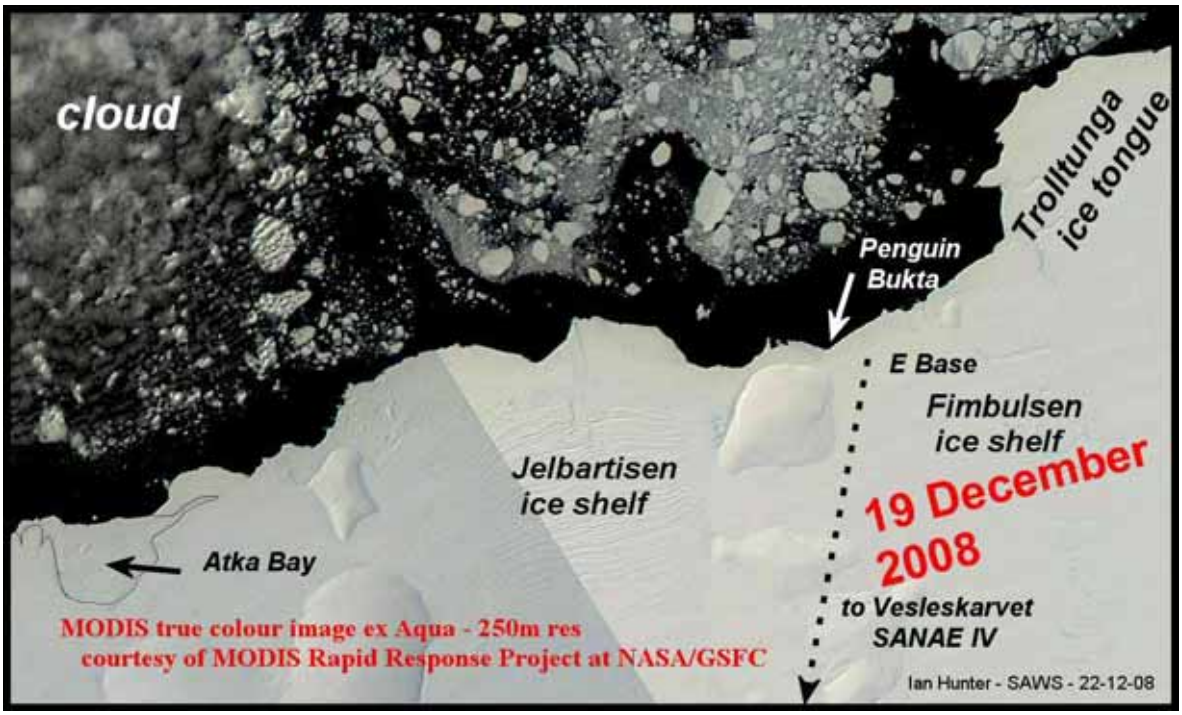
Thus it is useful to have concurrent coverage in the visual spectrum as well – assuming cloud cover allows it. One of best instruments for this purpose is the Moderate Resolution Imaging Spectroradiometer (MODIS) flying on NASA's Aqua and Terra satellites. It has a spatial resolution of

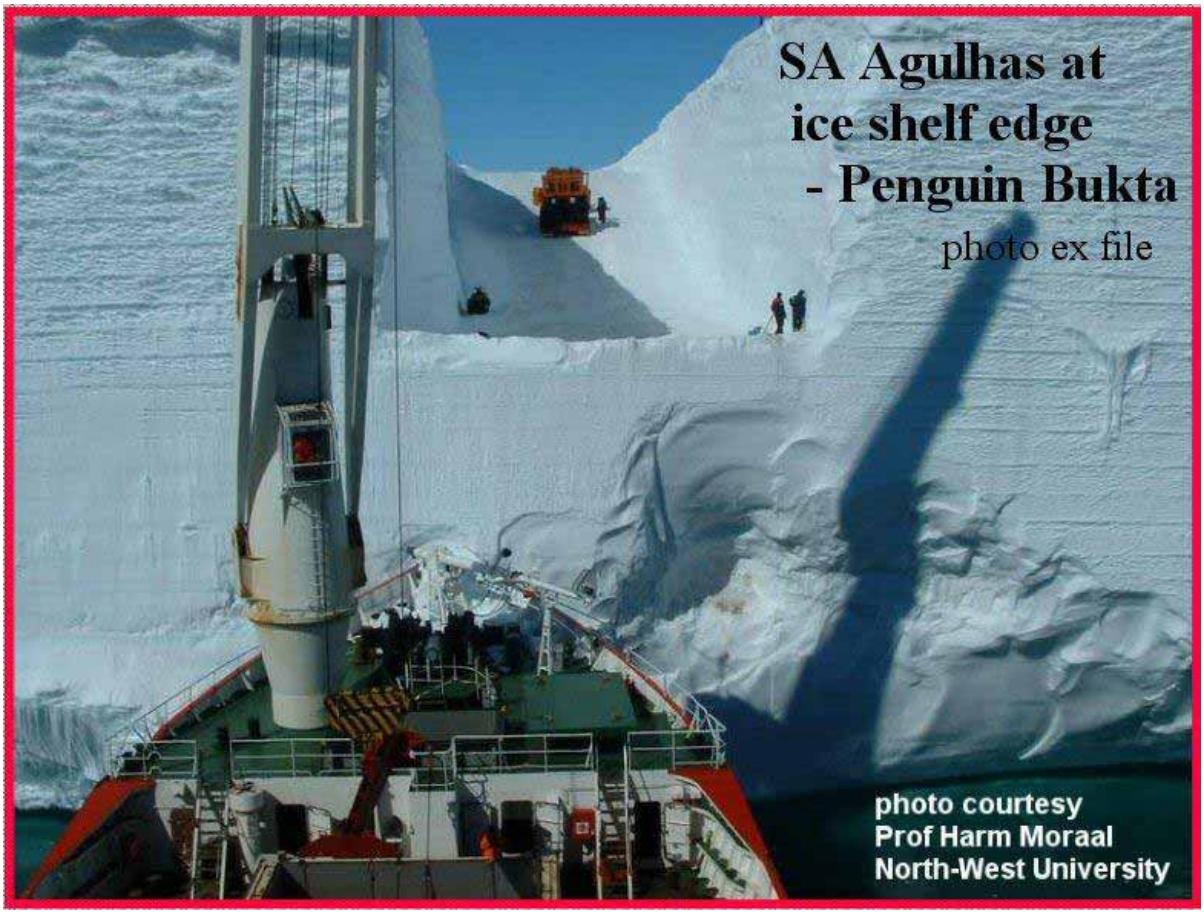
250m (channels 1-2 only). Unfortunately overcast conditions at these high latitudes preclude the use of the visible spectrum for surface observation. For much of the time.

Consider the recently-captured ASAR image below :

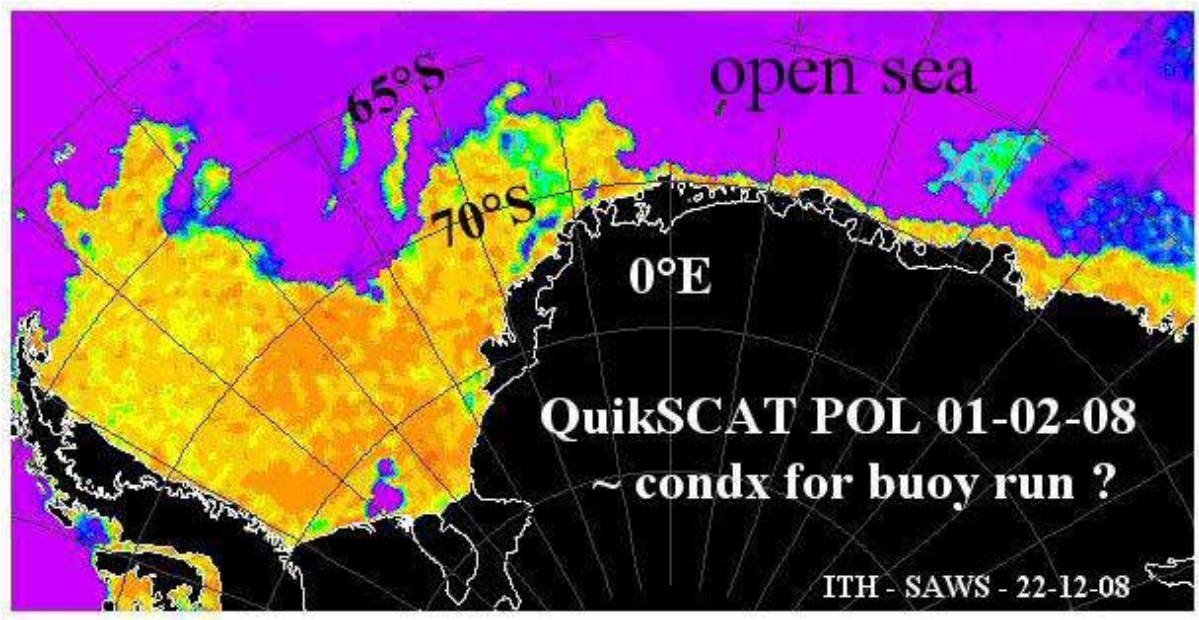


Unusually, there are very few icebergs (bright targets) - only the small cluster east of Atka Bay. The combination of visible imagery and microwave C band radar helps to distinguish various ice cover features which either of these sensors on its own may not detect. For example note how MODIS cannot readily distinguish the difference between shelf and sea ice - or sea ice and icebergs. On the other hand, SAR sometimes 'sees' fast ice (i.e. connected to the shelf) as open sea, the former often providing a relatively 'smooth' target. One needs the visible spectrum to check whether there is ice or open water adjoining the shelf. On 20 December Atka Bay was still covered in fast/ bay ice. Neumeyer also confirmed that there was some multiyear ice in the Bay. In the region of Penguin Bukta – where the *'Agulhas* normally unloads onto a man-made ramp at the shelf edge, there is also some fast ice still present :


cloud
Trolltunga ice tongue
Penguin Bukta
E Base
Fimbulsen ice shelf
Jelbartisen ice shelf
19 December 2008
Atka Bay
to Vesleskarvet SANAE IV
MODIS true colour image ex Aqua - 250m res
courtesy of MODIS Rapid Response Project at NASA/GSFC
Ian Hunter - SAWS - 22-12-08


SA Agulhas at ice shelf edge - Penguin Bukta
photo ex file
photo courtesy
Prof Harm Moraal
North-West University

During January the pack ice retreats to almost the edge of the Shelf in places. However, this is not the case in much of the Weddell Sea, where multiyear ice prevails :



By April a rapid freezing of the Antarctic ocean starts to take place, extending northwards. By September the area of pack ice around Antarctica has increased by *80%*. Whereas glacial ice has decreased significantly in some areas of Antarctica, the late summer pack ice minimum has not shown the dramatic downward trend of the sea ice in the Arctic.

Ian Hunter – SAWS – 24-12-08