



*Norwegian
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met.no*

SAR images and Polar Lows

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Observing polar lows in 2012:

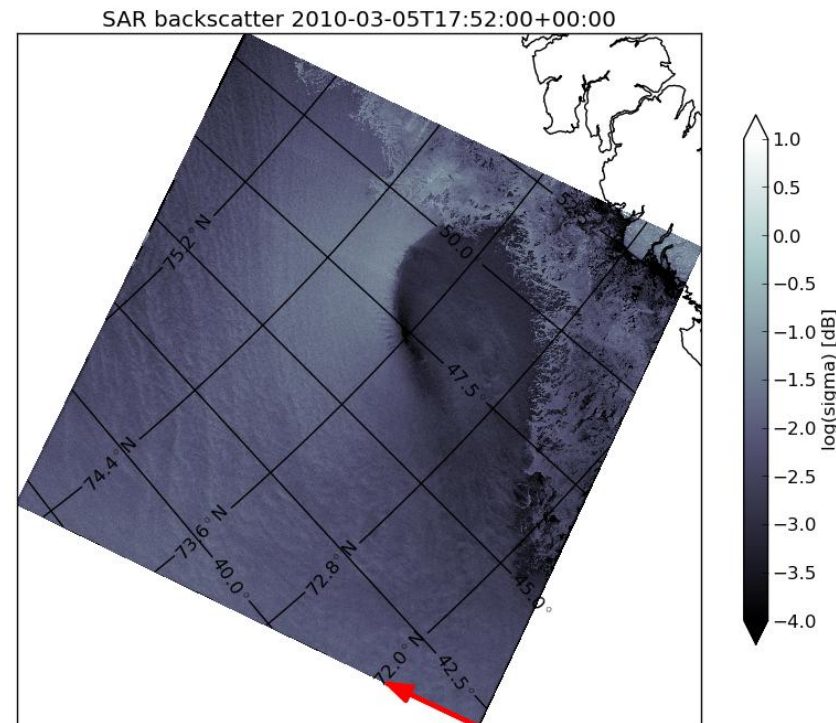


- AVHRR Polar orbiting satellite imagery
 - Primary source of info
 - Observations at cloud tops
- Synoptic observations
 - Isolated spot observations
 - Contaminated by topography at the coast
- ASCAT/Oceanscat:
 - Good at absolute wind speed, but lacking detailed info

Added information from SAR images in observing polar lows?



- Absolute wind speed
- Surface details
- Time span of wind increase
- A tool for early warning





Recorded Polar Lows at met.no

- met.no area
 - 2002-2011
 - 141 polar lows
 - Envisat ASAR WSM, GM and PRI (about 200 WSM are included in the database by now)
- Greenland
 - 2007-2010
 - 41 polar lows

Content of the SAR - files in STARS-DAT

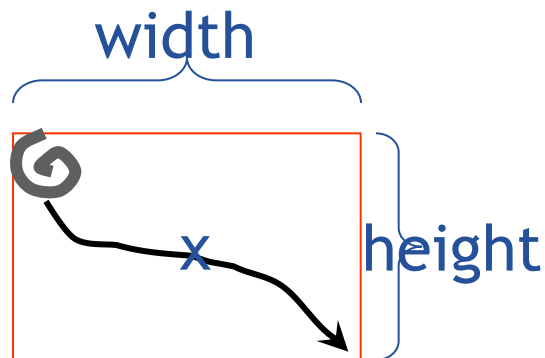


- Quicklook (.png)
 - Normalised backscatter quicklook
 - Wind speed and direction
 - Travel direction indicated with red arrow
- Interpolated to the STARS grid (netCDF)
 - Normalised backscatter image
 - ASAR wind speed
 - HIRLAM wind speed and direction
 - HIRLAM "sigma0"
 - Travel direction (ascending or descending)
 - Incidence angle
 - Latitude and longitude



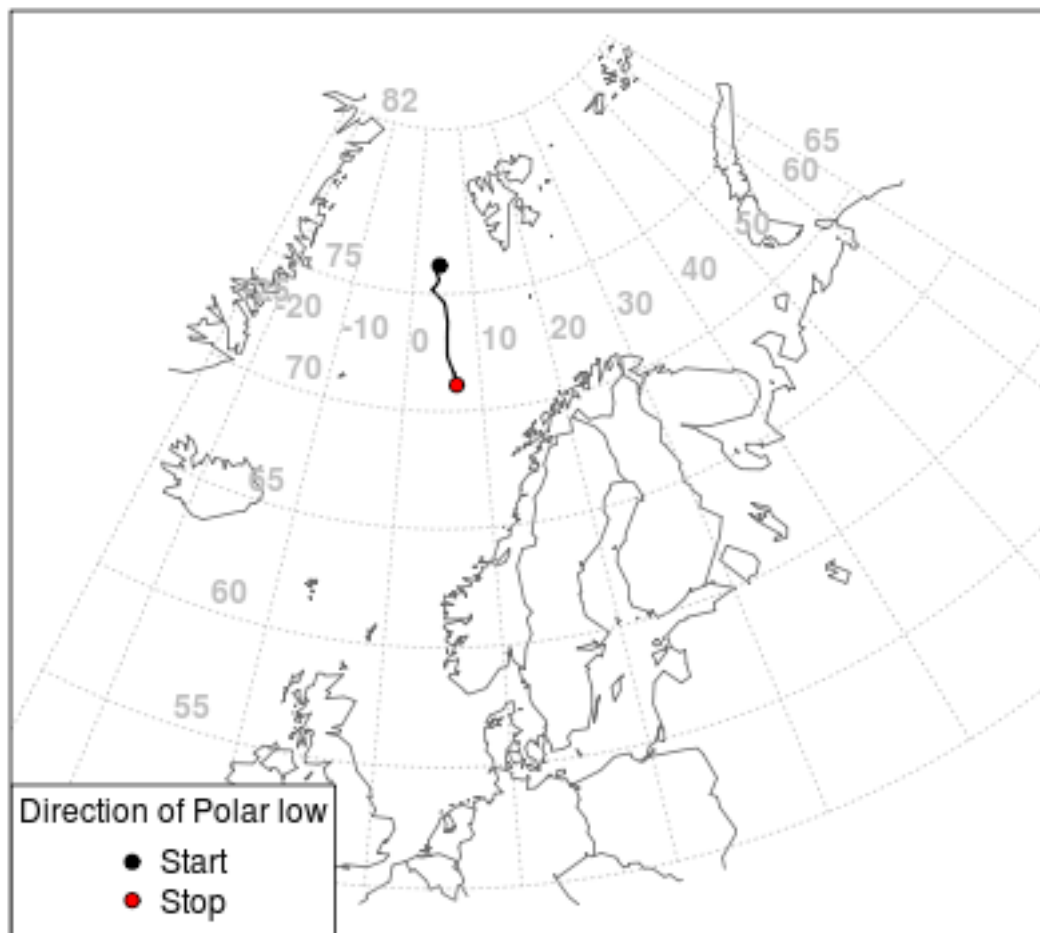
Criteria for ordering of SAR images

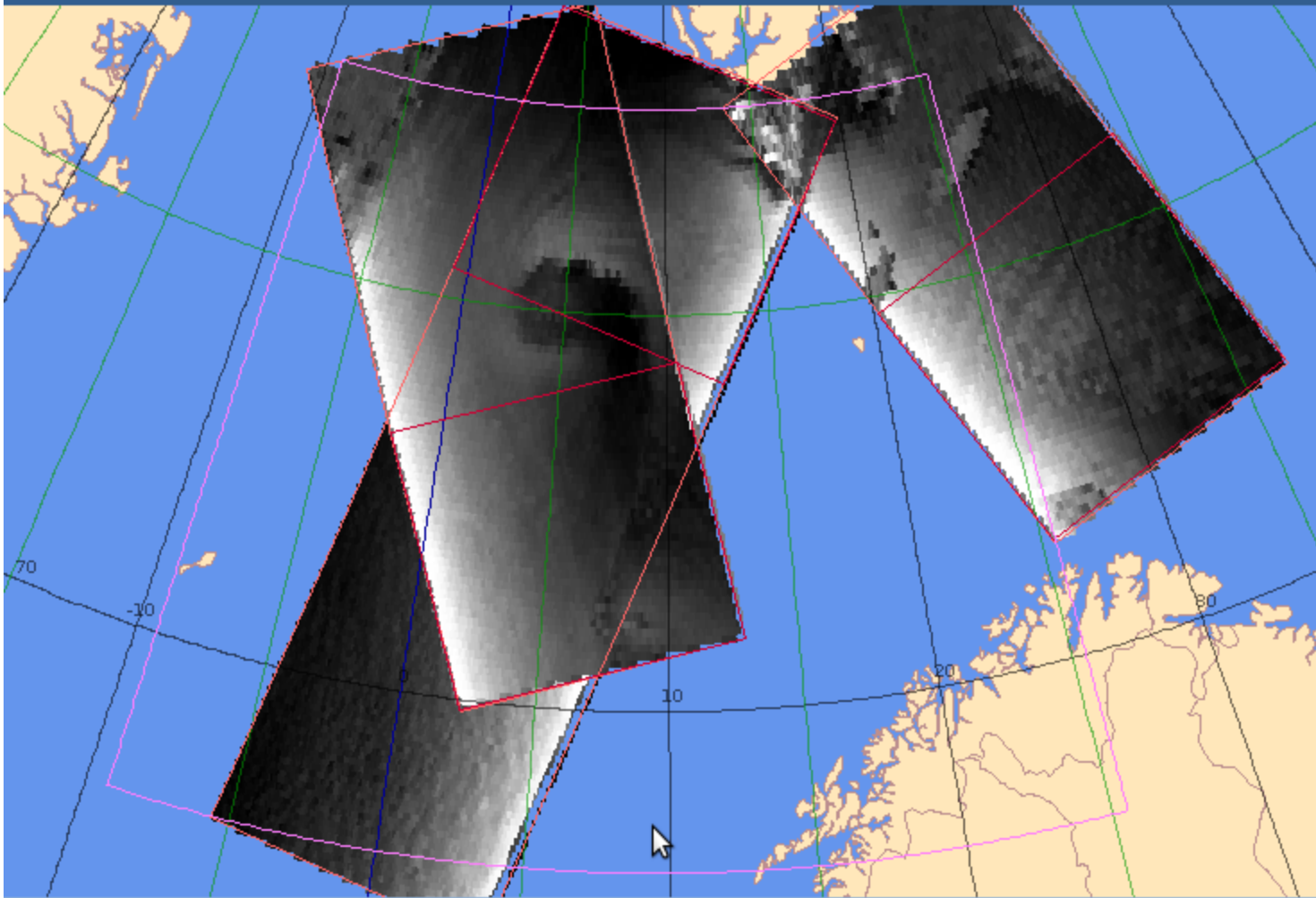
- +/-1 day
- Center position for each PL track
- Hight and width of area of observation + radius
- Include all images





Polar low case 10, North.
2007-01-22 14:00 - 2007-01-23 17:00





3 item(s) in Default ShopCart - 0 item(s) selected

Order	Display	Mosaic	Id	Mission	Sensor	Product	Status	Start	
Order	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	ENVISAT-1	ASAR/WS	ASA_WS_OP	Archived	2007-01-22 10:43:30.08	2007-01
Order	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2	ENVISAT-1	ASAR/WS	ASA_WS_OP	Archived	2007-01-22 18:58:31.68	2007-01
Order	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3	ENVISAT-1	ASAR/WS	ASA WS OP	Archived	2007-01-22 20:38:38.76	2007-01



SAR in forecasting - challenges

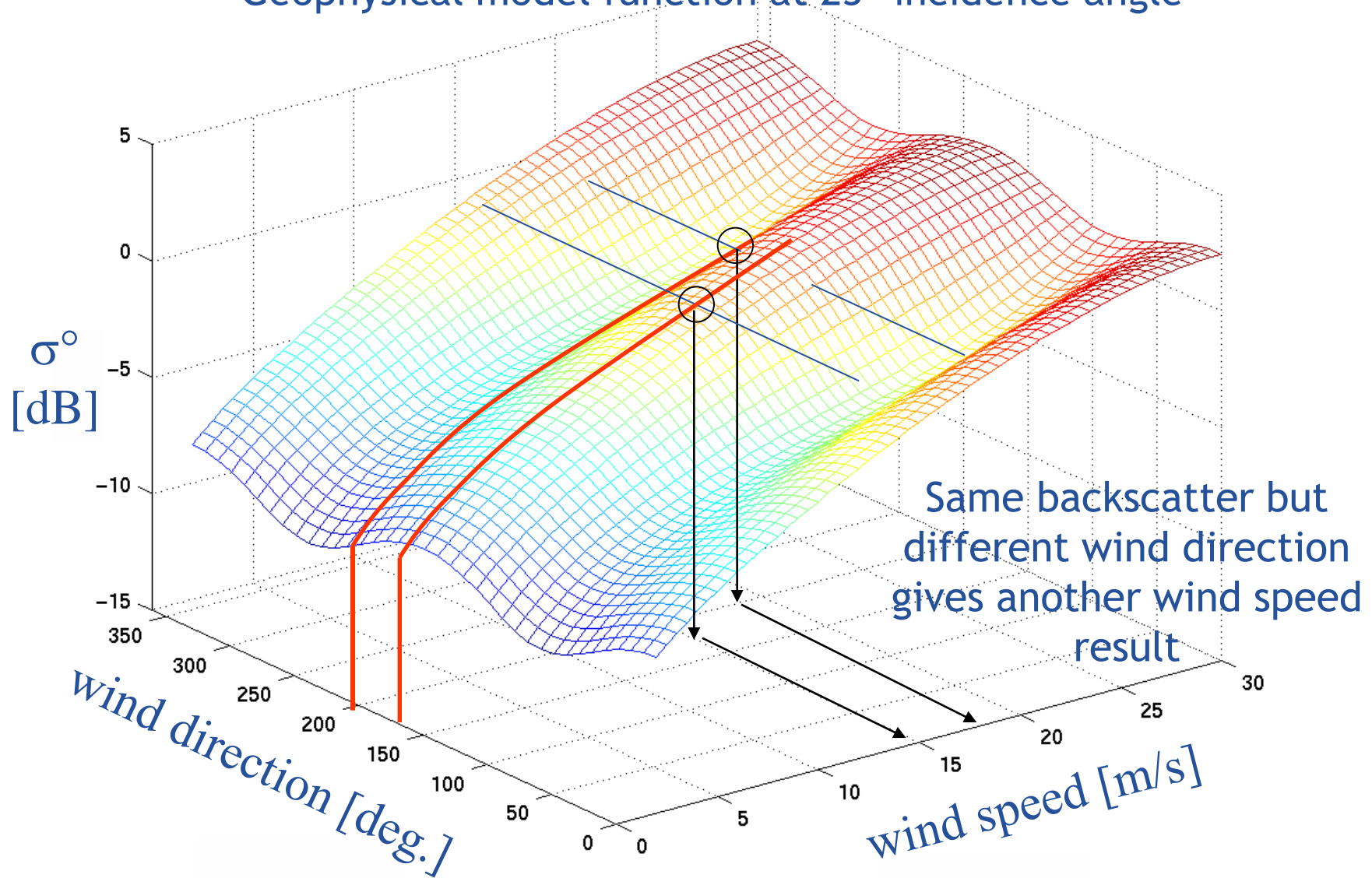
- Radar backscatter is a "raw data" variable
- Model wind directions may not be consistent with image
- -> absolute wind speed from SAR is often incorrect

- Wind directions from scatterometer?
- Other methods (Doppler, cross-pol,...)

The wind direction problem



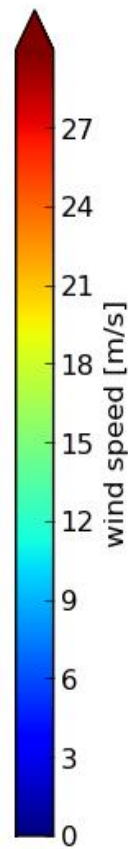
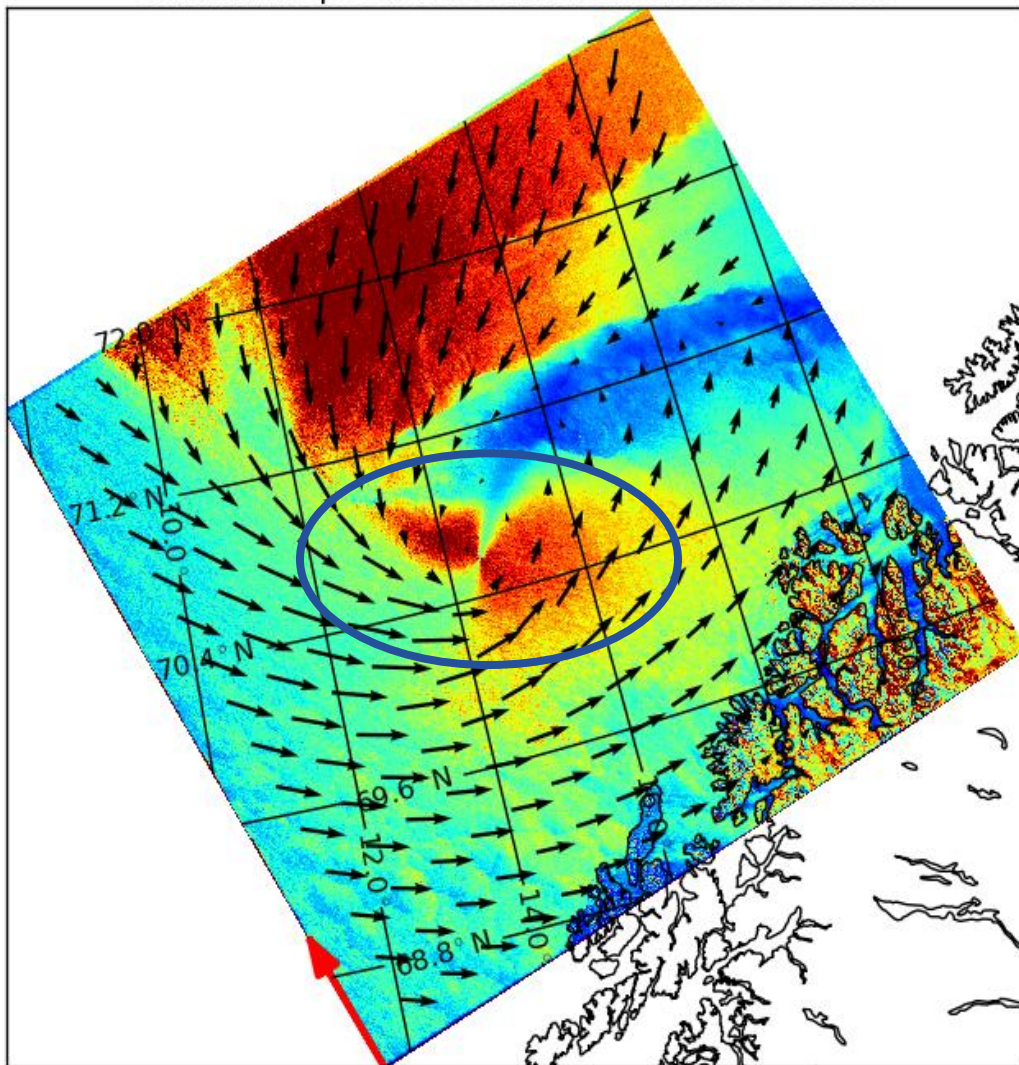
Geophysical model function at 23° incidence angle





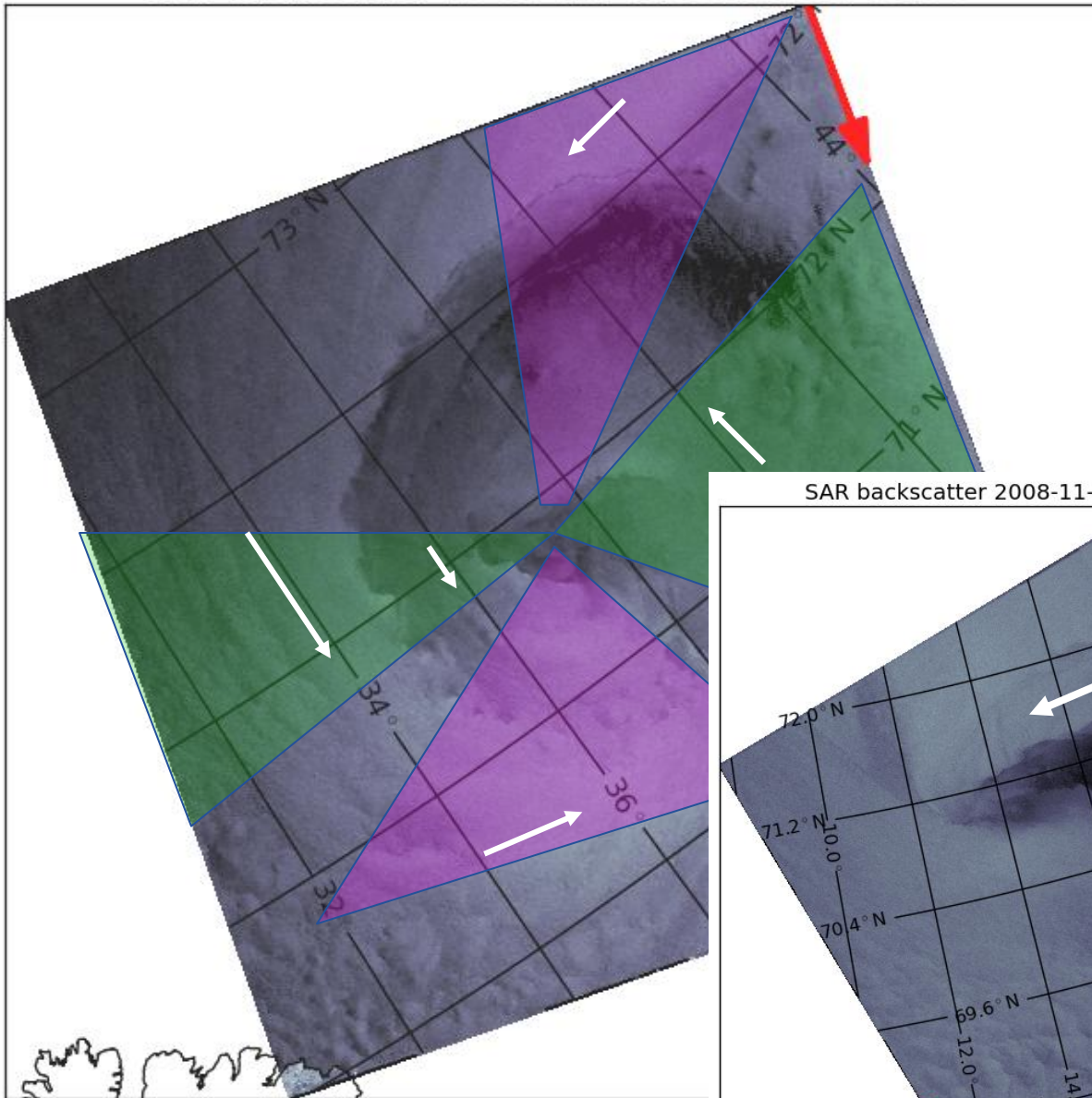
The wind direction problem

SAR wind speed 2008-11-18T20:06:00+00:00

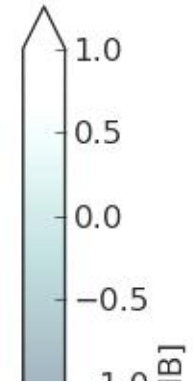


Same backscatter but
different wind direction
gives another wind speed
result

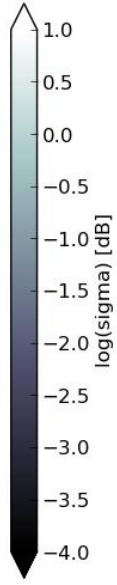
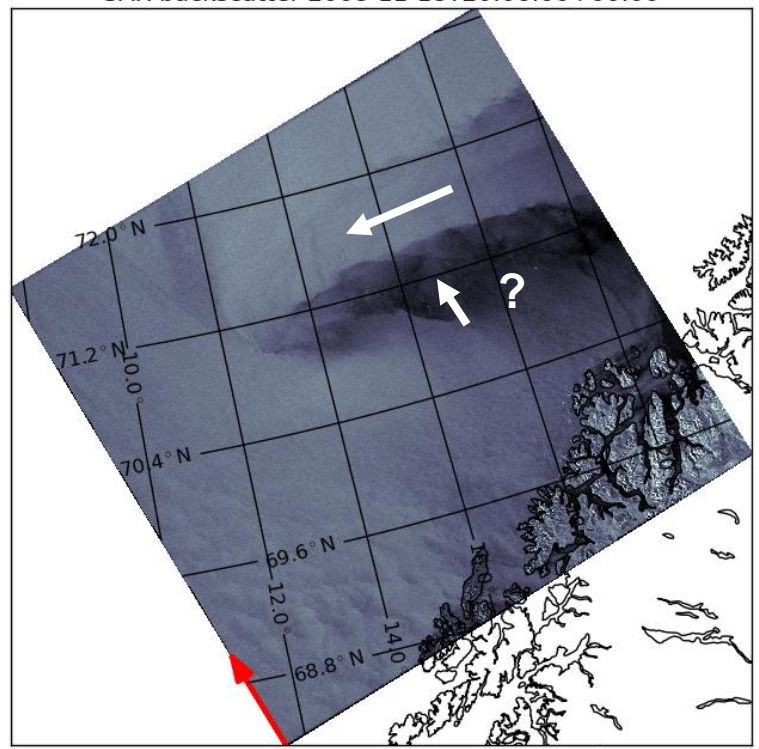
SAR backscatter 2009-02-28T08:26:00+00:00



brighter
darker



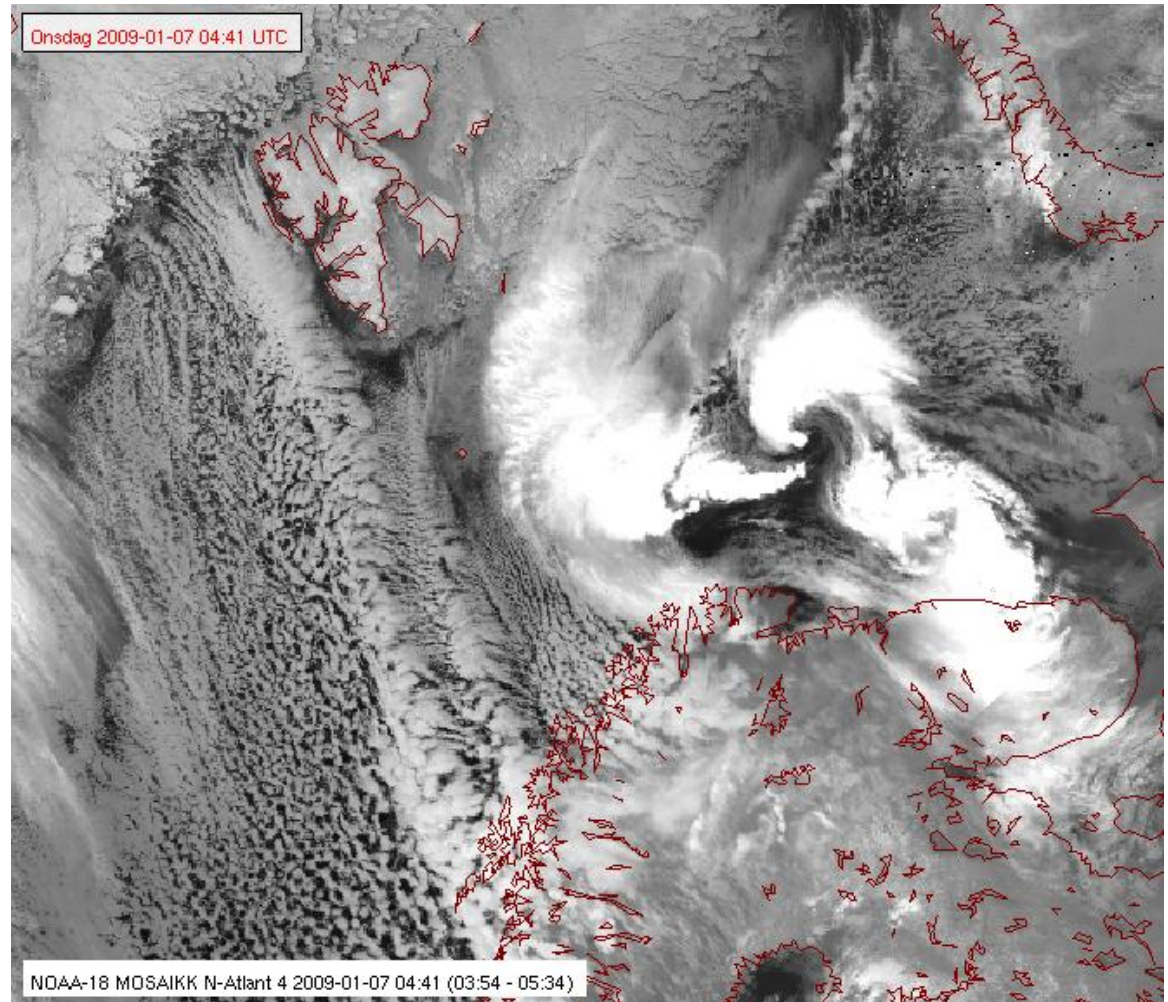
SAR backscatter 2008-11-18T20:06:00+00:00



The Honningsvåg case:



7.th January 2009

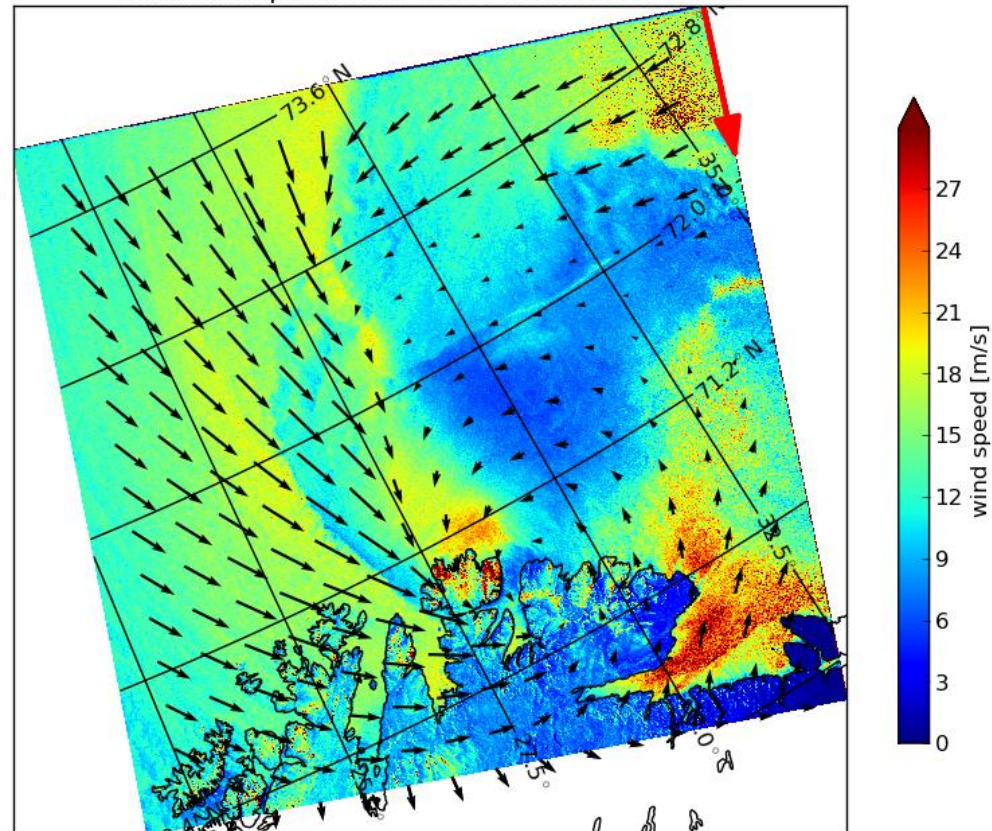
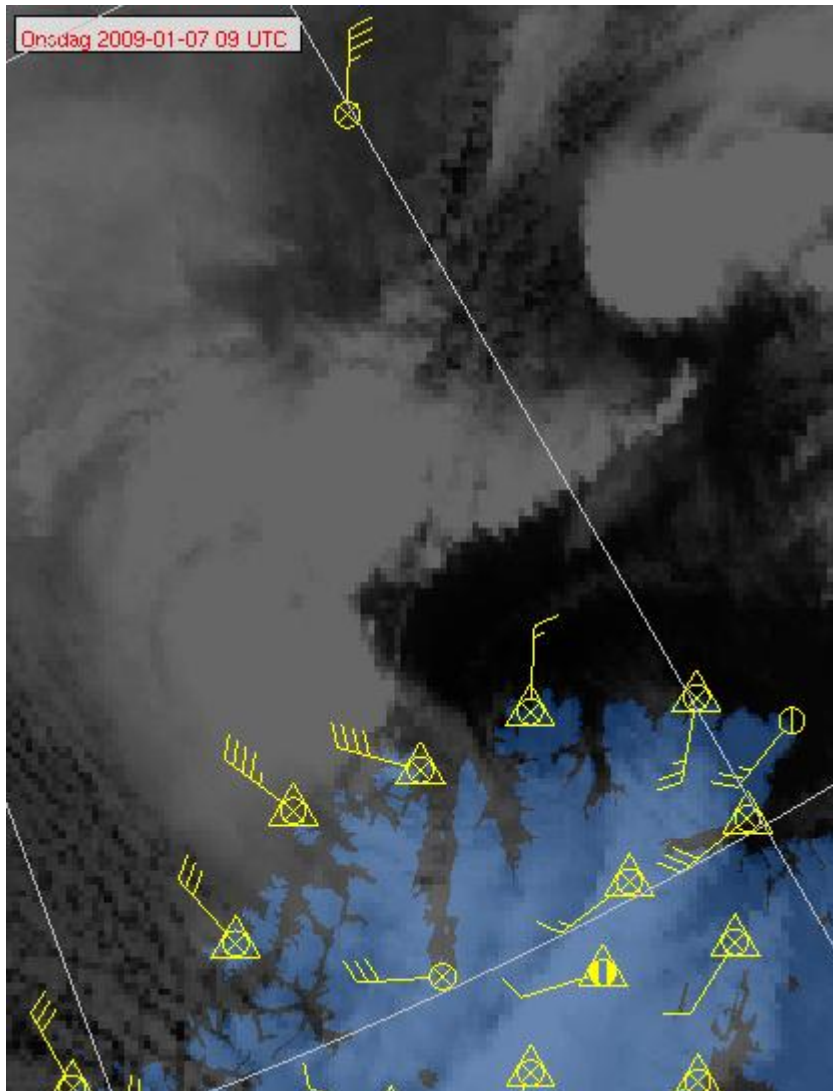


Absolute wind speed?



The Honningsvåg case: January 7, 2009, 09UTC

SAR wind speed 2009-01-07T09:01:00+00:00

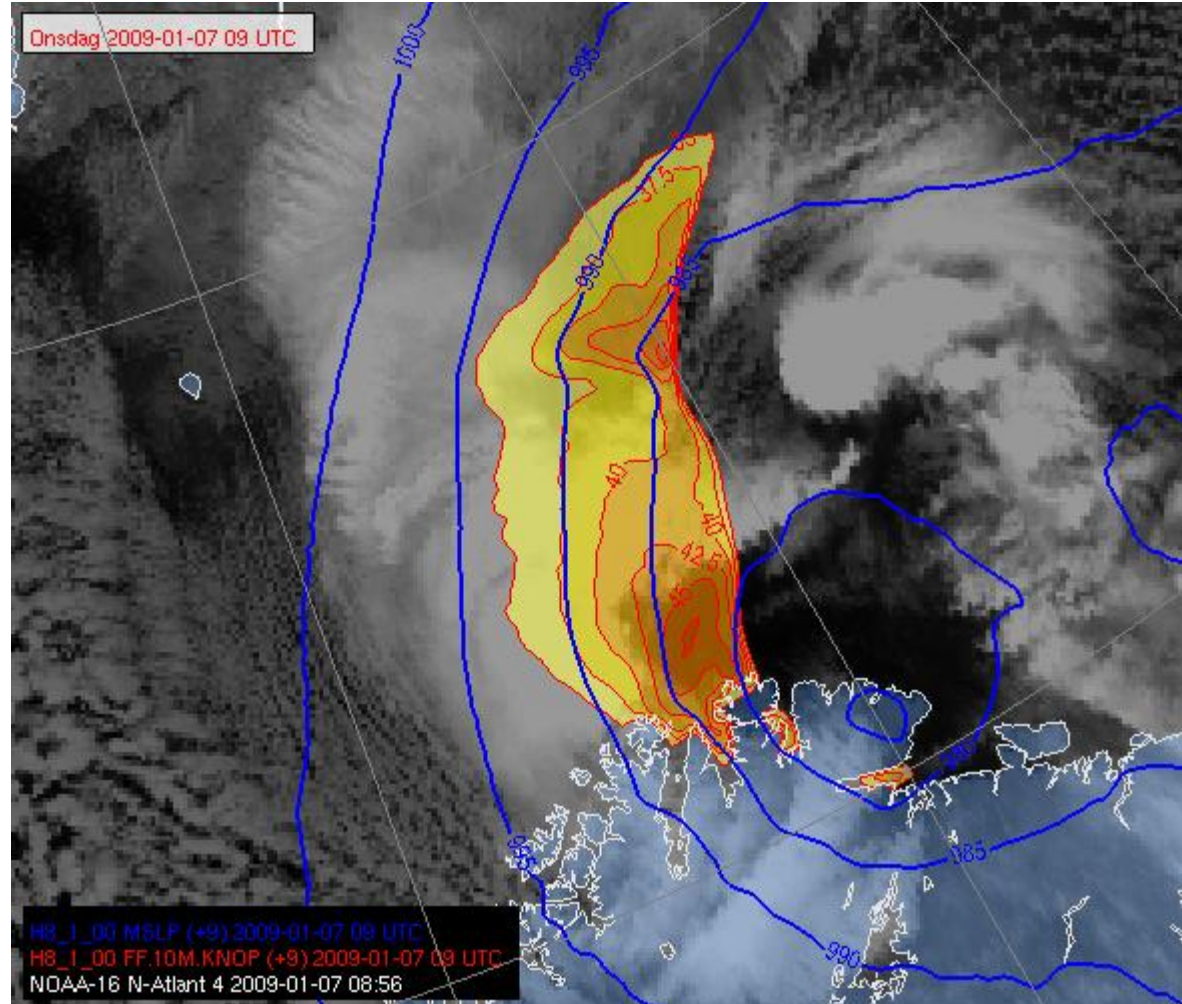


Model wind vs. reality



Model positional error:
- up to 150km @ +9 hrs

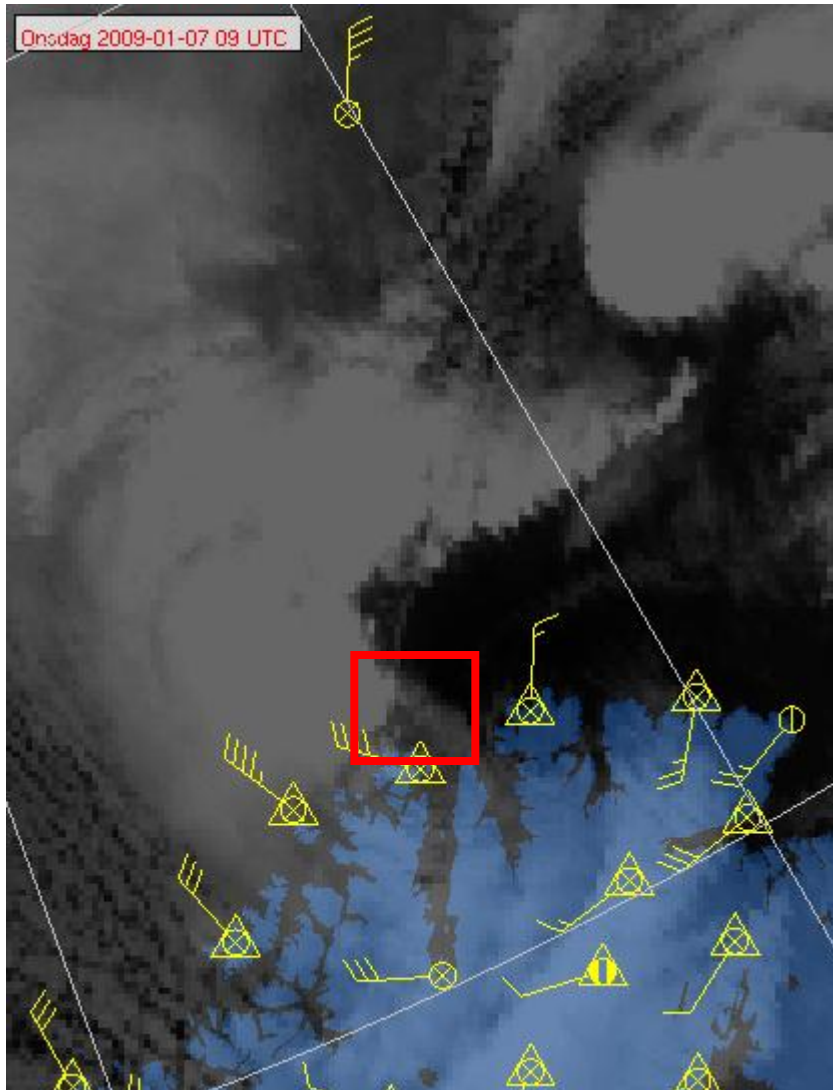
Large error in wind strength
and direction in area of
strongest wind



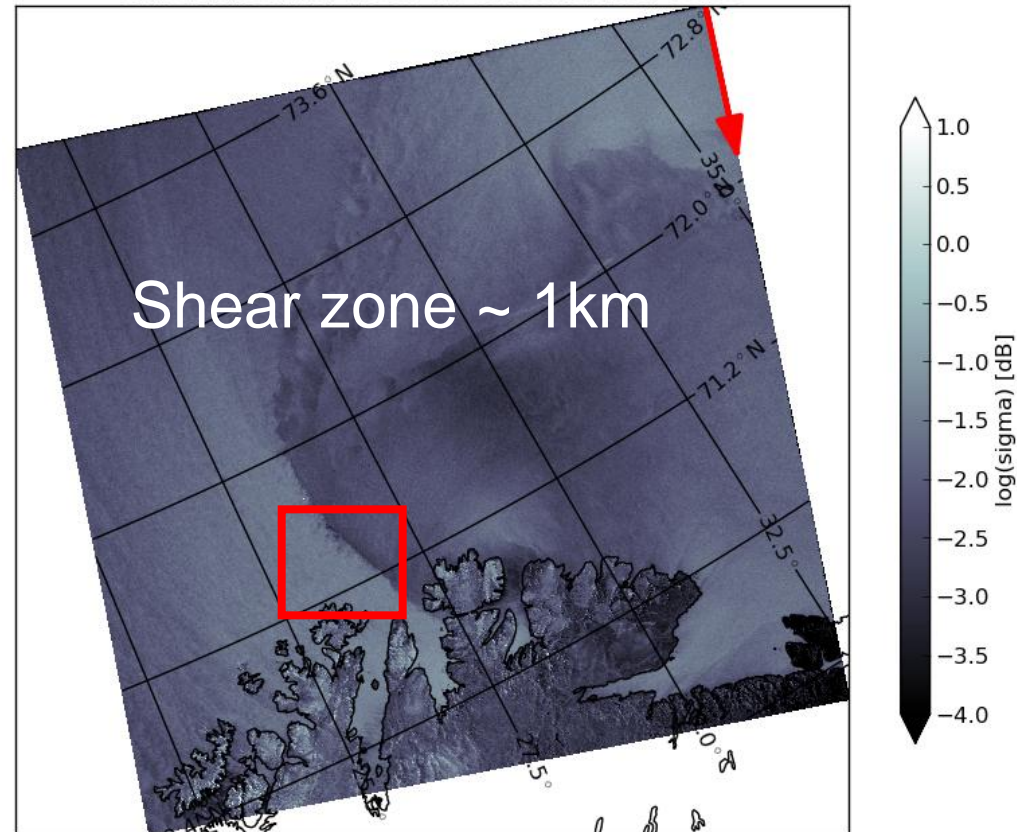
SAR details



The Honningsvåg case:
January 7, 2009, 09UTC



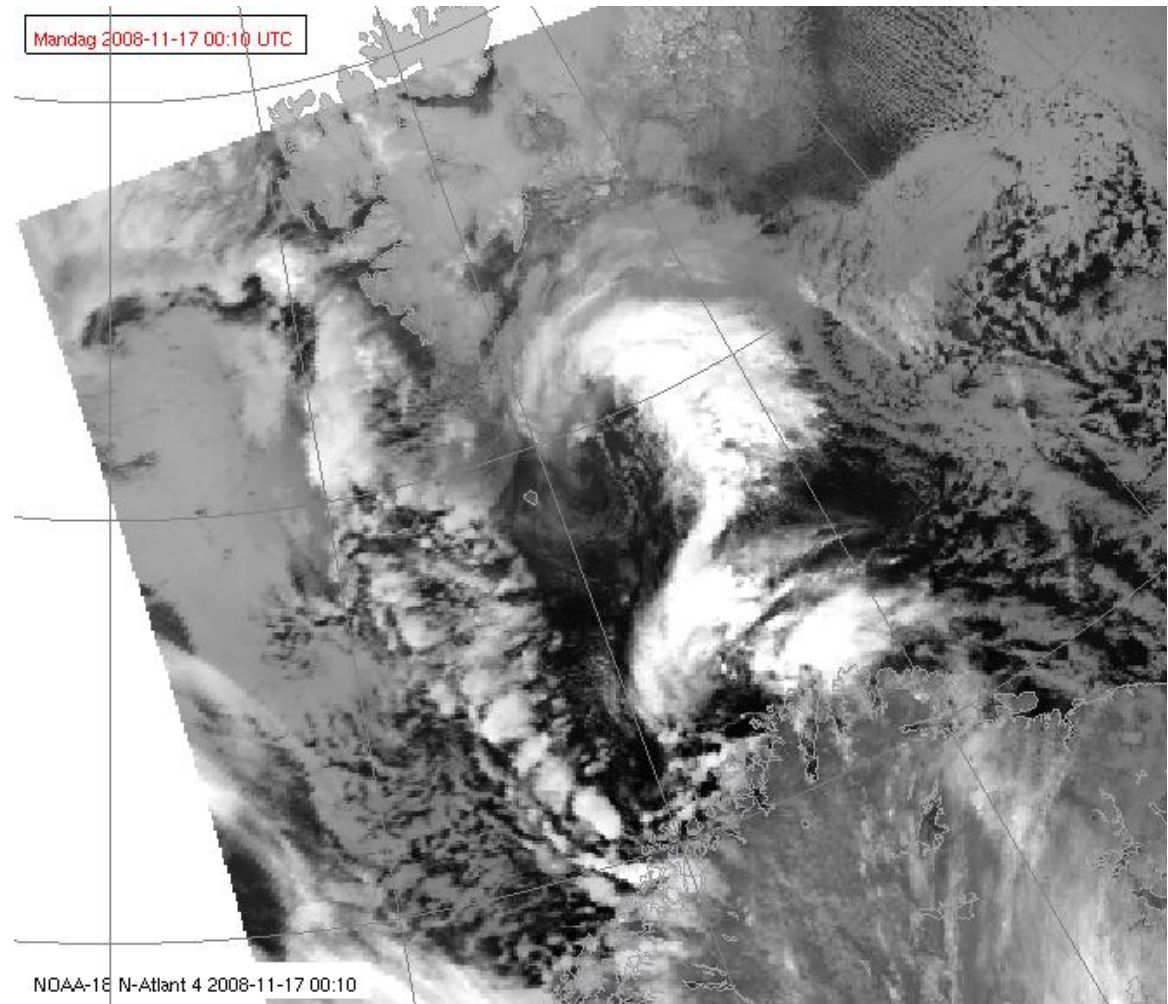
SAR backscatter 2009-01-07T09:01:00+00:00



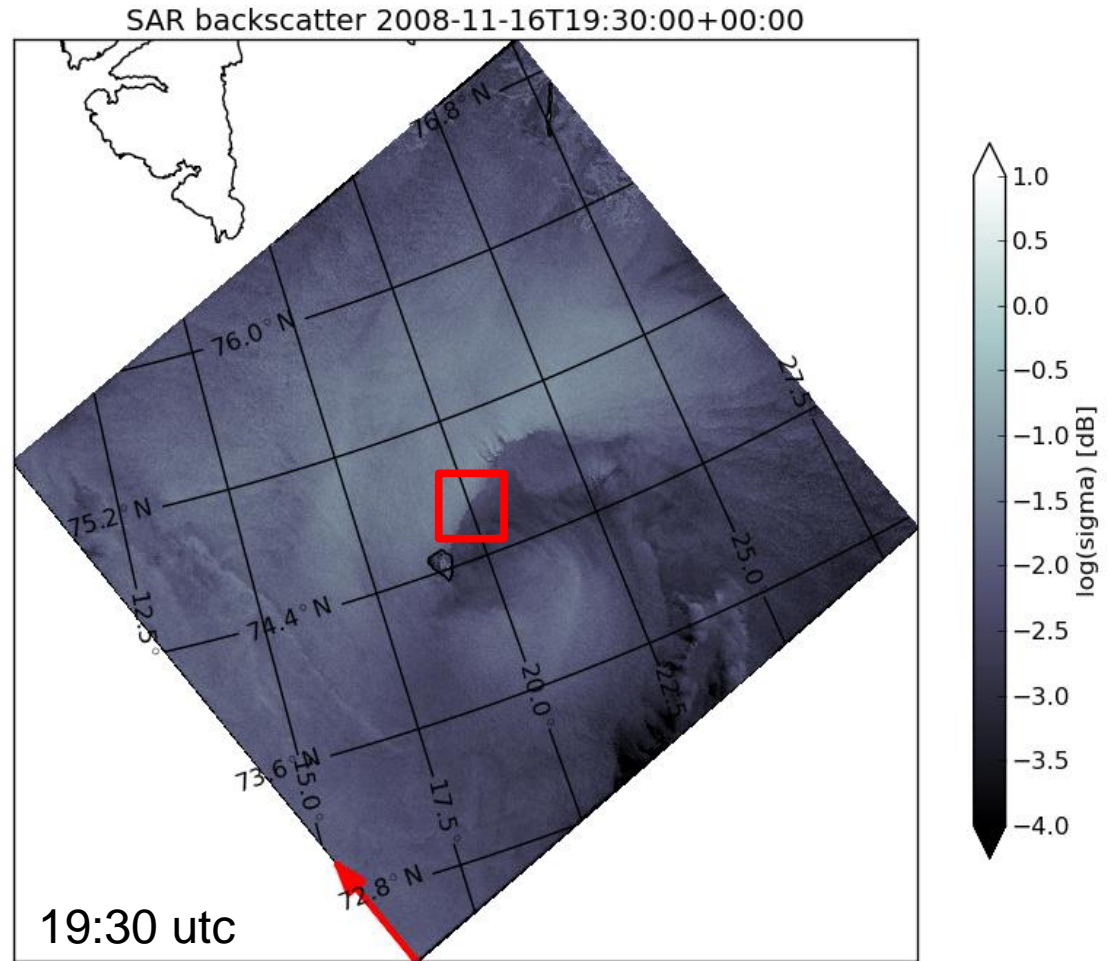
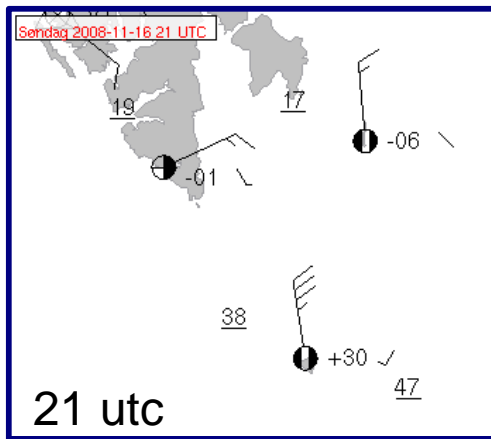
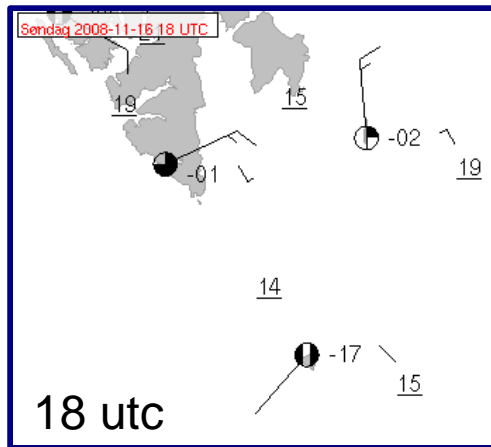
The Bjørnøya lows



16.th to 18.th
November 2008

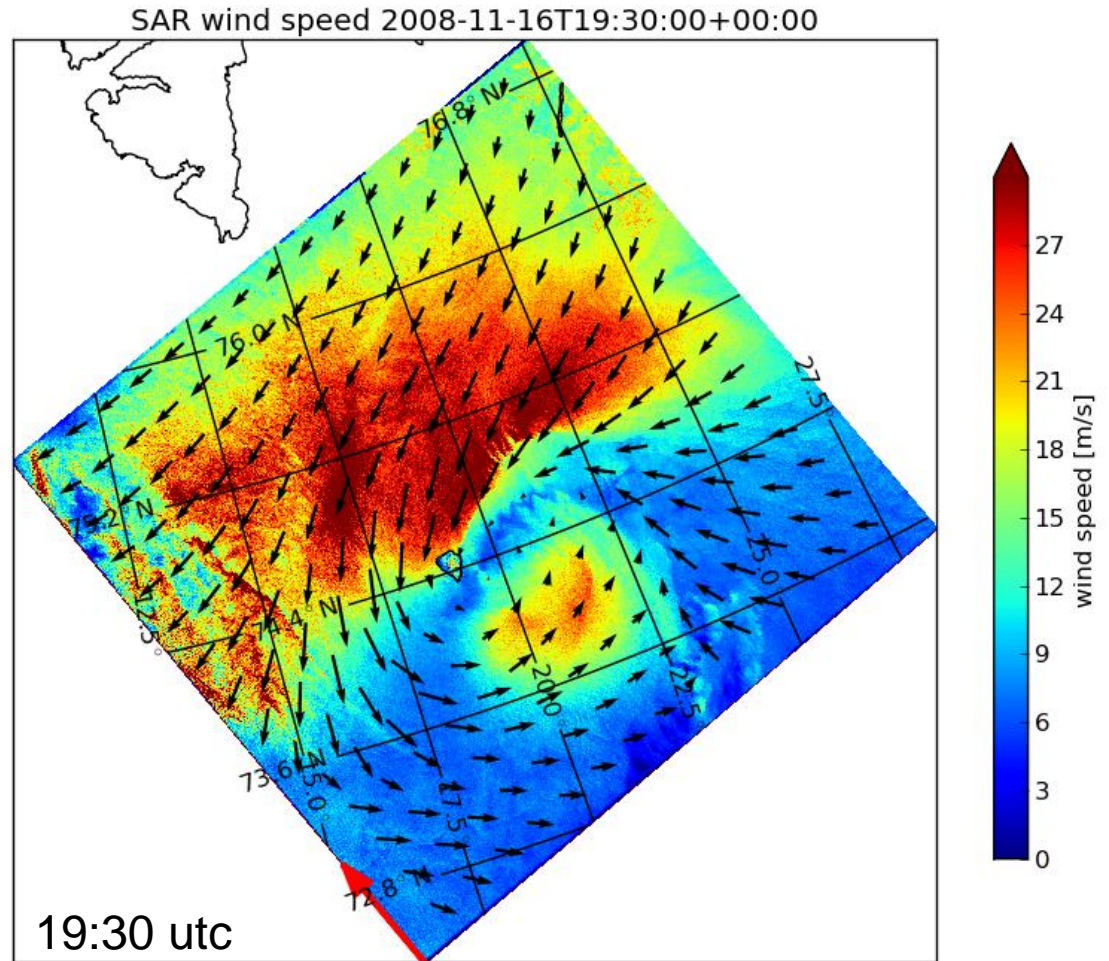
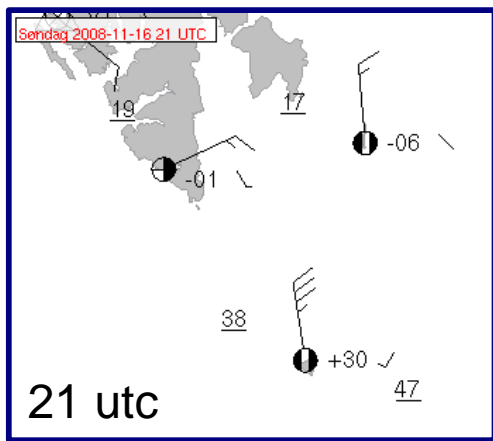
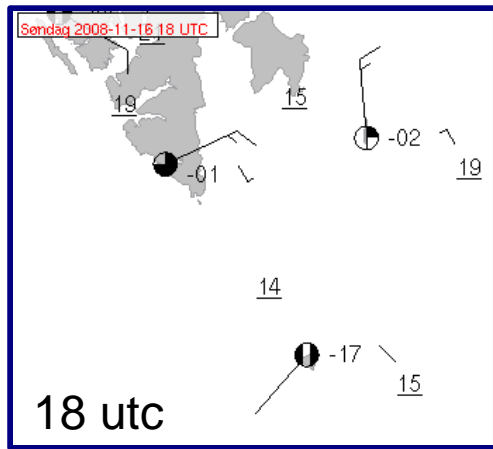


The Bjørnøya low:



Shear zone ~ 2-3 km, increase time ~ 5 minutes

The Bjørnøya low

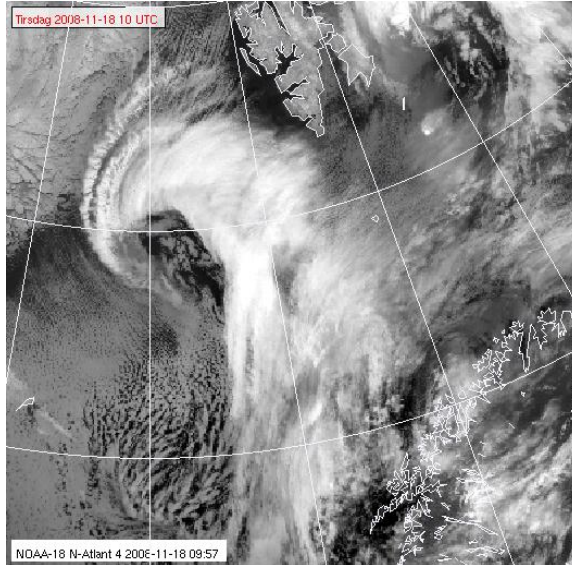


Bjørnøya synop: 38kt (19,5m/s). SAR winds: 25+ m/s

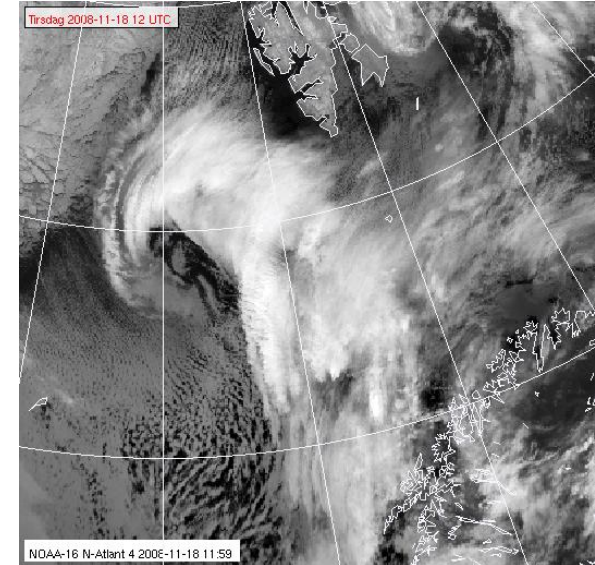


The 18.Nov. 2008 low: Early detection?

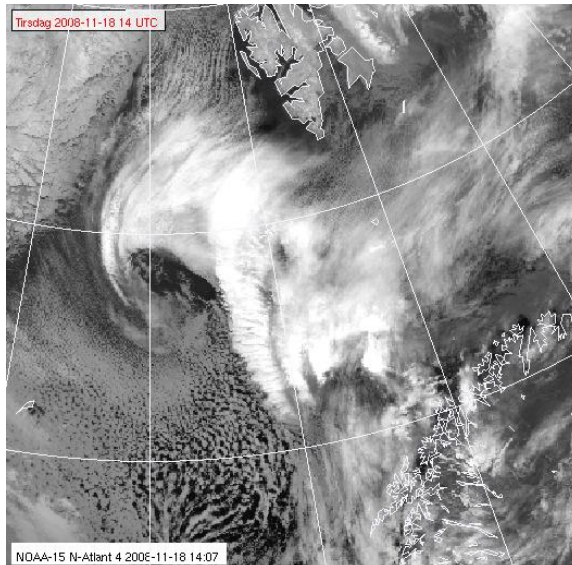
10 utc



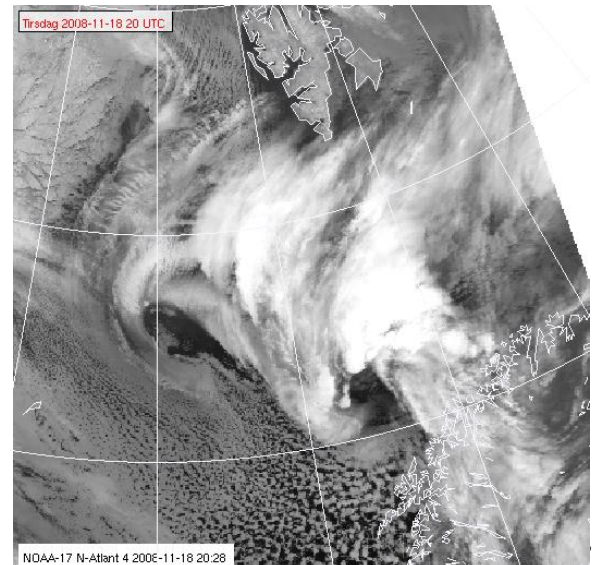
12 utc



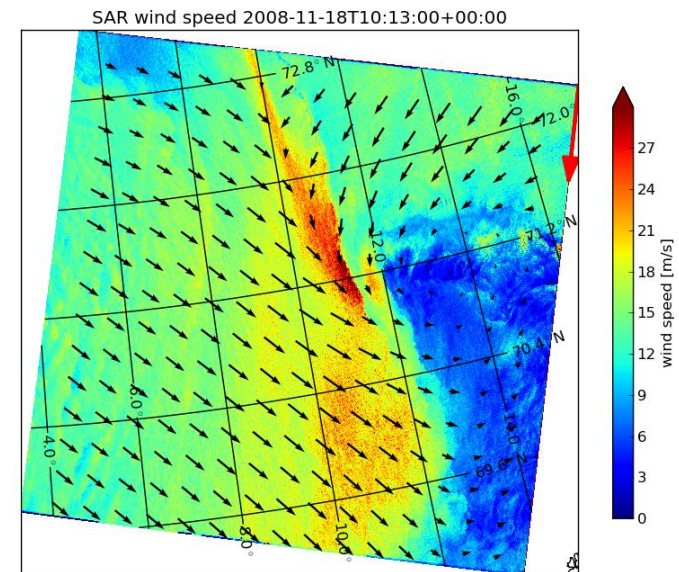
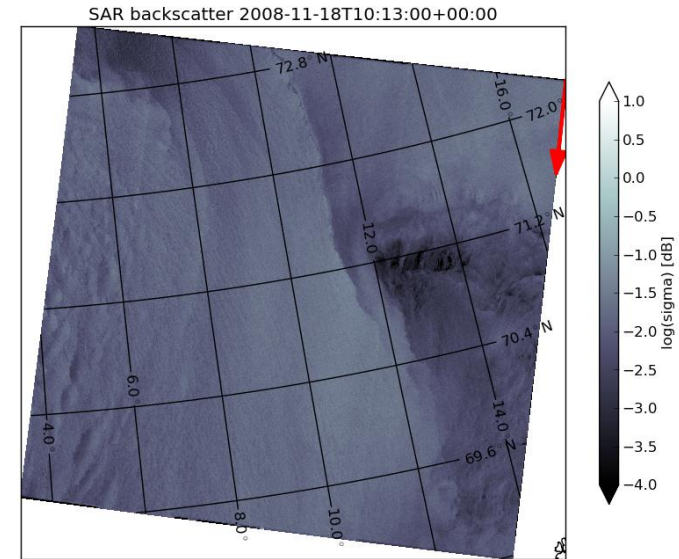
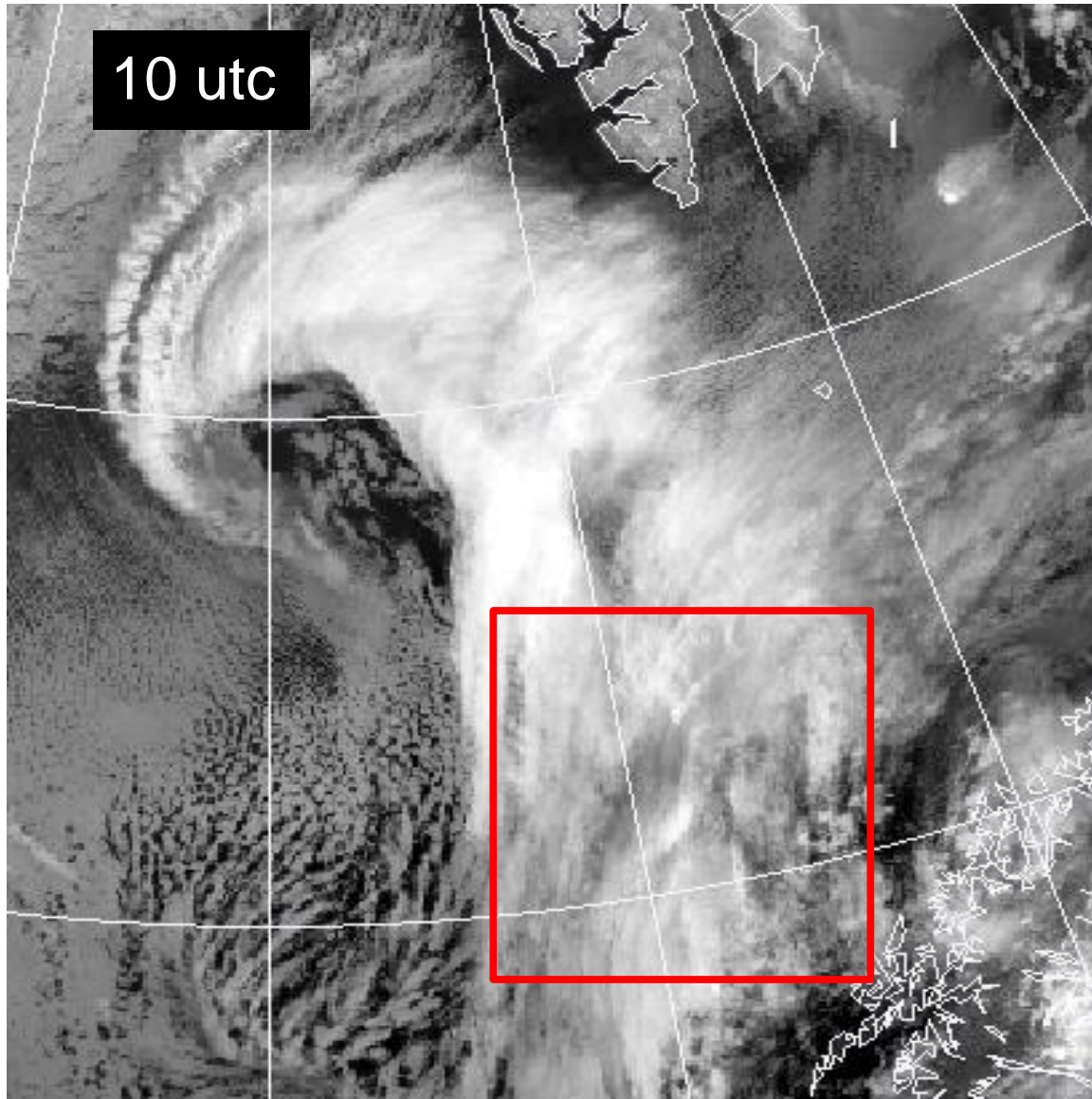
14 utc



20 utc



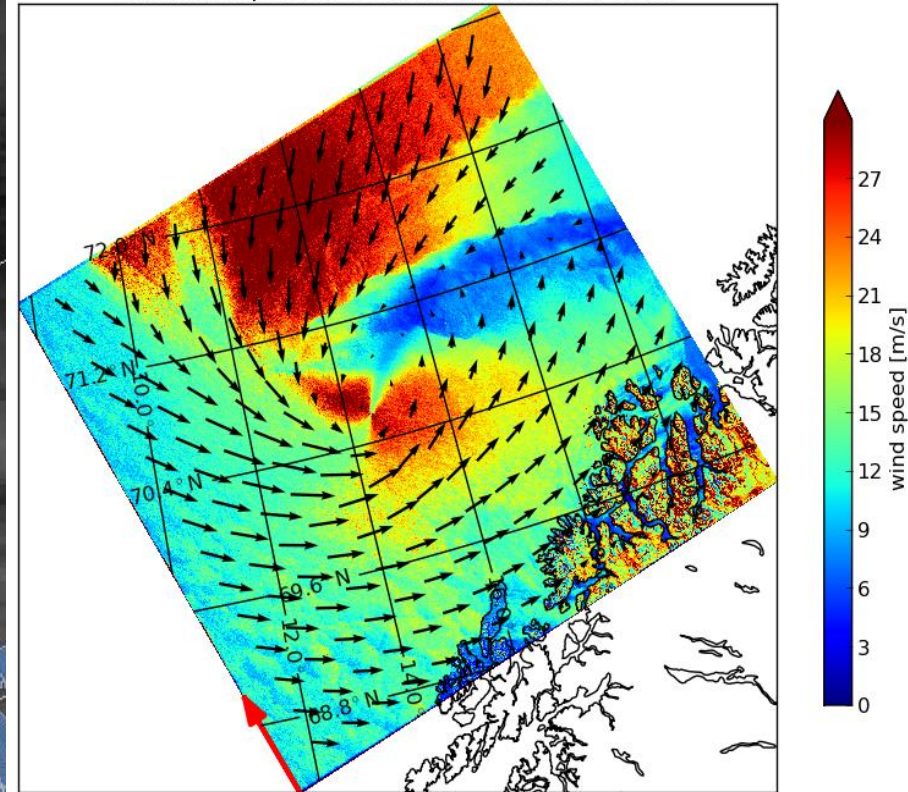
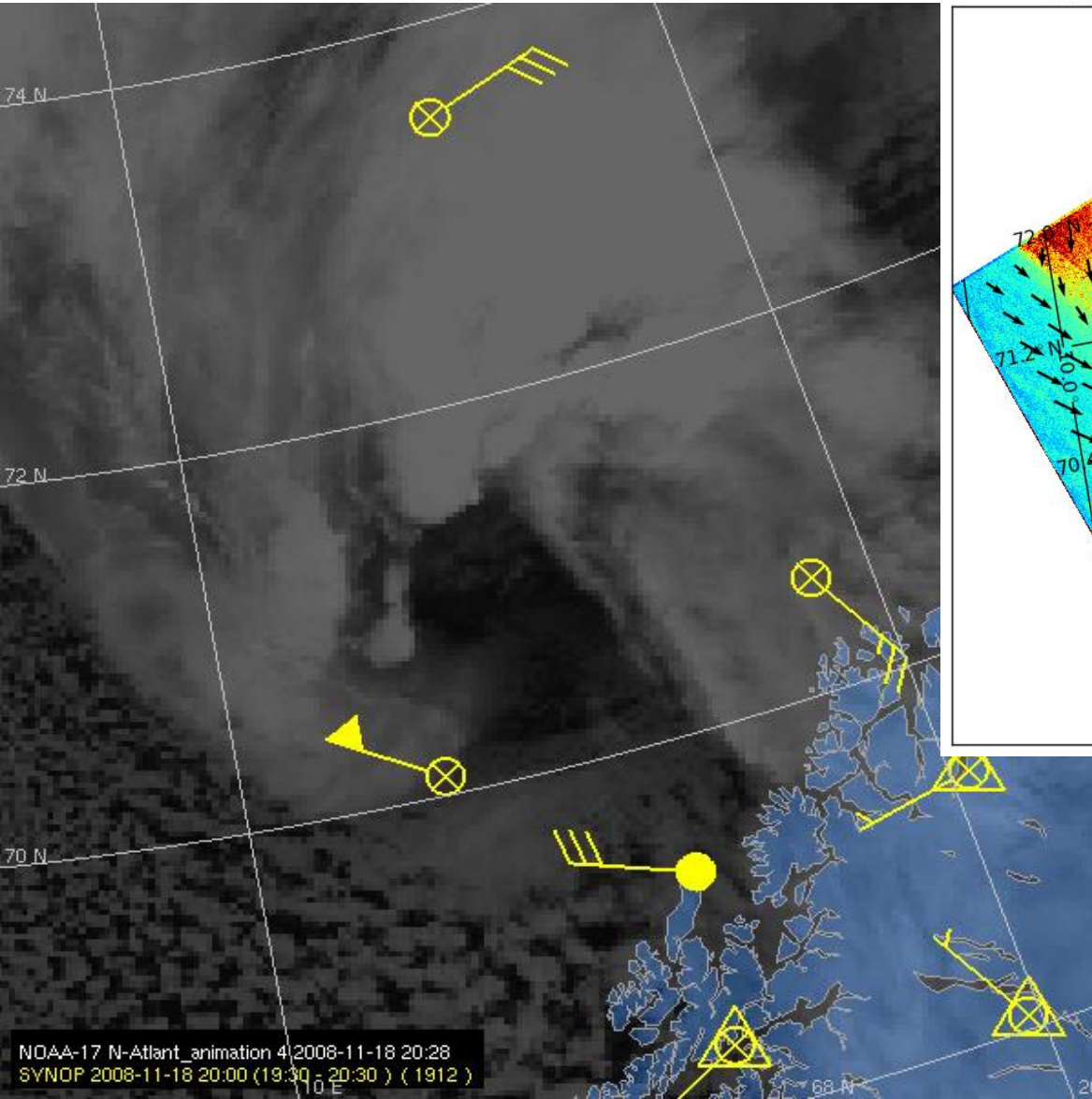
Surface signature in the SAR?



How about absolute wind speed?



SAR wind speed 2008-11-18T20:06:00+00:00

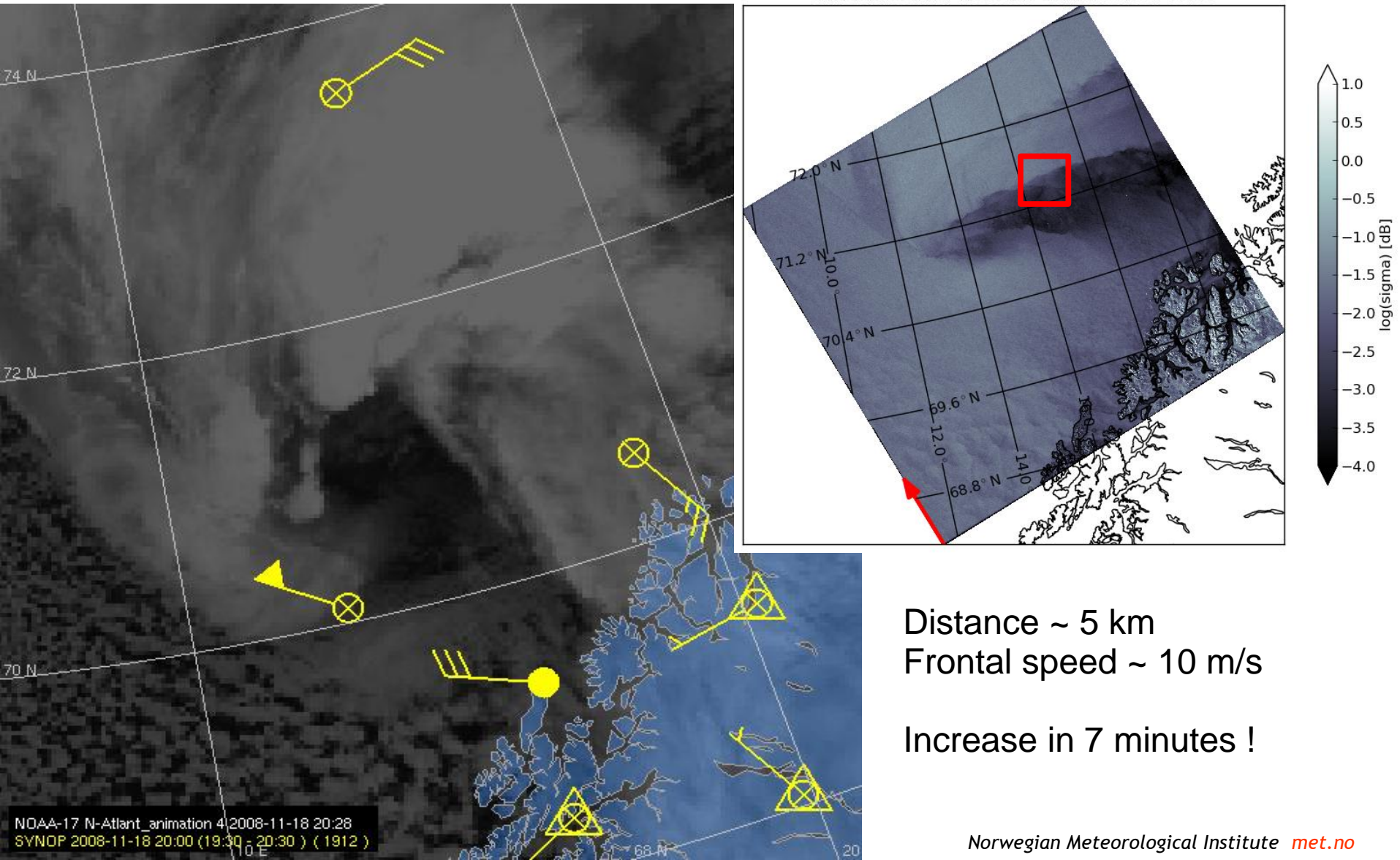


How good is the
absolute wind speed?

Rapid increase in winds?



SAR backscatter 2008-11-18T20:06:00+00:00



Distance ~ 5 km
Frontal speed ~ 10 m/s

Increase in 7 minutes !



Summary: SAR imaging of Polar Lows

- Important supplement to existing observational data
 - Excellent source of surface wind pattern
 - Absolute wind uncertain
- Imprints on the sea surface (as opposed to AVHRR)
 - Earlier detection ?
 - Polar low dissipation ?
- As of 2012 not sufficient coverage for operational use
 - Sentinel 1, 2 and 3 (2013-14)



Thanks for the attention 😊!



Foto: Gunnar Mellem

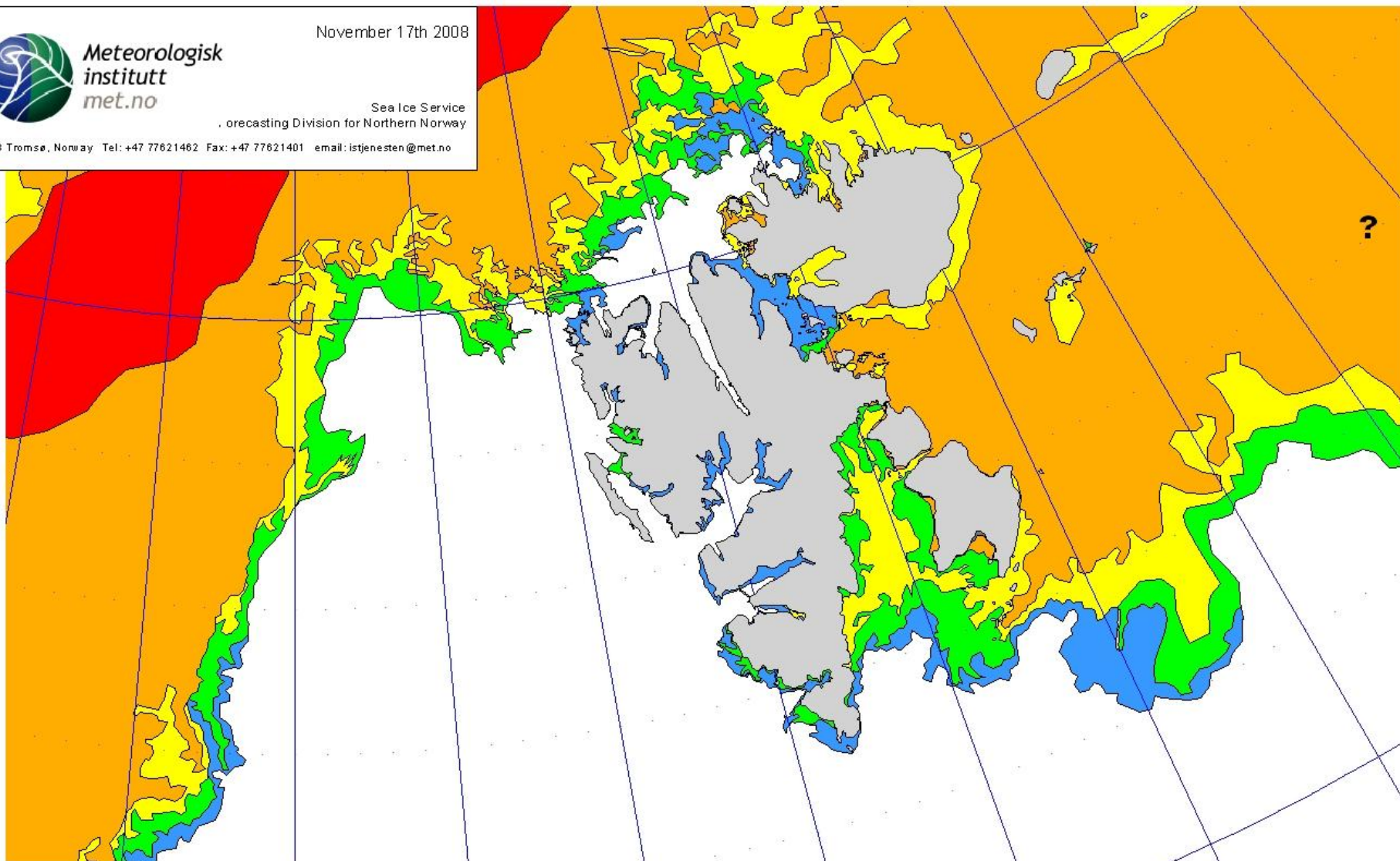


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





November 17th 2008

Sea Ice Service
Forecasting Division for Northern Norway

N-9293 Tromsø, Norway Tel: +47 77621462 Fax: +47 77621401 email: istjenesten@met.no



Ice Categories:

	Fast Ice		Open Drift Ice: 4/10 - 7/10
	Very Close Drift Ice: 9/10 - 10/10		Very Open Drift Ice: 1/10 - 4/10
	Close Drift Ice: 7/10 - 9/10		Open Water: 0/10 - 1/10

! Sea surface temperatures will no longer be displayed on the icecharts. Take contact with the ice service for further info. !