

Norwegian Meteorological Institute met.no

Assimilation of sea surface temperature and sea ice in HIRLAM

Mariken Homleid HIRLAM/AAA workshop on surface assimilation Budapest 13 November 2007



• HIRLAM status on

SST - sea surface temperature SIC - sea ice concentration

- Potential improvements of SST and SIC
 - SST and SIC from satellite data
 - experimental setup
 - results from parallel experiments
- Sensitivity of forecasts (and weather) to SST and SIC



HIRLAM current version

- SST analysed by successive corrections using observations from ship and buoys and pseudo observations created from ECMWF SST with 2 deg. resolution
- SIC diagnosed from SST

H20R - HIRLAM 7.0 - SST and SIC







Potential improvements of SST and SIC

Alternatives that are discussed:

- include SST and SIC fields covering sea areas from e.g.
 - ECMWF (NCEP)
 - O&SI SAF (SIC)

OR

assimilate satellite data by e.g. OI

Status 2007:

SIC - OSI SAF delivers a hemispheric product with good quality daily

- OSI SAF SIC has been used operationally at met.no since April 2005
- SST global SST products and analysis based on satellite data are available from e.g. the MERSEA project

- experiments with assimilation of OSI SAF SST in HIRLAM by OI give good results



OSI SAF - Ocean and Sea Ice -Satellite Application Facility

Delivers Sea Surface Temperature and Sea Ice products based on satellite data for input to operational meteorology and oceanography.

Sea Ice: hemispherical product daily (12 UTC), 10km Ice edge: SSM/I Ice concentration: SSM/I Ice type: SSM/I, Quickscat

MAP SST (Merged Atlantic Product) twice daily (00, 12), 10 km in cloud free areas

based on Meteosat, GOES and NOAA/AVHRR NAR SST (North Atlantic Regional) 4 times daily, 2km in cloud free areas, based on NOAA/AVHRR See: http://osi-saf.org





Sea Ice Concentration

- hemicpheric product
- available daily at 12UTC
- based on SSM/I

Also available

- ice edge
- ice type

OSI SAF HL SST - MAP SST at High Latitudes





OSI SAF HL SST - MAP SST at High Latitudes





OSI SAF HL SST - MAP SST at High Latitudes





Parallel experiment April 2006



- a time period with much satellite data
- relatively rapid changes in the SST and SIC
- **H20R**: HIRLAM 7.0

SST analysed by successive corrections
using observations from ship and buoys and
pseudo observations created from ECMWF SST
SIC diagnosed from SST

• H20exp: HIRLAM 7.0

SST analysed by optimum interpolation using observations from ship and buoys and OSI SAF MAP SST

SIC updated daily from OSI SAF products

H20R SST and SIC













SST analysed by optimum interpolation

- overlapping boxes; 600km*600km
 - MAP SST, 10km ==> more than 3000 observations
 - MAP SST, 20km ==> less than 1000 observations
 - pseudo ECMWF SST, 50km ==> about 150 observations
 - some observations from ship and buoys
- SST observations only available over open sea, NOT close to the coasts
- SST over land from monthly updated climatological values
- reduced influence of SST observations with increasing 'Fraction of Land'

Spatial error correlation modeled by Gaussian functions





H20exp SST and SIC





H20R SST and SIC





H20exp SST and SIC





Parallel experiment January 2007



- a time period with lot of clouds and not too much satellite data
- many polar lows during that period
- **H10R**: HIRLAM 7.1

SST analysed by successive corrections
 using observations from ship and buoys and
 pseudo observations created from ECMWF SST
 SIC diagnosed from SST

• H10exp: HIRLAM 7.1

SST analysed by optimum interpolation using observations from ship and buoys and OSI SAF MAP SST

SIC updated daily from OSI SAF products

H10R January 2007 MSLP SST and SIC





H10R January 2007 MSLP SST and SIC





H10exp January 2007 MSLP SST and SIC





H10exp January 2007 MSLP SST and SIC







T2m at Hopen SE of Svalbard observations H10R H10exp



ME and SDE of MSLP, T2m and FF10-forecasts January 2007

H10R H10exp Hirlam10 at met.no ECMWF

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Summary

- Experimental setup:
 - SIC over sea updated daily from hemispheric product delivered by O&SI SAF
 - SIC over land diagnosed from climatological values, interpolated in coastal regions
 - SST over sea MAP SST, ship observations and optionally pseudo ECMWF SST analysed by Optimal Interpolation
 - SST over land monthly updated climatological values
- Improved quality mainly due to improved SIC
- Quality of HIRLAM/ECMWF SST is good enough with 10-20 km resolution, south of N66
- MAP SST gives improved quality in northern regions

Remaining issues



- questionable quality of ECMWF SST north of N70
- questionable quality of MAP SST north of N70
- questionable quality of climatological SST values, particularly in northern regions

Could/should be done

- quality control of MAP SST to reject too cold values (due to non detected clouds)
- no use of ECMWF SST north of N70
- update climatological SST values (use ERA40)

p10r 5 SST and SIC 5 August 2006





ECMWF SST and SIC 5 August 2006





p10y SST and SIC 5 August 2006





p10z SST and SIC 5 August 2006



