Operational sea ice forecasting and navigation service for Chinese National Antarctic Research Expedition (CHINARE)

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13 MAY 2015
Who we are

National Marine Environmental Forecasting Center (NMEFC)

• A part of State Oceanic Administration (SOA)

• An exclusive state-authorized institution which provide forecasting service to CHINARE

• Operational forecasting service from the first CHINARE in 1984 to present
NMEFC’S Departments

Polar Environmental Research & Forecasting Division

- Marine disaster Pre-warning Division
- Polar research Division
- Polar sea ice group
- Polar ocean group
- Polar weather forecast group

- Marine Environment Forecasting Division
- Numerical Forecast Research Division
- Climate Prediction Research Division
- Marine Weather Forecast Division
- Network and Computation Service Division
- Marine Information Management Division
- Video Production Division
- Key Laboratory of Marine Disaster Forecasting Research
The Polar environmental research & forecasting division and the Marine weather forecasting division are responsible for the Antarctic station and navigation forecasting respectively.

Great Wall station (1985-, overall view)  Xuelong  Zhongshan station (1989-)

(Antarctic, 1984-)

• Polar observations (weather, sea ice and ocean)

• Polar forecasting service (weather, sea ice and ocean)
Antarctic Meteorological Observation

Joint work with CAMS (Chinese Academy of Meteorology Science).

Weather observational field
(Great Wall Station)

Zhongshan meteorological station
Meteorological Observation Onboard

automatic weather stations (AWS) onboard Xuelong
Satellite Receiving System Onboard
Antarctic fast ice wintering observation

From CHINARE 26, 2010-2011

(a) Antarctic fast ice observation field, (b) fixed and (c) mobile radiation station. (2010-2011)
CHINARE 2012-2014

2012:
- CNR4 Radiation and albedo
- Snow thickness: sonar + manual
- Ice thickness: 2 IMB + drilling
- Ice(Snow) Skin temperature
- Air surface temperature

2013:
- EM-31 ice thickness survey
- Spectral albedo
- IMB improvement

2014:
- Air-ice Eddy turbulent fluxes
- Micro-CTD profiles
- IMB(Ice Mass Balance)
Albedo parameterization results vs observation

(Yang et al., AS, 2015, submitted)
Difference of first-year and multi-year fast ice

(Zhao et al., 2015, in preparation)
Satellite Monitoring

- L/X satellite receiving system
  
  L: NOAA15-19 / AVHRR
  X: Terra, Aqua / MODIS

- 20-24 orbits every day, 8-9G
Satellite Monitoring & Application
Polar observations (weather, sea ice and ocean)

Polar forecasting service (weather, sea ice and ocean)
Polar weather forecast

Model: Polar WRF
Resolution: 30km; 10km; 3.33km
Operational weather forecasting for polar regions

Products include:

- Sea level pressure, temperature, humidity, precipitation tendency
- Surface wind direction and speed
- 850hPa, 700hPa and 500hPa geopotential height
Sea ice forecasting system

Initialization:
Nudging AMSR2
Sea ice concentration

Atmospheric Forcing
NCEP GFS / Polar WRF

MITgcm
Ocean Model

VP
Ice Model

Output
24-120h:
Ice concentration
Thickness
Velocity
...

Flow chart
Sea ice forecasting system

Ensemble-Filter sea ice data assimilation

- multivariate data assimilation
- summer ice thickness improvement (not expected).
- SMOS ice thickness assimilation leads to much better thickness forecasts (expected), and better concentration forecasts (not expected).

(Yang et al., AoG, 2014; JGR, 2014; QJRMS, 2015)
Sea ice forecasting system

Ice concentration long-term forecast from NCEP CFSv2 (1-3 month lead time)

a. Forecast

b. Observation

Collaboration with NCEP
Arctic and Antarctic sea ice seasonal outlook

Statistic model based;
The prediction provides support for the CHINARE planning.
Li and Li (2014), submitted to SIPN (Sea Ice Prediction Network); http://www.arcus.org/sipn/sea-ice-outlook/2014/august
Sea Ice Service for CHINARE

Ice analysis based on SAR
Ice service for Chinese commercial shipping in Arctic
Emergency forecasting Service when Xuelong Trapped in the Antarctic, 2014
Emergency forecasting Service when Xuelong Trapped in the Antarctic, 2014
Thanks for your attention!

Please feel free to contact us if you have any questions

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