Geophysical Research Abstracts, Vol. 8, 08433, 2006
SRef-ID: 1607-7962/gra/EGU06-A-08433

Terra Nova Bay polynya: a study by satellite microwave observations and Eta model simulations

G. De Carolis (1), **S. Morelli** (2), F. Parmiggiani (3) and G. Casini (2)

(1) ISSIA-CNR, Bari, Italy, (2) Dept. of Physics, University of Modena and Reggio E., Modena, Italy, (3) ISAC-CNR, Bologna, Italy

Antarctic coastal polynyas have been the subject of great scientific interest in the last two decades. Being regions of intense heat loss from the ocean to the atmosphere, polynyas can behave as "ice factories"' contributing a significant fraction of total annual sea ice production and, thus, to the climate of the Antarctic continent. This study focuses on Terra Nova Bay (TNB) polynya as it is one of the most important of the whole Antarctic continent, and also because the Italian Antarctic Base "Mario Zucchelli Station" is located in that area. Being the access to TNB polynya almost impossible in winter; remote sensing and model simulations remain the only available tools to study winter polynya phenomena.

Because of the very frequent cloud cover of polar regions in winter, optical and thermal sensors are practically useless and profitable observations are reduced to active (SAR) and passive microwave sensors. Two major microwave sensors have become available in recent years to the scientific community: 1. the Advanced Synthetic Aperture Radar (ASAR) on Envisat satellite; and 2. the passive microwave radiometer AMSR-E (Advanced Microwave Scanning Radiometer for EOS) on Aqua satellite. From the ESA archive of ASAR scenes of winter 2003 over TNB, the image of Sept.16, which displays an open polynya of about 3100 Km^2, and the image of Sept.25, with the polynya completely shut down, were selected. For the period 10-30 September 2003, daily images of the AMSR-E radiometer, covering the whole Ross Sea, were acquired and analyzed [1]. Wind data were retrieved from the Antarctic Automatic Weather Stations Project of the University of Wisconsin (uwamrc.ssec.wisc.edu).

Simulations of the meteorological conditions of Sept. 15-16-17 were carried on with the limited area model Eta, which is a three-dimensional, primitive equation, grid-

point model. It is one of the mesoscale numerical weather prediction models currently operational at the National Centers for Environmental Prediction of the U.S. National Weather Service. The Eta model is coupled with a land surface model derived from the Oregon State University model and it is able to perform hydrostatic and non-hydrostatic runs. Eta has been used for applications at mid-latitudes [2] and, in an older version, for the study of Antarctic summer conditions [3].

Eta runs were performed, both including the sea ice cover in the Ross Sea area, as retrieved from the ECMWF at a spatial resolution of 0.36° and a polynya of realistic extension, as shown from the satellite images.

The simulations were carried on with 50 layers from sea surface to 25 hPa, with higher resolution near the bottom of the domain. Horizontal resolution was 0.05×0.05 transformed degrees (about 8 Km $\times$ 8 Km as approximate distance between two mass points on the semi-staggered Arakawa E grid).

Results of this combined analysis of the physical properties of TNB polynya are presented and discussed.

REFERENCES

[1] Parmiggiani F. (2006), "Fluctuations of Terra Nova Bay polynya as observed by active (ASAR) and passive (AMSR-E) microwave radiometers", Int. J. Remote Sensing, in press.

[2] Cesini D., Morelli S. and Parmiggiani F. (2004), "Analysis of an intense bora event in the Adriatic area", Natural Hazards and Earth System Sciences, 4: 323-337

[3] Stortini M., Morelli S. and Marchesi S. (2000), "Modeling study of mesoscale cyclogenesis over Ross Sea, Antarctica, on February 18, 1998", Il Nuovo Cimento, vol. 23C, n. 2, pp. 147-163.