Press Releases

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JAMSTEC
Graduate School of Environmental Studies, Nagoya University
Atmosphere and Ocean Research Institute, The University of Tokyo
National Maritime Research Institute

Sea Bird and Ship Drift Data Help Capture Ocean Currents
~A new observation method for ocean current forecast~

A research team led by Dr. Yasumasa Miyazawa at Application Laboratory, the Japan Agency for Marine-Earth Science and Technology (JAMSTEC: Asahiko Taira, President) assimilated seabird (*Calonectris leucomelas*)[*1] and ship[*2] drift data obtained from Global Positioning Systems (GPS) logs into an operational ocean nowcast/forecast system, Japan Coastal Ocean Predictability Experiment 2, "JCOPE2". The result showed that use of seabird and ship drift for data assimilation[*3] can improve ocean nowcast/forecast skills. This study was carried out in collaboration with researchers from Nagoya University, Atmosphere and Ocean Research Institute of The University of Tokyo, and National Maritime Research Institute.

The JCOPE2 ocean nowcast/forecast system, which was developed by JAMSTEC's Application Laboratory, has been widely utilized for various fields from research projects on fishing operation and oceanic conditions to consulting businesses for oceanic industries and public sectors. Ocean current has usually been monitored by combing the JOCPE2 system with satellite remote sensing data. This experiment showed that assimilation of high-resolution seabird and ship drift data into the JOCPE2 systems is highly effective to enhance monitoring of ocean currents. Improvement of ocean nowcast/forecast skills by data assimilation will lead to more effective ship operation, which will offer extensive network for ocean current observation in an innovative manner. It is also expected to make further contributions to utilization in the fishing industry and marine resource exploration.

The above results were posted in *Nature Scientific Reports* on December 3rd (JST).

Title: Assimilation of the seabird and ship drift data in the north-eastern sea of Japan into an operational ocean nowcast/forecast system

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In this study, the field studies for seabird drift data were financially supported by grants from the Japan Society for the Promotion of Science (24681006, 24241001).

The ship drift data were obtained from the ships joining in a verification project of reduced CO_2 emission from ships by a shipping navigation supporting system (FY2013-FY2015), promoted by Ministry of the Environment of Japan.

*1 The Streaked Shearwater, *Calonectris leucomelas*

Photo by Ken Yoda, Nagoya University

Photo by: Takamori Sugawara, Nagoya University

It is a species of seabird found in the western Pacific, breeding on the coast and on offshore islands of Japan. During a period from spring to autumn, it travels hundreds of kilometers over sea, feeding on fish such as anchovies. When it rests on sea, its behavior is similar to that of a drifting buoy.

*2 Ship

Photo provided by Nippon Shipping Co.,Ltd and Nippon Express.

In this study, ship drift data were obtained from 12 cargo ships with a displacement of 10,000 tons.

*3 Data assimilation
In this study, it means estimating ocean current distributions by combing satellite data and calculations based on an operational ocean nowcast/forecast system. In general, it refers to processes which incorporate observation results into numerical models to obtain data of the state including areas where observation is not available.

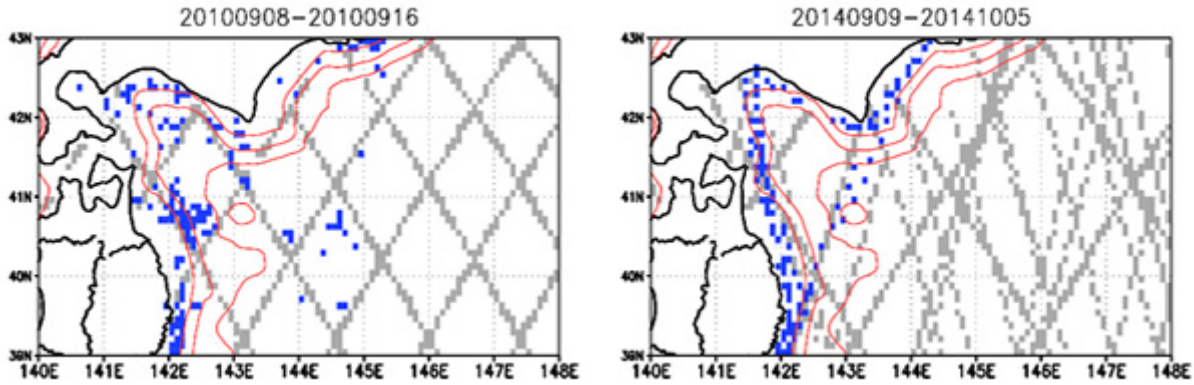

Figure 1: Measurement positions of the drift indicated by blue colored dots (left: seabird drift data, right: ship drift data) and the satellite altimetry by gray colored dots.
Contours with red color indicate iso-depth lines with 400 m, 800 m, and 1500 m levels. Left: From September 8 to September 16 in 2010. Right: From September 9 to October 5 in 2014.

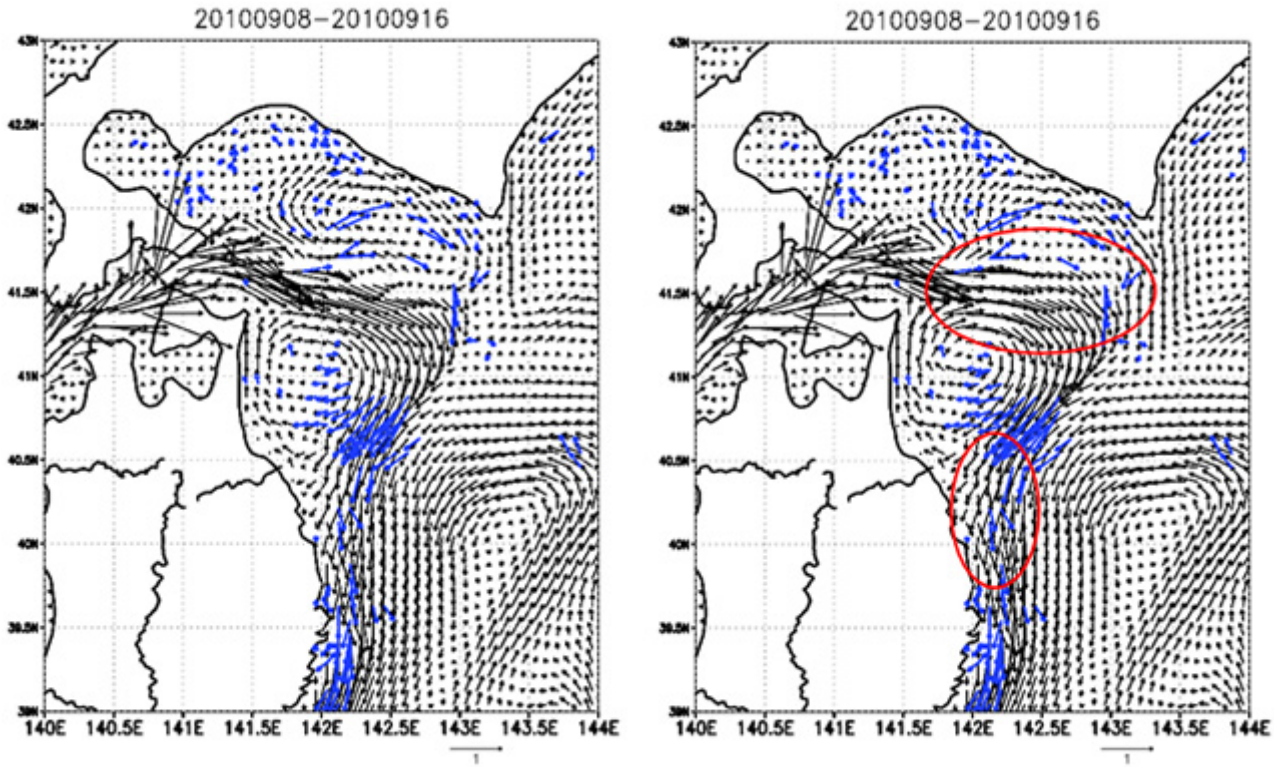

Figure 2: Current distributions averaged during the period from September 8 to 16 in 2010. The black arrows indicate current distributions at 5m depth obtained by JCOPE2, while the blue arrows the seabird drift data. Left: Results without assimilation of the seabird drift data. Right: Results with assimilation. A black arrow under the figure shows the scale of 1m/sec. Red circles indicate areas that showed significant differences between with and without data assimilation.

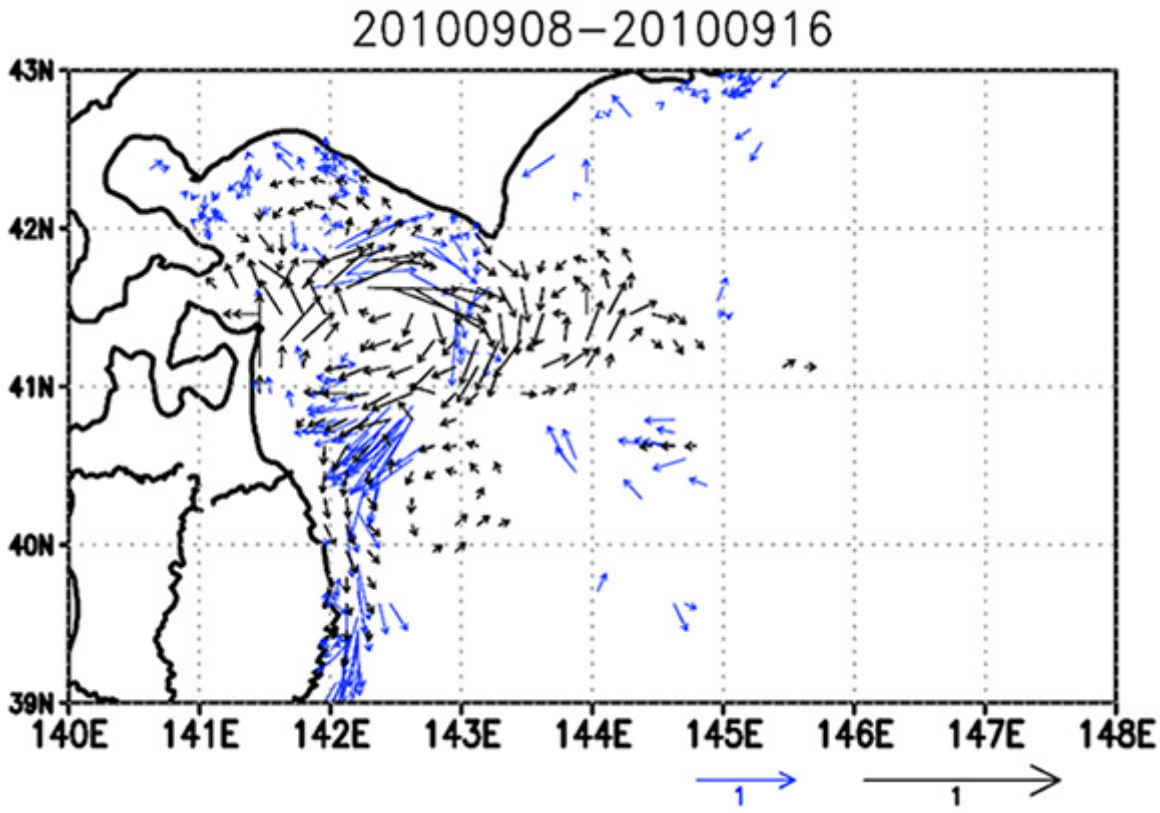

Figure 3: Difference between with and without assimilation of the seabird drift data shown by blue arrows (difference between right and left in Figure 1.) Under the figure, a blue arrow shows 1m/sec scale of drift data, and black one a size of 1m/sec difference in ocean current.

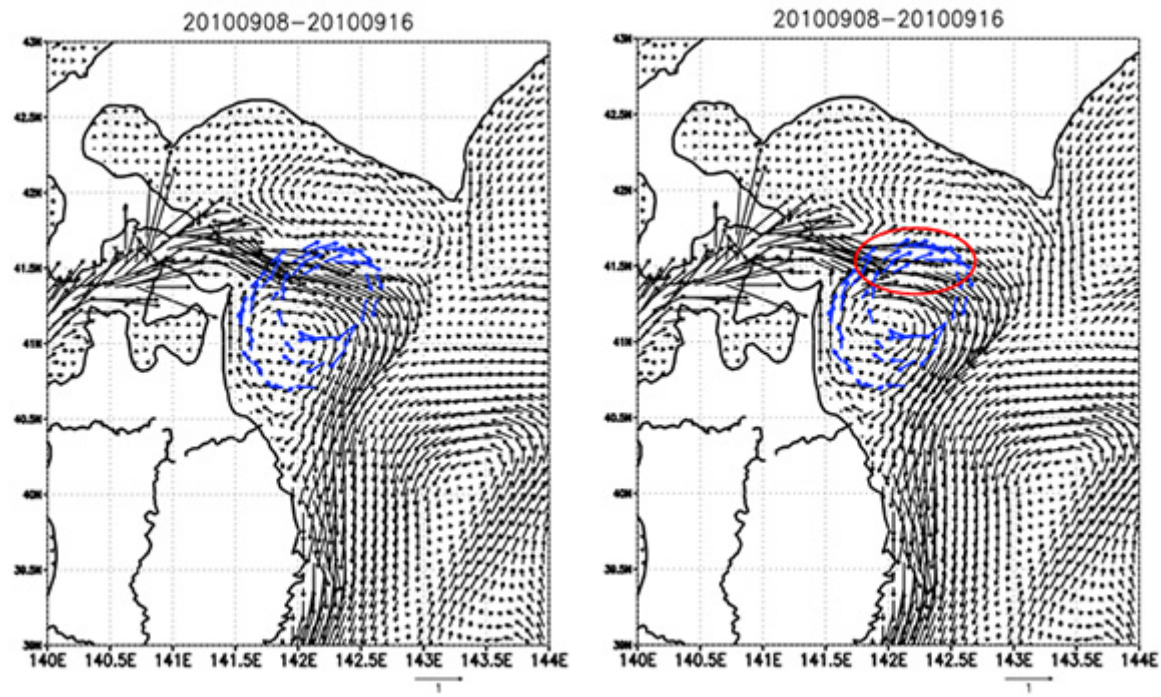

Figure 4: Current distributions averaged during the period from September 8 to 16 in 2010. The black arrows show current distributions at 5m depth obtained by JCOPE2. Indicated in blue arrows show data of the buoy drift, which was there at that time. Left: Results without assimilation of the seabird drift data. Right: Results with data assimilation. A black arrow under the figure shows the scale of 1m/sec. An area that showed similarity with buoy drift data with data assimilation is shown in a red circle.

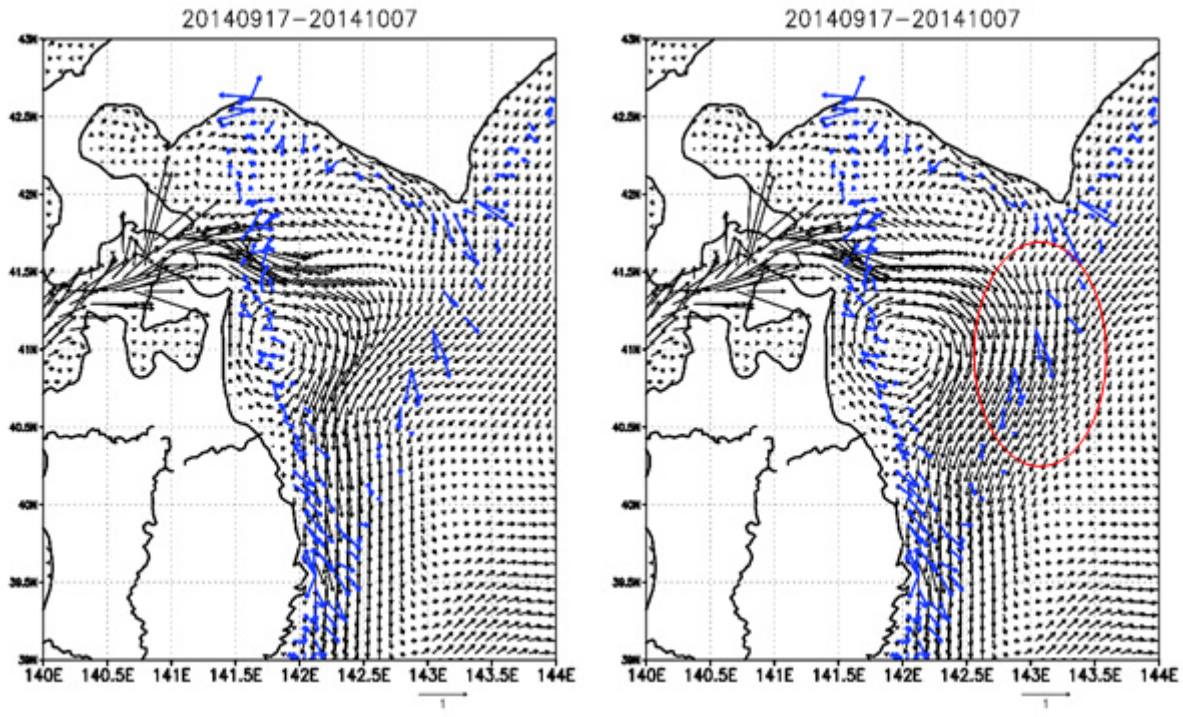

Figure 5: Current distributions averaged during the period from September 17 to October 7 in 2014. The black arrows show current distributions at 5m depth obtained by JCOPE2, while the blue arrows ship drift data. Left: Without assimilation of ship data. Right: With assimilation. A black arrow under the figure shows the scale of 1m/sec. Areas that showed significant difference with data assimilation is shown in a red circle.

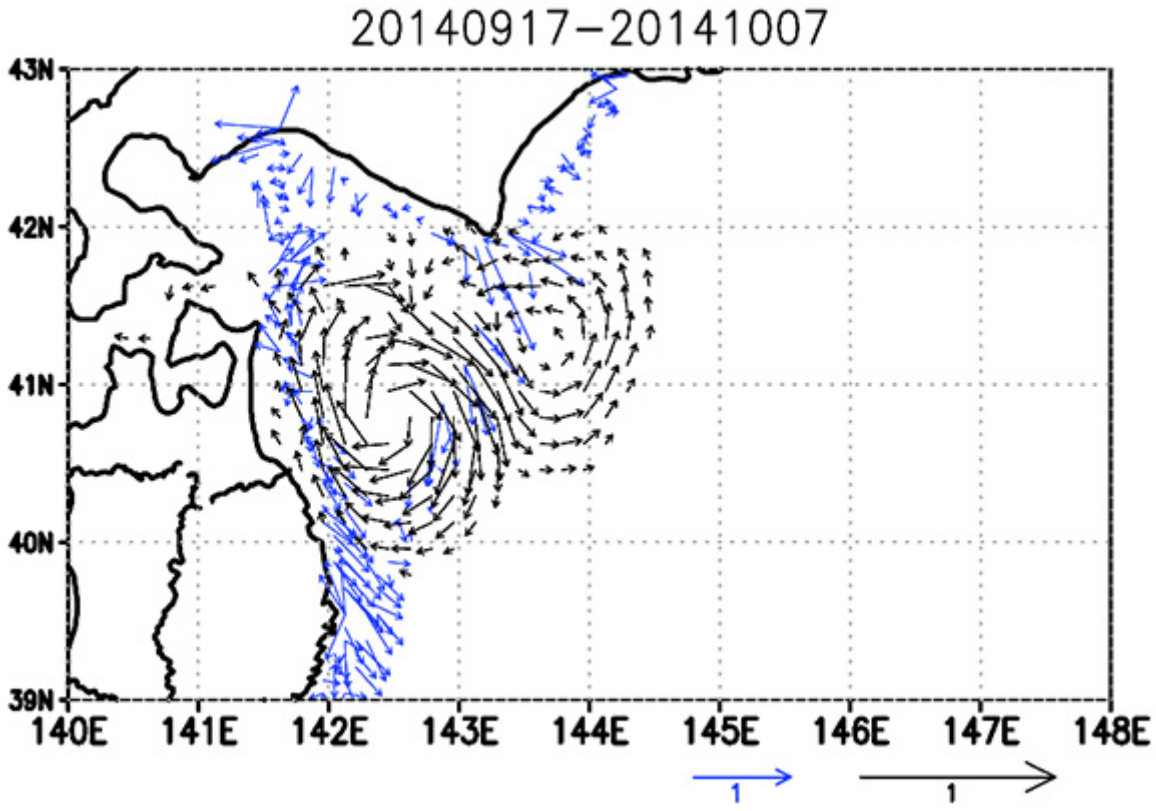

Figure 6: Difference between with and without assimilation of the ship drift data (difference between right and left in Figure 3). Blue arrows show seabird drift data. Under the figure, a blue arrow shows 1m/sec scale of drift data, and black one a size of 1m/sec difference in ocean current.

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