Front cover: Weybourne Atmospheric Observatory, UK

Weybourne Atmospheric Observatory, officially opened by Sir William Waldegrave in 1994, experiences an uninterrupted, "clean air" seaward aspect to the North. We are also able to measure plumes from many differing origins including London and the Arctic.

Ozone, oxides of nitrogen and sulphur, carbon monoxide, carbon dioxide, oxygen, hydrogen, and condensation nuclei are routinely measured. New instrumentation is also available to determine GHG's and VOC's utilising Gas chromatography and PTRMS.

A SODAR RASS and Sonic system is run providing meteorological information about the atmospheric column above the site.

The facility also has ample room to house temporary external applications; with the ability to provide 32amp, 16amp and three-phase electrical supply. Accommodation in the area is both plentiful and high quality. Norwich International airport is forty minutes drive away ensuring that mainland Europe is easily accessible.

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national report

Chile

The scientific activities related to SOLAS Chile are mainly associated to the research efforts of scientists of the Centro de Investigación Oceanográfica en el Pacífico Sur-Oriental (COPAS). COPAS researchers are working actively in determining carbon fluxes and reservoirs and their impact on fCO_2. The role of bacterioplankton (bacteria and archaea) within the photicand mixed layer is leading to the formulation of new paradigms that challenge the predominance of short, energy efficient food chains in upwelling ecosystems. Of special interest is the research activity that is being conducted within the oxygen minimum zone (OMZ) which is one of the world's most pronounced. The activity of anoxic bacteria and archaea relevant microbial groups is of particular relevance to the understanding of carbon and nitrogen cycles in the Humboldt Current System area.

I-I Lin obtained her Ph.D. degree in Remote Sensing from the University of Cambridge, England in 1995. From 1995-1999, she worked as a Research Scientist in the Centre for Remote Imaging, Sensing, and Processing of the National University of Singapore. In 2000 she returned to her home country, Taiwan, and is currently an Associate Professor in the Department of Atmospheric Sciences, National Taiwan University. Her research interest is in using synergy of multiple remote sensing data to study air-sea interaction problems, including typhoon-ocean interaction, dust storm-ocean interaction, and the role of surfactants in air-sea gas exchange.

Multiple remote sensing for air-sea biogeochemical interaction research in the western north Pacific and neighbouring seas

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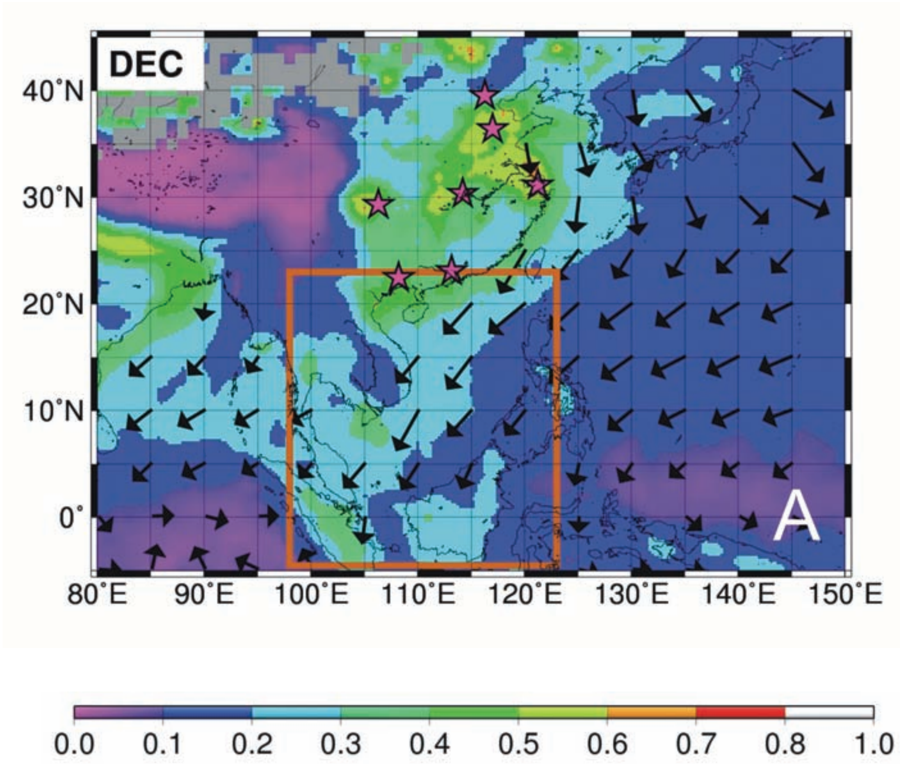
Air-sea biogeochemical interaction related processes are a critical component in the Earth's ecological and climate system. However, due to the complex and dynamic nature of these processes, many of the processes are poorly-observed and little understood. This is especially true in the vast western North Pacific Ocean and the neighbouring seas as this vast oceanic region is subject to frequent atmospheric episodic forcing from events like typhoons and dust storms. It has been difficult to use discrete ship-borne point measurements with irregular time and spatial intervals to observe these highly episodic processes. With the advancement in space-borne remote sensing offering frequent and systematic observations, it has become more feasible to take a glimpse at these complex dynamic processes. In this research, multiple remote sensors are used as it is necessary to have observations of a suite of physical and biogeochemical parameters for both atmosphere and ocean. In this research, five types of remote sensing data are used and they are: (a) ocean colour data (chlorophyll-a concentration and ocean colour spectra) from the NASA's SeaWiFS (Sea-viewing Wide Field-of-view Sensor) and MODIS satellites (O'Reilly et al., 1998); (b) aerosol optical thickness and fine mode fraction data from the NASA



MODIS (MODerate Resolution Imaging Spectro-radiometer, Kauffman et al., 2002) satellite; (c) SST data from the TRMM (Tropical Rainfall Measuring Mission) and AMSR-E satellites (Wentz et al. 2000); (d) the Sea Surface Height Anomaly (SSHA) data from TOPEX/Poseidon and JASON-1 satellites (Fu et al., 1994); and (e) ocean surface wind vectors from the NASA QuikSCAT satellite (Liu et al., 1998). This suite of sensors are applied to a number of applications in the western North Pacific Ocean and neighbouring seas and are introduced as follows.

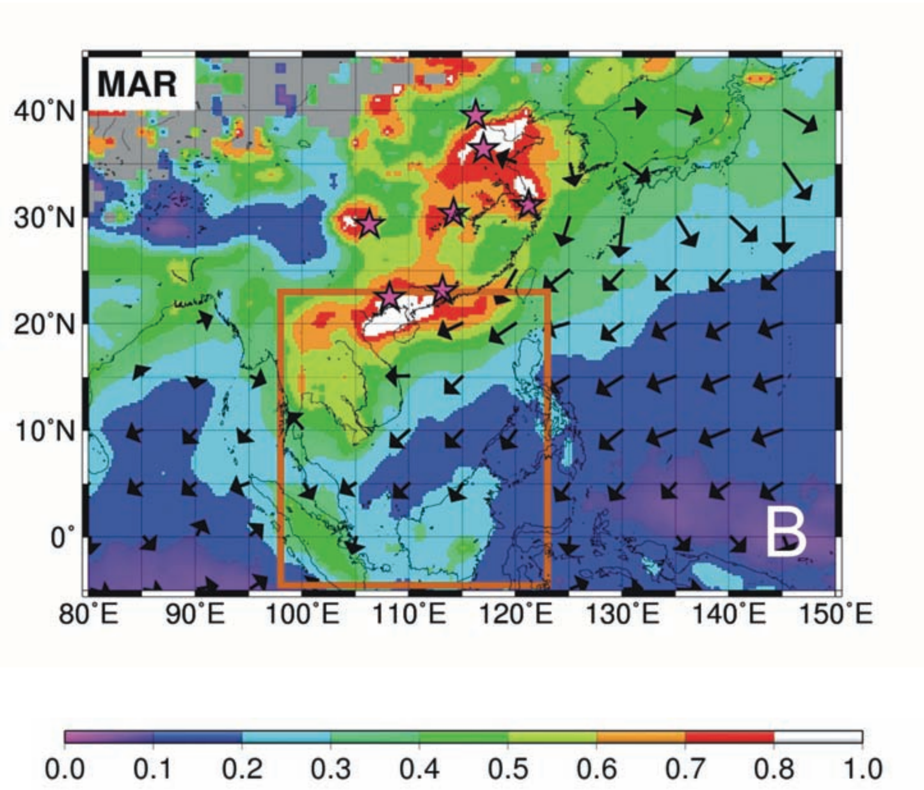
Application 1: Typhoon-Ocean Interaction (Lin et al. 2003)

Traditionally accepted mechanisms of nutrient supply to the upper ocean are insufficient for supporting the new production in the oligotrophic ocean estimated from geochemical tracers. This paradox, whose resolution is critical for a full understanding of the global carbon cycle, has generated an intensive search for sources of allochthonous nutrients to the upper ocean. Episodic injections of nutrients, as a result of enhanced vertical mixing and upwelling across the nutricline pumped by tropical cyclones, is a possibility that has been much speculated yet largely undocumented by direct observations.
Here Lin et al. (2003) use a combination of remote sensors to show that the impact of a moderate cyclone can be far reaching.

In July 2000, tropical cyclone Kai-Tak transgressed through the South China Sea (SCS). It caused up to a 300 times increase in phytoplankton biomass and 9°C reduction of sea surface temperature.
A minimum of 0.8 Mt of carbon, equivalent to 2-4% of the annual new production in the oligotrophic SCS, has been generated. Given that there are in average 14 tropical depressions/cyclones passing SCS annually, their contribution to the SCS carbon cycle is estimated to be as high as 20-30%, though it has been totally neglected before.
Related report on this work can also be found in the Nature 'News and Views in Brief' in August 2003.

Application 2: Aerosol-Ocean Interaction in the South China Sea (SCS) (Lin et al. 2007)

For long it has been much hypothesised that Asian desert dust is the primary source of aerosol loading impacting the biogeochemistry in the SCS. In Lin et al. (2007), the MODIS aerosol optical thickness (AOT) and fine mode fraction data together with QuikSCAT wind vectors are used to test this hypothesis and systematically investigate the situation. It is found that the current hypothesis is over-simplified and that desert dust is not the primary aerosol source in the SCS. Rather, anthropogenic aerosol loading from the fossil fuel burning of eastern China is the primary aerosol loading source. As can be seen in Fig.1A, high anthropogenic AOT loading in Eastern China, especially near major cities of even higher AOT, loadings of 0.5 and above (depicted in stars) from eastern China were transported by the prevailing northeast monsoon to the SCS. Even during the dust storm season in March (Fig.1B), the anthropogenic fossil fuel aerosols are mixed with the desert dust and transported together to the SCS. Thus the situation is much more complicated as it was hypothesised to be and an integrated approach is deemed necessary to further understand the aerosol impact biogeochemistry of the SCS.



< Figure 1: 3-year (2002-2004) averaged total AOT from MODIS for December (non-dust season, Fig. A) and March (dust season, Fig. B) in the South China Sea (boxed region) and neighbouring regions. QuikSCAT ocean surface wind vectors are overlaid. Major Chinese cities are annotated in stars.

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