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Carbon cycling in China Seas - budget, controls and ocean acidification (CHOICE-C)

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The open ocean, coastal ocean and terrestrial ecosystem are three major components modulating atmospheric CO₂ and thereby the earth climate system. The complexity of the carbon cycling in the coastal ocean under the impact of both the land input and dynamic exchanges with the open ocean makes it a huge challenge to be included in any realistic prognostic climate simulations (Figure 1). The marginal seas adjacent to China (Figure 2), such as South China Sea and East China Sea span a wide range of latitudinal zones with diverse and distinct ecosystem structures. Added in more complexity is the land input from the major world rivers, such as Changjiang (Yangtze River) and Zhujiang (Pearl River) from the mainland continent. As such, carbon cycling in China Seas exerts significance both at regional and global scales.

CHOICE-C focuses on the carbon budget, controls, ecological response and future changes in coastal ocean systems.

The focal area includes, but is not limited to the continental shelves in both the South and East China Seas (Figure 2). Through an integrated study of the carbon cycling between field observation, remote sensing as well as numerical modeling in China Seas with a contrast/comparison strategy, CHOICE-C aims to determine the source and sink terms of atmospheric CO₂ and their associated controlling processes. What follows concentrates on the ecological response of the uptake of anthropogenic CO₂, primarily on the ocean acidification during the past 100-200 years. Core themes of CHOICE-C are: 1) assessment of the variability of carbon sources and sinks in China Seas at a seasonal

and inter-annual time scales; 2) processes and mechanisms that control the carbon budget, 3) determination of ocean acidification 4) future trends of carbon budget and ocean acidification in response to global climate changes (Figure 3).

Eight subprojects are designed for the CHOICE-C program. The linkage between CHOICE-C core themes and subprojects is illustrated in Figure 4:

- 1) Air-sea CO₂ flux and its temporal and spatial variability, PI: Minhan Dai, Xiamen University
- 2) Primary productivity and carbon inventory, PI: Delu Pan, The 2nd Institute of Oceanology, SOA
- 3) Recycling, export and burial of carbon, PI: Pinghe Cai, Xiamen University

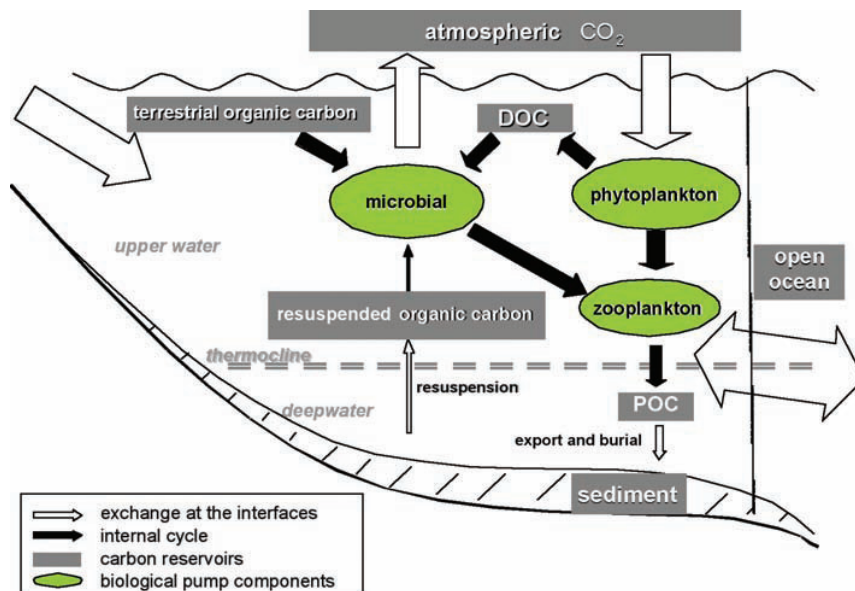


Figure 1 Schematic of the coastal ocean carbon cycling. Note the pathway has been simplified. Coastal ocean carbon cycling is determined to a large extent by the coastal ocean physics and the hydrological dynamics, and is characterized by large amount of land input, intensified surface-bottom sediment interaction, and dynamic exchanges with open ocean. Coastal ocean is also characterized by general high biological production and diverse ecosystems.

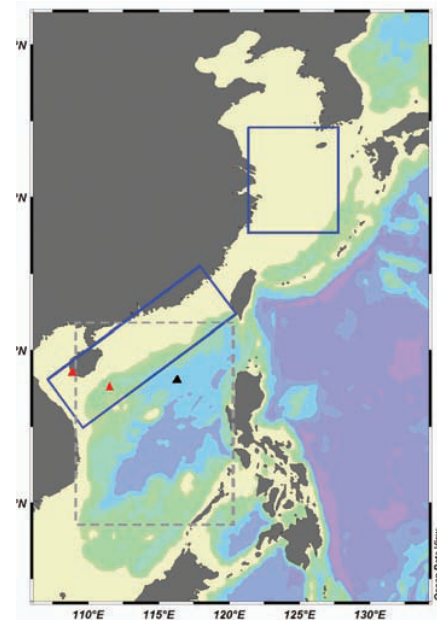


Figure 2 Map of the China Seas showing CHOICE-C domains. Boxed areas including the East China Sea and South China Sea shelves are the focused regions of this study while flux mapping will cover the whole China Seas northern to 10°N.

4) Terrestrial carbon input and its impact on the carbon cycling in the coastal ocean, PI: Xuchen Wang, Institute of Oceanology, CAS

5) Carbon exchanges between the continental shelf and the open ocean, Co-PIs: Li Li and Xiaogang Guo, the 3rd Institute of Oceanology, SOA

6) Ocean acidification-reconstruction and current status, Gangjian Wei, PI: Guangzhou Institute of Geochemistry, CAS

7) Ecological response to ocean acidification, PI: Kunshan Gao, Xiamen University

8) Simulations and predictions of future carbon budget, PI: Jianping Gan, Hong Kong University of Science and Technology

Progress in 2009

CHOICE-C activities in 2009 include among others finalization of the implementation plan and execution of major field campaigns.

On March 6-8, 2009 CHOICE-C international workshop was held at Xiamen University, with more than 80 participants. The primary objectives of the workshop were to review the current knowledge on carbon cycling in marginal seas, to examine the implementation plan of CHOICE-C. CHOICE international advisory committee members were invited to the workshop and their comments and suggestions have added tremendous values to the workshop and implementation of the project.

Four major cruises covering the CHOICE-C domains are planned in CHOICE-C project. The first cruise was conducted on July 18 – August 31, 2009, in which 105 scientists and students from 12 Chinese institutions participated.

(More information at <http://973oceancarbon.xmu.edu.cn>)

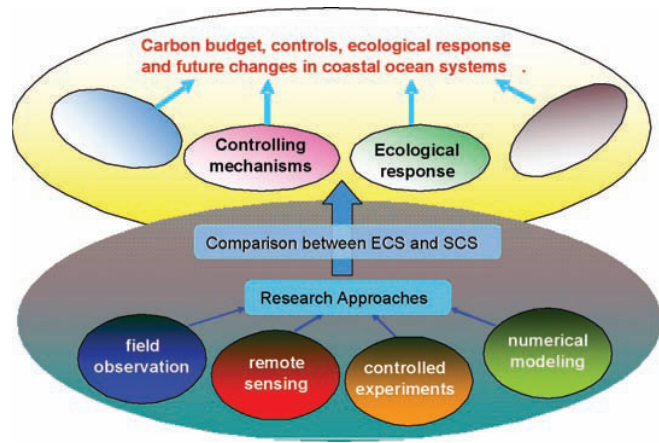


Figure 3 CHOICE-themes and approaches.

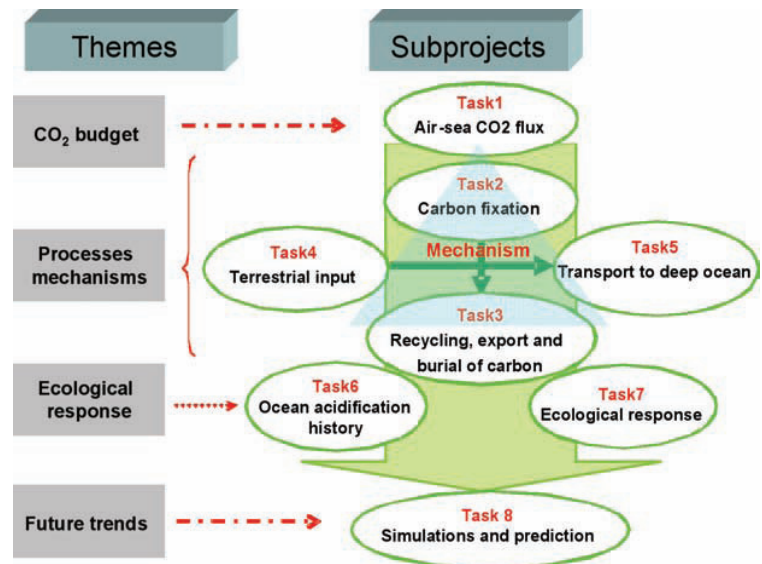


Figure 4 Research themes and subprojects.



Photo Participants to the 1st CHOICE-C international workshop on March 6-8, 2009 in Xiamen China (photo by Vera Shi).

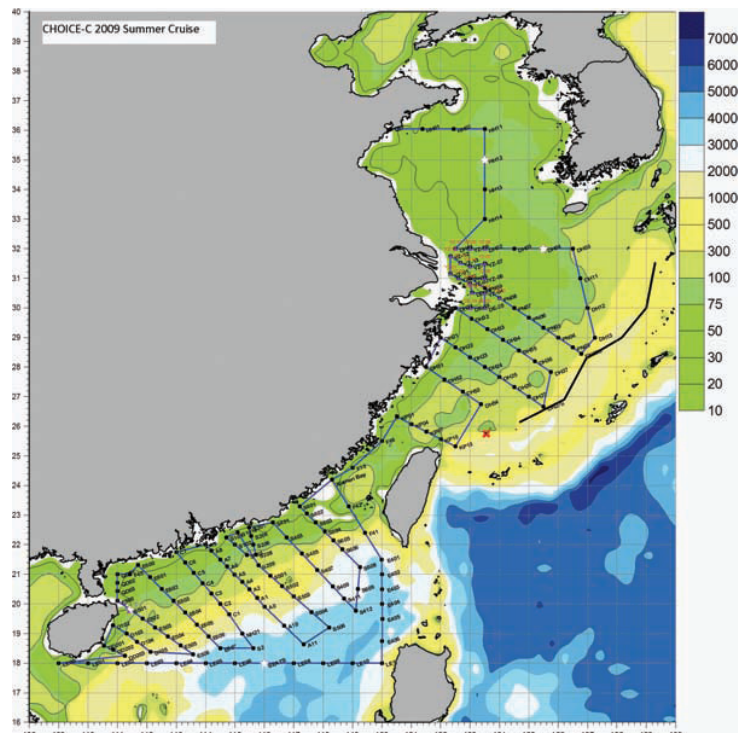


Figure 5 Map of the China Seas showing the cruise tracks and sampling stations during the first CHOICE-C cruise carried out on July 18 – August 31 2009.