UC San Diego –National Sun Yat-sen University

2019 Bilateral Research Symposium

Marine Science Breakout Session I

FRIDAY AFTERNOON, MARCH 8, 2019

HUBBS HALL, RM 4500
SCRIPPS INSTITUTION OF OCEANOGRAPHY

14:00 - 16:00 Marine Science I (Chair: Ron Burton)

- Bill Gerwick, Professor, Scripps Institution of Oceanography, UC San Diego
  "The Multidisciplinary Efforts of the Center for Marine Biotechnology and Biomedicine"
- Hsien-Hua Lee, Professor and Dean, College of Marine Science, NSYSU
  "Participation of NSYSU to Ocean Related Green Energy Development in Taiwan"
- Luca R. Centurioni, Research Oceanographer, Scripps Institution of Oceanography, UC San Diego
  "The Global Surface Drifter Array: Main Impacts and Vision for the Next Decade"
- Yuan-Pin Chang, Professor, Department of Oceanography, NSYSU
  "Reconstruction and Simulation of Last Glacial Maximum Kuroshio"
- Matthew Alford, Professor and Director, Marine Physical Laboratory, Scripps Institution of Oceanography, UC San Diego
  "Observations of the full life cycle of internal gravity waves in the South China Sea"
- Linus Y.S. Chiu, Institute of Undersea Technology, NSYSU
  "Acoustic Experiments and Observations in the South China Sea"

ABSTRACTS

The Multidisciplinary Efforts of the Center for Marine Biotechnology and Biomedicine

William Gerwick

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The Center for Marine Biotechnology and Biomedicine (CMBB), in existence for over 20 years, is a focal point for marine drug discovery research at Scripps Institution of Oceanography, UC San Diego. The CMBB currently has 7 Principal Investigators; Bill Gerwick, Bill Fenical, Brad Moore, Paul Jensen, Lena Gerwick, Eric Allen, and Chambers Hughes. Collectively, our laboratories are home to nearly 100 students, postdocs, technicians and visitors, and they have an impressive output of high quality research papers, patents, and other scholarly works. The fields of investigation among these laboratories include basic studies in microbiology, drug discovery, new methodologies in analytical chemistry, synthetic medicinal chemistry, biosynthesis, molecular biology and genomics, and chemical ecology. These efforts have resulted in characterization of novel microbial organisms, clinical trial agents, new methodologies in NMR spectroscopy, discovery of unique biosynthetic pathways and pathway components, and development of promising antiparasitic drugs. In the Gerwick laboratory, several of these topic areas are under investigation, focused mainly on marine cyanobacteria, and will be presented along with those from other of the CMBB laboratories, as representative of the scope of work occurring in this area at Scripps.

Participation of NSYSU to Ocean Related Green Energy Development in Taiwan

Hsien-Hua Lee

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Due to a dis-nuclear policy that no more nuclear power plant will be established and all of the running nuclear power plants will be closed by a certain period of time, the substitution of power supply in a various form has been an urgent matter in Taiwan now. The target-year was set in 2025 till it was overturned in a referendum held in 2018, but the timetable is still there, which is only to be reset to a later time. Fortunately, nuclear power takes only 10% the total electricity required in Taiwan, but 10% substitution for the vacancy of power supply for nuclear power is not enough to meet the full loaded requirement especially in the summer time. The reason is that the demanding of the electricity power supply is increased every year due to the demanding of new tech plants of high end semiconductor and communication products, which induces the establishment of new fossil combustion power plants or new generators in existing plant. Naturally, the air pollution is getting worse and caused another public issue. Therefore, a replacement measure for the nuclear power plant will be limited to green energy and the scale will be larger than what the nuclear power plant can supply now. For green energy power generation, the most maturely developed techniques are solar system and wind-power generators, while others are still on the way struggling to meet a cost down economy even though technically they are doable. The development of green energy related to ocean now in Taiwan includes the biomass harvest techniques, wave power harvest, sea current energy system, curosho current power generating system and most of all, wind farm set in offshore ocean. Basically, the faculties of marine college, NSYSU have participated into most of all of these developments and in some areas, NSYSU plays a leading role such as the developments of curosho current power electricity generation system, and in some other systems also has important contribution such as the development of offshore wind power system. A more complete review will be presented in the conference.

Keywords: Green Energy; Biomass Harvest; Offshore Wind Farm; Curoshio Current; Sea Current Power Generation; Wave Energy Harvest

The Global Surface Drifter Array: Main Impacts and Vision for the Next Decade

Luca R. Centurioni

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The boundary between the ocean and the atmosphere plays a very important role in the Earth system. It is where the atmosphere sets the ocean in motion, ocean-driven processes feedback to the atmosphere, climate/weather relevant air-sea processes occur and pollutants (i.e. plastic, anthropogenic carbon dioxide, radioactive/chemical waste) enter the sea. Estimates of the state of the ocean and of the atmosphere are crucial for accurate forecasts of physical and biogeochemical processes at this interface, and support sustainable blue economy planning, growth and disaster mitigation. Meteorological and marine estimates and forecasts rely on accurate and integrated in-situ and satellite surface observations. High-impact uses of ocean-surface observations of Essential Ocean/Climate Variables (EOVs /ECVs) include (1) assimilation into/validation of weather, ocean and climate forecast models to improve their skill, impact and value (2) ocean physics studies (i.e. heat, momentum, freshwater and biogeochemical air-sea fluxes) to further our understanding and parameterization of air-sea processes and (3) calibration and validation of satellite ocean products (i.e. currents, temperature, salinity, sea level, color, wind, waves). Networks of multi-parametric platforms, such as the global drifter array, which is primarily supported by the US funded Global Drifter Program, provide the baseline of in-situ surface for several oceanic and atmospheric products, including temperature data for the calibration and validation of satellite derived sea surface temperature datasets, sea-level pressure observations which are known to have a very large and positive impact of weather predictions, and a unique source of global near-surface ocean currents. The evolving drifter technology offer opportunities for new and improved in-situ observations that will shape the global drifter array in the next decade. Advances in sensor technology, such as low-cost wave sensors, are discussed in this talk, together with impacts and sustainability of air-sea observations from drifters.

Reconstruction and Simulation of Last Glacial Maximum Kuroshio

Yuan-Pin Chang[1], Shih-Jie Wu[1], Chin-Hsing Liu[1], Chia-En Chuang[1], Horng-Sheng Mii, Chuan-Chou Shen, Yi-Chia Hsin, Takuya Itaki, Ken Ikehara

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It has been well-known that the Kuroshio, a part of North Pacific gyre, can transport large amount of heat and materials from the tropical Pacific to higher latitudes and plays an important role on regulating climate systems in north Hemisphere. Plenty works about the varied Kuroshio flowing path during the Last Glacial Maximum (LGM) had been published, however, usage of different proxy might indicate to different results. It still needs constrains to compliment all paleo-records. Several cores retrieved from inner and outer part of the Okinawa Trough were studied in this study. Proxies of Mg/Ca ratio and oxygen isotope of three planktonic foraminiferal species which dwelling in different water depths were used to reconstruct the vertical structure of water mass in the Okinawa through. We found that there is almost no difference between the reconstructed thermal structures in three cores, but the salinity data did show difference within LGM. A simulating model then was established for better interpreting the results. Firstly, the present Kuroshio is reconstructed by the Kuroshio Current Model, which is built up based on the Princeton Ocean Model (POM), with the present bottom topography and atmospheric forcing. Further, the LGM Kuroshio is simulated by forcing the Kuroshio Current Model with the LGM bathymetry (subtracting 135 meters from the present water depth) and wind field (setting as outputs from Paleoclimate Modelling Intercomparison Project, PMIP). Supported by the proxy preserved in palaeoceanographic records and our numerical simulations, we found that the Kuroshio main stream during LGM did not enter the Okinawa Trough through the East Taiwan Channel. Instead, it flowed along the eastern side of Ryukyu Islands, where the present Ryukyu Current passes. Our simulations also show that the stronger winter monsoon during LGM transported a considerable amount of surface Kuroshio water into the northern Okinawa Trough through channels among Ryukyu Islands, in agreement with the LGM temperature and salinity recorded in the cores in northern Okinawa Trough.

Keywords: Kuroshio; Oxygen Isotope; Mg/Ca; Thermal-Salinity Structure; POM, PMIP

Observations of the full life cycle of internal gravity waves in the South China Sea

Matthew Alford

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I'll present results from several consecutive joint US-Taiwanese initiatives in the Luzon Strait and the South China Sea. The world's largest internal gravity waves were measured and tracked from their generation site in Luzon Strait to their eventual demise near Dongsha coral atoll. The waves cause an extremely large amount of turbulence, and are strong enough to impact navigation in the region and to significantly affect the foraging habits of pilot whales. In the talk I'll describe the phenomenology of the waves, the technology used to observe them and several new aspects of their physics that were learned.

Acoustic Experiments and Observations in the South China Sea

Linus Y.S. Chiu

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Large subaqueous sand dunes, nonlinear internal waves, and various sediments are expected to affect acoustic propagation on the upper continental slope, shelf break, and the continental shelf in the South China Sea. In the past eighteen years (2001-2018), we have learned from bilateral cooperation between ONR and Taiwan that environment parameters such as water column variability, bathymetry, and sediments are expected to couple acoustic propagation and degrade the sonar performance in this area. Besides, the acoustic effects in seagrass meadow was also studied in Dongsha Atoll. In this talk, international cooperated experiments and the acoustic propagation observations were reviewed, including the effects of nonlinear internal waves, subaqueous sand dunes, large slope shelf break, and the seagrass. [This research work was supported by the Ministry of Science and Technology with project number:MOST 107-2623-E-110-001 -D]

Keywords: South China Sea; Acoustic propagation; Nonlinear internal waves; Sand dunes; Dongsha Atoll