THE RAMON MARGALEF SUMMER COLLOQUIA
A view of the ocean from Barcelona

Conference Title:

The global marine carbon cycle and climate change: a synergy of biological and physical processes

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Abstract:

Understanding the carbon cycle is essential to understanding the climate system, life, and the link between life and climate. Carbon is cycled through the lithosphere, the hydrosphere, the biosphere and the atmosphere, where it has its most direct impact on global climate in its oxidised gaseous form of carbon dioxide (CO_2). Fluxes to and from the atmosphere to all of these carbon reservoirs are important, but their relative importance depends on the time-scale under consideration. On relatively short (10-10,000 year) timescales, the hydrosphere (i.e. the oceans) and the biosphere (especially the terrestrial plant/soil system) are the dominant carbon cycle players. However, of these, the ocean plays a particularly interesting and important role, as it is a very large carbon reservoir (~60 times larger than the atmosphere, and ~20 times the terrestrial soil/biosphere system), it is highly dynamic (varying significantly on seasonal to millennial time scales), and it is tightly connected to the atmosphere via the solubility and reactivity of CO_2 in seawater. From a global climate perspective, the ocean's role in the carbon cycle is best viewed via its impact on atmospheric CO_2, which is set by the average partial pressure of CO_2 in the surface ocean. The tendency for the surface ocean, on average, to 'inhale' CO_2 from the atmosphere (becoming a net sink for atmospheric CO_2), or to 'exhale' CO_2 to the atmosphere (becoming a net source of atmospheric CO_2), ultimately depends a synergy of physical and biological process, many of which are concentrated in the climatologically sensitive polar latitudes.

This lecture will explore these fundamental physical and biological processes through the exploration of simple biogeochemical box-models and through a consideration of a natural 'case study' of global carbon cycle change that has been unfolding over the last 20,000 years.

References:

Sarmiento, J.L., Gruber, N., 2006. Ocean Biogeochemical Dynamics. Princeton University Press, Princeton. 528 pp. Especially CHAPTERS 1, 8, 9 and 10.