Submission from the Inter-American Institute for Global Change Research (IAI)

In response to the invitation by the 35th Session of the Subsidiary Body for Scientific and Technological Advice (SBSTA) to provide information on the technical and scientific aspects of emissions by sources, removals by sinks and reservoirs of all greenhouse gases from coastal and marine ecosystems (mangroves, tidal salt marshes, wetlands and seagrass meadows), the Inter-American Institute for Global Change Research (IAI) presents in this submission, emerging research findings from its multinational Consortium for the study of ocean related global and climate changes in South America (SACC). SACC is a multinational, multidisciplinary research network led by the *Servicio de Hidrografía Naval* of Argentina in collaboration with scientists in Argentina, Brazil, Chile, the United States and Uruguay.

The upcoming United Nations Conference on Sustainable Development (Rio+20) is calling attention to the urgency of taking action to ensure the sustainable management and use of oceans and their marine resources. IAI´s SACC research is conducted on the Patagonian shelf and neighboring western South Atlantic Ocean, which contains one of the most productive marine ecosystems. It is identifying the physical and biological mechanisms that control the oceanic biological production and the exchanges of CO_2 between the ocean and the atmosphere. SACC's findings are providing an understanding of regional carbon sources and sinks to inform policy-makers on possible mitigation approaches. The Patagonia shelf may play a special role in the global CO_2 balance because its nutrient supply and carbon sequestration depend on a permanent upwelling caused by ocean currents, rather than on seasonal winds as is the case of the most productive marine regions. This means that in frontal regions, where upward nutrient fluxes are quasi-continuous, productivity extends throughout the summer and early fall. Observations and numerical simulations suggest that these frontal regions are maintained by mixing induced by tides, and by the interaction between an intense slope current and the topography of the ocean floor. The productivity of lower trophic levels spreads through the food web, reaching top predators which include commercial fish, marine birds and mammals. At the same time predation (including fisheries) affects the diversity of this food chain, resulting in a close link between productivity and diversity.

The Convention on Biological Diversity (CBD) at its 10th Conference of the Parties (COP10) adopted a ten-year Strategic Plan for Biodiversity (including the Aichi Targets). CBD Parties have emphasized that the identification of ecologically or biologically significant areas and selection of conservation and management measures is a matter for States and competent intergovernmental organizations. As an intergovernmental organization, the IAI is committed to promoting international cooperation and providing scientific information to policy makers. IAI´s SACC research on the Southern Brazilian Sea was discussed at a recent CBD workshop in Recife, Brazil following a request from CBD COP-10 for a series of regional workshops to be held on Ecologically or Biologically Significant Marine Areas (EBSAs) to facilitate the description of these areas through the application of scientific criteria and guidance on the identification of marine areas beyond national jurisdiction. The workshop concluded with the adoption of the southern Brazilian seas as an EBSA and a recommendation for the organization of a workshop involving other partners for the SW Atlantic.

SACC findings are improving the understanding of the energy and matter fluxes among different ocean areas and the physical and biological mechanisms that mediate those exchanges, including processes with major impact on the global carbon balance. Life in the ocean is not uniformly distributed, with abundance and biodiversity concentrated in relatively small productive spots separated by vast, less productive regions. The Patagonian shelf break has a harvest of millions of tons of fish and squid every year. Overfishing and the resulting decrease in fish population could affect zooplankton and phytoplankton communities - thereby disrupting the ability of the ocean to

capture CO_2. Such alterations of the marine ecosystem are analogous to the impact of land-use change on the continental carbon budget.

Seagrasses and mangroves are known for being ecosystem carbon sinks which can be restored, providing for mitigation and blue carbon initiatives. However, the primary production in the ocean is, in itself, a huge natural sink. Since such oceanic sinks are not evenly distributed, there is merit to identifying areas that are important sinks, and then try to manage outside impacts on those areas (nutrient inputs, overfishing, habitat destruction, etc.). This would hopefully allow for keeping the carbon removal properties of these important oceanic areas.

Phytoplankton growth plays a significant role in global climate because photosynthesis leads to the absorption of CO_2 dissolved in sea water and promotes further uptake from the atmosphere. This CO_2 absorption from the atmosphere, referred to as the biological pump, is partly responsible for the oceanic control of the global climate. Subsequent transport of the biologically fixed carbon into the deep ocean is thought to be the ultimate long-term sink for as much as 90% of the human-derived carbon dioxide, but models still do not capture all of the important mechanisms or pathways for carbon from the biologically active surface layers into the deep ocean.

The ocean uptake of about two billion metric tons of carbon per year is nearly balanced by a very large release of carbon with only a small net uptake remaining. A change in the processes controlling that delicate balance could be a game changer when it comes to predicting future atmospheric CO_2 and resulting climate change.

Oceanographic surveys over the Patagonia continental shelf and adjacent western boundary currents have revealed that the region is a strong sink of atmospheric CO_2, at rates comparable to regions of strongest CO_2 uptake in the World Ocean, such as the northern North Atlantic. The estimated uptake of 17 million metric tons of carbon per year in the Patagonian continental shelf is equivalent to all the carbon content of 100 thousand hectares of rainforest. Although carbon fluxes over continental shelves are very large, the natural fluxes only become a factor in the mitigation of anthropogenic carbon emissions if the resulting carbon sequestration changes relative to its pre-industrial size. In fact, these natural fluxes are so large, that small changes can have a major impact on the scale of our emissions reduction targets. The mitigation effect also critically depends on how long the CO_2 remains sequestered.

SACC studies have shown that the offshore currents, which are themselves controlled by the large-scale wind field, exert a strong influence on the continental shelf circulation. In the case of the Malvinas Current, this influence manifests itself in the northward spreading of cold waters derived from Patagonia up to the latitude of southern Brazil, thus creating the strong Subtropical Shelf Front. Similar transitions have been identified between the South Atlantic Bight and the Mid Atlantic Bight in the east coast of the US. The frontal region plays a significant role in the early life cycle of various commercial species in southern Brazil. The possible biogeochemical implications of these fronts still need to be investigated.

UNFCCC decision 9/CP.11 recognizes the need to enhance the contribution of developing countries to climate change research efforts, including by building the capacity of these countries to contribute to and participate in climate change research and invites regional organizations to promote a multidisciplinary approach to address research on cross-cutting issues. The IAI, through its collaborative multinational, multidisciplinary SACC network has significantly contributed to improving the research capacity of developing countries in the Americas and has had a concrete impact in the development of marine sciences in South America. SACC has created important integrated international and interdisciplinary institutional links. Without these links, continental

shelf oceanography research would simply not have been possible. Furthermore, this network has published their findings in dozens of international journals and developed the capacity of 200 young scientists from developing countries through its training activities and scholarships.

Information on scientific and technical aspects of emissions and removals from coastal and marine ecosystems needs to be integrated with similar information relating to pelagic and benthic systems in the open ocean and the deep sea, such as the Patagonian continental shelf. *SBSTA may wish to consider in its Research Dialogue, the inclusion of scientific constituencies working with all relevant marine systems that significantly contribute to carbon-related issues*.

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IAI-South American Climate Change Consortium (SACC)
http://sacc.coas.oregonstate.edu/~sacc/project_sacc_ai_crn2.php

Setting:

The continental shelf of the southwestern Atlantic (SWA) is an irregularly shaped platform that extends from the tropic of Capricorn to the southern tip of South America. With a total area of 2.7 million km2 this broad and relatively smooth submarine terrace is the largest continental shelf in the southern hemisphere. Located along its western margin are some of the most important industrial and commercial centers of Latin America: Rio de Janeiro, Sao Paulo, Montevideo, and Buenos Aires.

SACC Partners:

Argentina
Servicio de Hidrografía Naval (SHN), Universidad de Buenos Aires (UBA), Centro Nacional Patagónico (CENPAT), Instituto Nacional de Investigación y Desarrollo Pesquero (INIDEP), Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Universidad del Sur

Brazil
Instituto Oceanografico de Sao Paulo (IOUSP), Universidade Federal do Rio Grande (FURG), Instituto Nacional de Pesquisas Espaciais (INPE)

Uruguay
Programa de Ciencias del Mar y de la Atmósfera (PCMYA), Sección Oceanología, Facultad de Ciencias, Universidad de la República, Servicio de Sensores Remotos y Aeroespaciales (SSRAFAU) (Fuerza Aérea Uruguaya), Servicio de Oceanografía, Hidrografía y Meteorología de la Armada (SOHMA), Centro de Recepción, Procesamiento, Archivo y Distribución de imágenes de observación de la Tierra en Uruguay (CREPADUR)

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