

Sea-Ice-Atmospheric Signals of Mid latitudes-Antarctic Linkages (SIAS)

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Within the framework of the scientific SCAR Programme AGCS (Antarctica and the Global Climate System), it was identified the need to increase our knowledge with respect to the coupling between the Sub-tropics and Antarctica. It has been recognised that South America imprints environmental changes in the Antarctic ice-sheet through the atmospheric transport of water vapour, heat, organic and mineral microparticles. On the other hand, the Antarctic continent exerts significant influence over the South American climate and on the tropical marine productivity. The total extent of this relation has yet to be uncovered and a joint effort towards a consistent answer is necessary. Herein we will focused this question on the geochemical-meteorological approach. Within the Brazilian Antarctic Programme and the possibility of including other countries, a joint project is proposed to investigate two integrated research lines in the above area: (1) the ocean-sea-ice-atmosphere interactions; (2) the ice-record of man-made activity and proxies of environmental changes. The specific objectives of this proposal are outlined below: A. Monitor elemental composition of fine and gross aerosol modes from the tropical region to the Antarctic Peninsula (XRF, EPMA and MEV+EDS) owing to identify its crustal, marine and anthropogenic components; B. Monitor minor gases (eg.: N₂O, NH₃, O₃ and CH₄) pointed out in the IPCC 2002 report; C. Monitor the effective optical thickness of the atmosphere due to the calibration of satellite images of the sea and transport mechanisms; D. Integrate simultaneous numerical transport models and back trajectories analysis with gases and aerosols database; E. Use the ²²²Rn atmospheric tracer to validate numeric models; F. Monitor the MSA aerosol and marine productivity of the sea; G. Monitor CO₂, N₂O (nitrous oxide) and NH₃ (ammonium) in seawater and the above atmosphere in order to estimate their fluxes at the ocean-atmosphere interface; In the atmosphere, nitrous oxide is a greenhouse gas and contributes to the consumption of O₃ in the stratosphere. In the lower atmosphere, ammonia forms fine particles of ammonium sulphate and nitrate and can be transported to long distances; H. Monitor the aerosol black carbon together with PAHs and total aerosol composition due to the extension of the atmospheric impact attributed to the industrial activity and the large-scale biomass burning of South America; I. Monitor stable isotopes of sulphur as a tracer of industrial activity and the large-scale biomass burning of South America; J. Develop ice-coring at the Antarctic Peninsula and at the Ross Ice-shelf in order to investigate the air-ice exchange, stable isotopes and microparticle elemental composition; use the MSA and Chlorine content on dated snow and firn as proxies of ocean primary production and sea-ice extent variability; K. Investigate the atmospheric microbiological apportionment to the Antarctic ice.