Final project report

<i>Project ID:</i>	2003/6.2
Title:	<i>Study of the chemical processes of aerosols in the Antarctic troposphere</i>
Principal investigator:	Antonietta Ianniello
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Duration:	2 years
Assigned funding:	€ 45.000,00

Activities and results

Aerosols play a key role in the climate change and atmospheric chemistry. Antarctic sea salt is the only abundant and alkaline aerosols. In order to obtain a better understanding of the behaviour of particulate species, the gas-particle interactions, and their mechanisms of deposition, it is necessary to obtain more information about the their presence. In fact, species adsorbed on particulate matter or those emitted into the atmosphere from particles are very important. For example, nitrous acid is adsorbed on particulate matter. This research was oriented to the study of the main processes responsible for emission, formation, transport and deposition of air pollutants and to the development of analytical methods able to sample and analyze atmospheric species present at very low concentrations. The activity was aimed to measure the concentrations and size distributions of inorganic particles.

The samples were carried out at Campo Icaro (Antarctica) where multi-stage low pressure impactor (SDI) was installed. It is able to select the particles in twelve stages in size range between 8.5 and 0.045 mm. The ion content of samples was analyzed by Ion Chromatograph obtaining the particle concentrations of chloride, bromide, nitrite, nitrate, sulphate, ammonium, potassium, magnesium, sodium and calcium.

The results show that the size particle distributions are associated primarily with either fine either coarse fractions, with the exception of sulphate. In fact, this specie is the dominant ion in the Aitken accumulation mode. The maximum of size sulphate and ammonium distributions is located on a Dp (aerodynamic diameter) value equal to 0.32 mm. Thus, the particulate sulphate in the fine fraction is mainly composed of sulphuric acid or ammonium bisulphate. The agreement between the data obtained by the impactor and those by the denuder technique is a further indication of the gathered date quality. The ratio between cations and anions reaches its minimum in the accumulation mode with Dp between about 0.2 and 0.8 mm. This is due to the presence of sulphate in this size range. The values of this ratio show also the acidic nature of the particles. A direct consequence of the acidic nature of the particles in accumulation mode is their limited ability to retain acidic semi-volatile gases such as nitric and hydrochloric acid. Indeed, nitrate and chloride concentrations in size range of 0.2 - 0.8 mm are always negligible compared to those obtained in larger size ranges. In acidic particles, then, absorption of pollutants, as SO₂ and HNO₃, occur. Here, even the formation of nitrous acid occur that in the presence of radiation solar, photolyzes leading to nitrogen monoxide and the radical OH.

However, the sulphate nitrate and ammonium concentrations are very low demonstrating that Antarctica is not influenced by anthropogenic sources.

Products

A – papers in scientific magazines

- 1. Ianniello, R. Sparapani, I. Allegrini, C. Vazzana, C. Mazziotti Gomez de Teran, M. Montagnoli, A. Fino, A. Felici (2003). Study of nitrogen containing compounds in the polar troposphere. Annali di Chimica, 93, 69.
- 2. H. J. Beine, A. Amoroso, F. Dominé, M. D. King, M. Nardino, A. Ianniello, J. L. France (2006). Surprisingly small HONO emissions from snow surfaces at Browning Pass, Antarctica. Atmospheric Chemistry and Physic, 6, 2569.

Programma Nazionale di Ricerche in Antartide (PNRA)

B – book chapters

 Ianniello, I. Allegrini (2007). Determinazione delle specie gassose e particellari nella troposfera polare mediante i denuders di diffusione. Clima e Cambiamenti Climatici – le attività di ricerca del CNR (CNR – Dipartimento Terra e Amnbiente Editrice), 315.

C - proceedings of international conferences

- H. J. Beine, A. Amoroso, F. Dominé, A. Ianniello, T. Georgiadis, M. Nardino, M. King (2004). Fluxes of nitrous acid from snow surfaces in Antarctica. Eos Trans. AGU, 85(46), Fall Meet. San Francisco, CA, Suppl., Abstract A11B-0035.
- H.J. Beine, A. Amoroso, A. Ianniello, F. Dominé, M. King, M. Nardino (2005). Surprisingly Small HONO Emissions Fluxes From Snow Surfaces at Browning Pass, Antarctica. Eos Trans. AGU, 85(52), Fall Meet. Suppl., A24A-04.

D – proceedings of national meetings and conferences

E – thematic maps

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F – patents, prototypes and data bases

G - exhibits, organization of conferences, editing and similar

H - formation (PhD thesis, research fellowships, etc.)

1. Assegno di ricerca su "Reattività diffusionale ed analisi di inquinanti atmosferici contenenti azoto" presso CNR -Istituto sull'Inquinamento Atmosferico.

Research units

CNR-IIA: Responsabile Antonietta Ianniello

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Date:

16 Ottobre 2008

Note