

# FLATACOA

compiled by Remi Losno

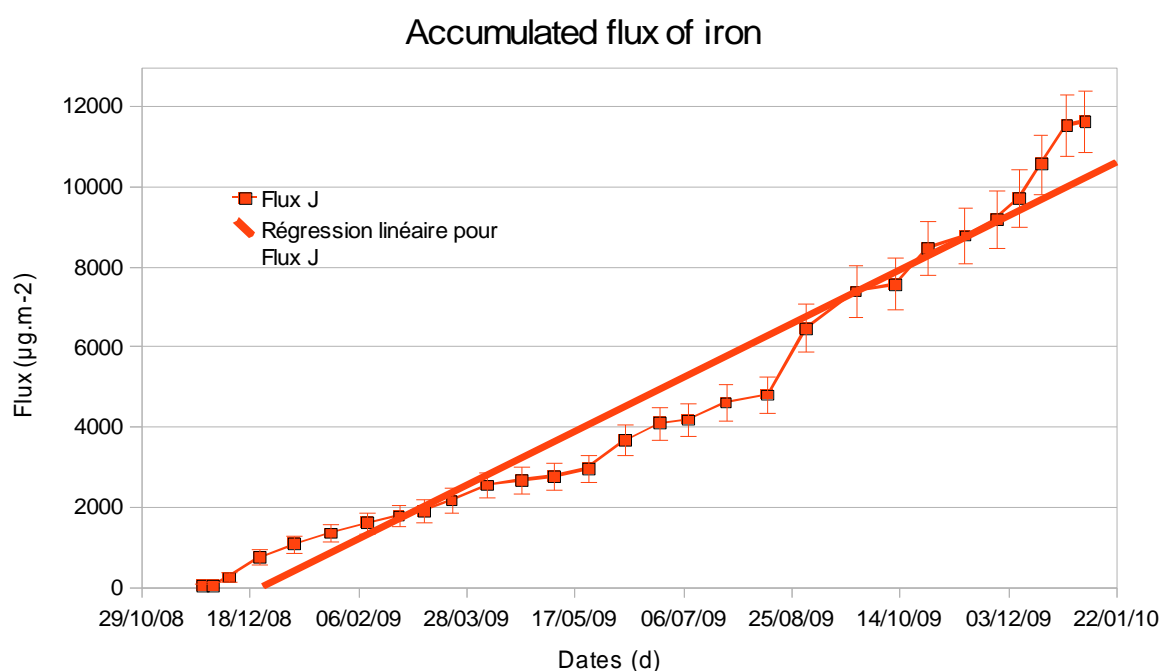
Notes:

Reporting Period is January 2011 – December 2011

Information will be used for: reporting, fundraising, networking, strategic development & outreach

## 1. Key scientific SOLAS-relevant highlights/findings (you may include figures and references)

Year 2011 have seen the last samples back to the lab from Crozet and Kerguelen Islands. We performed analyses of total deposition by ICP-AES and HR-ICP-MS and have now a database with deposition flux of Li, Na, Rb, Mg, Ca, Sr, Ba, Ti, V, Cr, Mn, Fe, Co, La, Ce, Nd, Sm, Yb, U, Al, P, S, As and Pb (Ni and Zn in progress), for 2 years at Kerguelen and one year at Crozet (Heimburge et al. 2011, ASLO communication). For example, the total deposited iron flux is about 500 nmol/m<sup>2</sup>/year at Kerguelen, in good agreement with models.



**Figure 1:** accumulated iron flux at Kerguelen from December 2008 to January 2010. The slope of the linear regression is the average flux over the period.

Another result is that there is no large gradient between both stations neither at Kerguelen (30 km distance) nor between Crozet and Kerguelen (1500 km).

The evolution of the project moved our attention to source regions. Because the South Hemisphere is mainly constituted of oceans, the only possible dust sources are East Patagonia, South Africa and Australia. Patagonia is suspected to be the major dust source for the oceanic region ranging between 40°S and 60°S. We begin to investigate the relevant properties of the aerosols emitted from Patagonia, including their chemical composition, the factors controlling their emission and transport, and their bioavailability by looking at their solubility and other ad-hoc assessments. We have instrumented a sampling station in Rio Gallegos (Argentina, 51°37'57.70"S; 69°13'41.64"W) including aerosol sampling, Lidar measurements and meteorological records. This station is situated at the circumpolar atmospheric circulation latitude and may intercept emitted dust as well as locally as transported from the west border (250 km) of this region. In complement and in order to investigate at

a limited cost the spatial (2D) distribution of the atmospheric concentration of trace metals in Patagonia, we collect and analyses lichens harvest in a large area around. Lichens are slow-growing organisms which, over their lifespan, are expected to accumulate and retain high levels of mineral elements present in the atmosphere, but not from the host tree limb or rocks from which they are suspended. It can not be used for temporal studies but it has been shown through large and systematic investigations that the variations in lichens chemical composition are reflecting the variations of local aerosol chemical composition integrated on large time periods (Monna et al., 2006, Monna et al., 2011). In an emission area, lichen chemical composition will reflect the average composition of the emitted aerosol.



**Figure 2:** Atmospheric sampling station set up at Rio Gallegos.

First results will come in the year 2012.

F. Monna, M. Poujol, R. Losno, J. Dominik, H. Annegarn, H. Coetzee, Origin of atmospheric lead in Johannesburg, South Africa, *Atmospheric Environment*, Volume 40, Issue 34, November 2006, Pages 6554-6566, ISSN 1352-2310, 10.1016/j.atmosenv, 2006.

**Monna, F.**, Bouchaou, L., Rambeau, C., Losno, R., Bruguier, O., Dongarrà, G., Black, S., Chateau, C. Lichens used as monitors of atmospheric pollution around Agadir (Southwestern Morocco) – A case study predating lead-free gasoline, *Water air and soil pollutions* DOI 10.1007/s11270-011-0942-2, 2011.

## **2. Activities/main accomplishments (research projects, cruises, special events, workshops, remote sensing used, model and data intercomparisons etc)**

A new project was proposed at the French agency CNRS/INSU through the LEFE/CHAT action: "Dust From Patagonia". Today, we are expecting the answer for the end of January. A positive answer will give 2 years continuity of our investigation in the Patagonian source region (see section 6).

## **3. Human dimensions (outreach, capacity building, public engagement etc)**

Alexie Heimburger, PhD student working on FLATOCOA made a short movie with Fanny Mazoyer intitled "Qui sème la poussière récolte le phytoplancton", awarded and available here for download or show:

<http://www.science.gouv.fr/fr/telescience/bdd/res/4336/qui-seme-la-poussiere-recolte-le-phytoplancton/>

[This movie tells a large public the methods in use to collect and analyse dust in remote oceanic areas.](#)

#### 4. Top 10 publications in 2011 (Reports, articles, models, datasets, products, website etc)

The first publications in journals will be submitted during the year 2012, including dust deposition at Kerguelen and a comparison of dust flux measured at Kerguelen and Crozet and model outputs. Two communications were made in 2011.

Heimburger, A., Losno, R. and Dulac, F, **Atmospheric deposition of trace elements over the South Indian ocean: a time series at kerguelen islands**, 2011 ASLO Aquatic Sciences Meeting, San Juan de Porto Rico, 14-18 february 2011.

A.Heimburger, R. Losno, S. Triquet, E. Bon and A. Perot, **Dust deposition over South Ocean measured at Crozet an Kerguelen Island**, SOLAS-France meeting, 29-30 june 2011, Paris. ([http://www.lisa.u-pec.fr/SOLAS/2011/Docs/FSOLAS2011Alexie\\_Heimburger.pdf](http://www.lisa.u-pec.fr/SOLAS/2011/Docs/FSOLAS2011Alexie_Heimburger.pdf)).

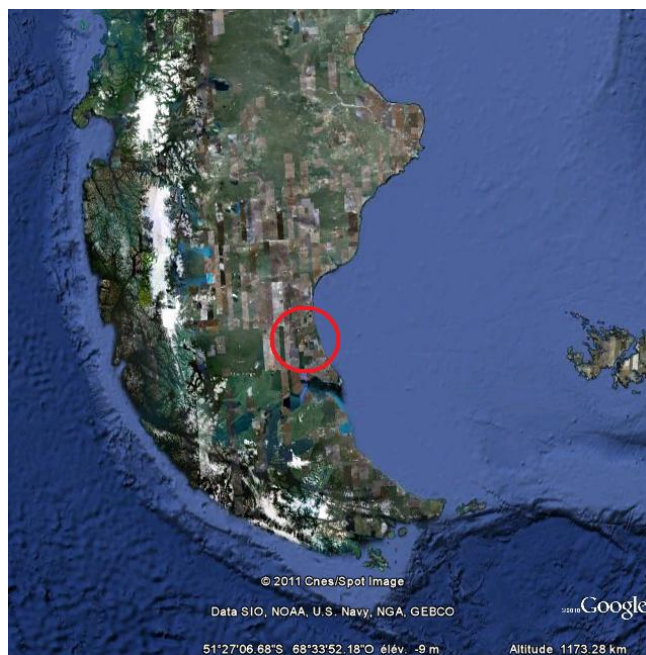
#### 5. International interactions and collaborations (including contributions to international assessments such as the IPCC, links with observation communities etc)

We began collaboration with CEILAP (Buenos Aires, Rio Gallegos) in Argentina. CEILAP bring their LIDAR expertise and the facilities of the laboratory installed at Rio Gallegos.

#### 6. Goals, priorities and plans for future activities/events

##### *Experimental work*

Next step will be to work on the chemical properties of source aerosols from Patagonia (Rio Gallegos sampling station). This will include sampling but also laboratory experiments with collected aerosols. We will use an aerosol Lidar at Rio Gallegos to help us selecting dust events with a vertical extension large enough for long range transport. The main conclusions we expect of Lidar profile will be information on the continuity of the aerosol layer from ground to higher altitudes. In case of continuity, we will assume that the aerosol layer is homogeneous from ground to its top and extrapolate the measured chemical composition at ground level to the top of the layer.



*Location of the new sampling area*

Aerosol will be sampled for 2 years, its elemental composition determined and solubility of Fe, Co, Zn... investigated with laboratory experiments.

Aerosol will be produced from soils collected in emission zones using the techniques developed in LISA (Lafon et al., in preparation). This technique allows collecting dust aerosol samples on bulk filters and cascade impactors. This cascade impactor will be useful to obtain the size-resolved elemental composition. This material will be processed as natural samples to determine their mineralogical and chemical properties, including solubility. The various soil samples will be processed in the LISA device in order to study the regional of Patagonian dust.

#### *Model*

The coupled LMDz model with a zoom that can go down to 50x50km<sup>2</sup> resolution will be used over the region coupled with INCA module (Interactions between Chemistry and Aerosols). Five aerosols components are simulated (sulphate, black carbon, organic carbon, dust and seasalt) and particular emphasis will be put on the analysis of dust fields that include emission, dry and wet deposition fluxes, optical depth, radiative forcing in the SW and LW. We will simulate the distribution of dust over the 2 years of the experiments by nudging the winds of the model to the ones from the ECMWF analysis. To evaluate the model performance, we will compare the LIDAR retrieved profiles of extinction with the vertical profile of dust extinction computed by the model. In addition, we will use the 10x10km MODIS product of optical depth to compare the simulated aerosol optical depth from LMDz-INCA to the ones retrieved from MODIS.

#### **7. Other comments**

*Aknowledgements:* the staff of the IPEV and TAAF for their help at Kerguelen and Crozet, the Argentine military for their hosting at Rio Gallegos.