CLIMSLIP Workshop Report, Paris, 21/22 November 2012-11-28

Participants :
LAMP : O. Jourdan, V. Scherbakov, G. Guyot
LGGE : H.W. Jacobi
LSCE : I. Pison, J.D. Paris, A. Berchet
LMD : S. Turquety
LATMOS : K. Law, G. Ancellet, JC Raut, F. Ravetta, J. Thomas, B. Quennehen, L. Marelle, M. Pommier, Y. Blanchard

Excused: J. Pelon (Latmos), A. Schwarzenboek (LAMP)

Writing of the minutes: G. Ancellet and K. Law

1. Introduction (K. Law)
Progress report is due on month 18. The topics discussed during the workshop will be included in this report. Presentation of the deliverables of the project to identify their adequation with the work being done during the first year.
The main goals of this workshop are the following :
-report on the work being done during the spring campaign
-report on the summer 2012 YAK campaign
-modeling activities on POLARCAT data analysis
-modeling of the boreal fires

2. Analysis of cloud-aerosol interaction and BC deposition during the spring Ny Alesund campaign

LGGE Contribution (HW Jacobi, M. Zanatta, M. Meneguoz)

This activity was funded by ANR and IPEV. There is also a link with the PAPRIKA at LGGE to study the BC deposition in the Himalaya region because the methodologies are similar and the comparison. The list of the BC measurements at Zeppelin (420m) and Corbel are recalled in the following table with a SP2 and two kind of aethalometer (cosmos and Greek instrument). Snow pits and fresh snow analysis of BC, Cl, Br, sulphate and nitrate compounds are also indicated. Snow pits allow a reconstruction of the snow composition over 1 year. The BC analysis with SP2 in snow is using a nebulisation process developed at LGGE with a 50% efficiency.

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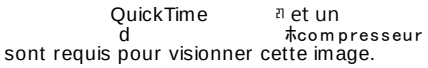
Results show that SP2 weaker than aethalometer (not clear the respective role of absorbing aerosol composition and differences in the optical measurement technique of the SP2).
Recommendation to find proxys to identify the role of local pollution events (aerosol, CO, wind, etc…)
Need to work on vertical gradient using measurements at different altitudes to quantify dry deposition (using only aethalometer).
The SP2 analysis in snow is not finished. Work presented is from the PAPRIKA project in the Himalaya.
The CROCUS model was developed at LGGE for albedo calculation in a multi-layer air snow interface. The model is very sensitive to the precipitation values and observed values improve the model outputs compared to estimated precipitation. The BC deposition is especially important during the spring/summer transition during the snow pack melting.
Work with MAR and LMD-z was conducted but not necessarily in coordination with the CROCUS or the data collected during the campaigns.
The benefit for climate model simulations using MAR at the regional scale and LMD-Z at the global scale have been discussed. The methodology must be clarified during the second phase (add one more snow layer in ORCHIDEE ? coupling MAR and CROCUS ?)

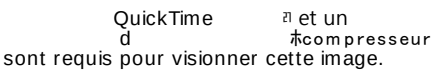
LAMP contribution (O. Jourdan and G. Guyot)

The objective was to collect a 2-month during the spring period (March-Avril) when the accumulation mode becomes significant compared to the aitken mode which will peak in June. This spring transition will have important implication in the CCN distribution and the cloud optical properties.
Numerous days with mixed phase clouds were encountered and the LAMP microphysics instruments (Polar Nephelometer, CPI cloud imager, Netzorov probe for ratio LWC/IWC ,

FSSP for size distribution 3-45µm) were operated at the zeppelin station in conjunction with standard aerosol measurements by the ITM Swedish group (CPC, SMPS, interstitial and CCN aerosol for cloud condition).



Different atmospheric conditions have been also encountered, namely precipitation and snow events.



Problems identified for the coherence of measurements by the Netzorov and FSSP (low accuracy of Netzorov for low wind speed conditions) and of measurements by the FSSP and nephelometer (frequent variation of the alignment of the probes with the wind direction). This will be studied in more details using the Puy de Dome station to improve the usefulness of the CLIMSLIP campaign. The March 11 episode is useful to distinguish the role of polluted and pristine air mass (lower Dm for an increase of continental aerosol and larger droplet concentrations). The crystal size are much lower for the snow wind storm compared to the precipitation cases, with also different crystal shapes identified by the CPI. Because of the low altitude of the stations and wind alignment variability, there is a limited number of good cases for the study of the aerosol/cloud interaction. The analysis of the aerosol measurements will focus on (1) the link between low aerosol episode and wet removal during cloudy conditions (ii) the difference between the 27/4 and the 29/3 episode where the activation of small particles (<50 nm) increases significantly. Recommendation for looking at a possible link between the BC evolution with the characteristics of the droplets and ice crystals.

3. Analysis of spring aerosol pollution events

LATMOS contribution (L. Marelle, JC Raut, G. Ancellet, J. Pelon, F. Ravetta, K. Law)
Louis Marelle presents the work which was done during his master study under the supervison of JC Raut and K. Law. The WRF-CHEM model was run with the aerosol module and a 30x30 km resolution for the simulations of the ATR-42 aerosol measurements for the last 3 days of the spring campaign when various pollution transports were encountered. The model is initialized with GFS for the meteorological fields and MOZART4 for the chemical composition. The PM2.5 is calculated assuming sphericity for the particules shapes. The aerosol plumes seen in the observations are well represented by the model using PM2.5 concentrations, but the composition is still wrong with too much dust (due to the large dust plumes in MOZART4) and an underestimation of the SOA.

Gerard Ancellet presents the analysis of the CALIOP data for the Spring period. A new methodology is presented to use the L1 lidar data with a cloud screening and a 80-km horizontal averaging. The 10-d climatology is compared with airborne lidar observations for the POLARCAT spring period and the ATR-42 measurement area. There is a good agreement between the distributions of the 532 nm and 1064 nm scattering ratios (R532) and the aerosol color ratio. The interannual variability of the April horizontal distribution of R532 and the color ratio exhibits a permanent aerosol enhancement over the Atlantic ocean pathway to the Artic in the lower layer, while there is a clear increase over the Eurasian continent above 4 km especially in 2008.

François Ravetta presented the work of Lionel Doppler on the heating and photolysis rates calculation using the Univ. of berlin radiative transfer model MOMO. An example of the use of lidar and in-situ aerosol data has been presented for the March 30 observations. Need to contact SAFIRE to check the quality of the radiation measurements on-board the ATR-42 in spring 2008.

LAMP contribution (B. Quennehen and A. Schwarzenboeck)

Boris Quennehen presents the work done during his PhD thesis which was published in 2012 in ACP. A thorough analysis of the aerosol composition for an Asian fire plume and a European anthropogenic pollution plume was done using the airborne measurements including analyses of the aerosol refractory size distributions. The Lagrangian evolution o fthe European plumes could be undertaken showing that the Aitken mode was mostly composed of volatile compounds. The accumulation mode particles includes a refractory mode changing from a 48 to 59 nm modal diameter for a 3-day transport to the Artic. A comparison of Euroepan fire emissions and Asian air mass with a mixture of biomass burning and anthropogenic emissions shows a mono-modal distribution for the European plume with a dominant aged accumulation mode and a multimodal ambient and refractory aerosol for the Asian plumes in good agreement with the assumed mixing of different sources derived from the study of Adam de Villiers et al. In the POLARCAT project using lidar measurements. Modelling of the aerosol particle with the Jacobson model shows that ageing by coagulation cannot explain alone the evolution of the size distributions.

4. Methane and ozone budget in the Arctic

LSCE contribution on methane inverse modelling (I. Pison and A. Berchet)

Discussions with the Japanese NIES (Sasakawa) in charge of the 7 ground based CH4 stations have been successful and data are now available at LSCE for starting the inverse modelling

work. The last 2012 YAK campaign was also successful with the operation of the PICARRO instrument on the TU-134 between Novossibisrk and Yakoutsk in Summer 2012. The DLR CH4 airborne data obtained near Ny-Alesund during the July ACCESS campaign can be also used. Discussions about the usefulness of satellite data concluded that they are not suitable for the inversion model in the Arctic region (low contrast between atmospheric and ground brigthness temperature for the methane analyis). The model inversion will be use with a variable grid (25 km around the stations and 300 km elsewhere). A new method using variance-covariance matrix will be developped for the region with a small number of observations. The emission model include EDGAR for the anthropogenic sources, ORCHIDEE for the biosphere contribution and the new fire emission model developped by LMD (Solene Turquety) in the CLIMSLIP project.

LSCE contribution on ozone sources in Siberia (JD Paris and A. Berchet)

An analysis was made of the various ozone sources in Siberia using the YAK 2010 spring campaign by A. Berchet with a paper submitted to ACP in September 2012. The long range transport of maritime low ozone data is compared with the ozone increased due to stratospheric intrusions in Eurasia and spring biomass burning emissions. The new data obtained for the ozone measurements during the YAK 2012 camapign were also presented showing plumes with very large O3 and CO concentrations associated with the numerous fires in Siberia during last summer..

LATMOS contribution on ozone observations in Greenland (J. Thomas, F. Ravetta, M. Pommier, G. Ancellet, K. Law)

Three tasks were included in CLIMSLIP workplan (ozone summer climatology over Greenland, satellite validation and ozone plume modelling). The analysis of the POLARCAT summer ozone climatology did not progress during the first year of CLIMSLIP except for a PV/O3 correlation analysis performed by JC Raut using the ATR-42 observations and the WRF model.

Matthieu Pommier presented the validation work of the IASI ozone observations using airborne data obtained during the 2008 polar year. This work was published in 2012 in ACP. Overall the tropospheric mean column is well reproduced but the large UTLS ozone gradient leads to a IASI O3 overestimate in this region. The question arises about the usefulness of the IASI temperature profil instead of the model temperature in the ozone retrieval near the tropopause.

Jenny Thomas presented her work on WRF modelling of the ozone plumes advected from North America over Greenland during the Summer 2008 aircraft campaigns. The model was able to assess the respective contribution of the fire plume an dthe anthropogenic plume on the ozone distribution. Pollution plumes are often located near stratospheric intrusions with implication for the need of a good represention of the mixing processes in the model. Ozone level are well reproduced regardless of discrepancies in precursor distributions (model CO too low near fires and in the Greenland upper troposphere, model NOx too large near fires). The 10 day average O3 increase is large than 6 ppbv for the anthropogenic plume but lower than 3 ppb for the fire plume.

Jenny Thomas also reported on the POLMIP exercise where 9 models are intercompared in the Arctic. WRF is the only one to represent regional model performances. First comparaisons

show difficulties with HNO3 distribution (differences in precipitation) and reproducing low level ozone in the winter.

5. Work on boreal fires

LMD contribution (S. Turquety)

Solene Turquety presented the her work on a new fire emission model. Two companions project are the APIFLAMME PRIMEQUAL project for the Mediterranean and European region and the PICS CNRS project on air quality with Russia. For the latter CHIMERE simulations are performed to test the usefulness of the fire emission model (collaboration with LISA). The emission model is based on Modis for the burnt areas, UGS landuse for the emission factor and ORCHIDEE for the biomass properties. Exemples of fires maps are shown for 2008 and 2010. Comparaison with previous emission model (GFEDv3) shows large contribution over Europe but weaker values for Siberia. A first test of pyroconvection was analyzed with LMD-Z INCA showing a 2.5 km injection height near the fires increasing to 3-4 km traceur distribution at 100 km from the fire area. A postdoc will be hired very soon to perform the following task:

- simulation of the 2008 emissions and validation with IASI-CO
- 1D simulation of the pyroconvection model and validation with MISR and CALIOP for the injection height
- to include the pyroconvection model in LMD-Z.

LSCE and LATMOS contribution (JD. Paris, G. Ancellet, J. Pelon, K. Law)

The YAK 2012 flights represent a good case to study the impact of fire on aerosol and ozone. A visit of the Russian colleagues took place on October 10 to 12 in Paris to discuss the next YAK campaign schedule and payload and also the possibility of ground based lidar measurements in Tomsk at the Fonovi station on the Ob river to sudy the trace gas and aerosol biogenic emissions. A lidar developed by CIMEL for measurements in the near IR will be sent to Russia next spring.

6. Summary and actions to be done

Kathy peux tu te charger de cette section

resumer discussion sur interaction entre travaux de modelisation
choix des périodes à étudier en priorité (aerosol, ozone)