

Troposat-2

The Remote Sensing of Atmospheric Constituents from Space

ACCENT-TROPOSAT-2 (AT2): An ACCENT Integration Task

Report from the Fourth AT2 Workshop

Held at the Magistero Faculty, via Saffi 15, Urbino
Monday 12th September 2005

Peter Borrell
Deputy Coordinator

Workshop Plenary Session.....	2
AT2 News and Feedback Session	3
Task Group 1: Progress in 2005, proposals for 2006.....	5
Task Group 2: Progress in 2005, proposals for 2006.....	7
Task Group 3: Progress in 2005, proposals for 2006.....	7
The DANDELIONS Campaign	8
The Heidelberg Workshop on Radiative Transfer Modelling.....	9
AT2 E-Learning Meeting: Report.....	12
Attendance.....	13

September 2005

Fourth AT2 Workshop

Workshop Plenary Session

Held at the Magistero Faculty, via Saffi 15, Urbino
Monday 12th September 2005

Report

4-1. **Workshop opening.** The Coordinator (*John Burrows*) opened the meeting at 09.00 on Monday 12th of September 2005 by welcoming the 33 people present. *A list is appended.*

The purpose of the brief workshop is to bring the AT2 members attending the ACCENT Symposium together and obtain a brief overview on present activities.

The coordinator reported that:

- ACCENT was allowing the group to focus on remote sensing from satellites and on the use and abuse of the data obtained;
- the proposal for a geostationary satellite (GeoTrobe) had been submitted and the outcome is awaited;
- a good programme was developing for the next twelve months;
- AT2 was likely to over run on the budget for this year and some proposed activities had been curtailed to keep the budget within bounds.

4-2 **AT2 News and Feedback Session.** The Deputy Coordinator (*Peter Borrell*) reported on the latest developments and plans within AT2. *A full report is appended.*

4-3 **Task Group 1.** Progress in 2005; proposals for 2006. *Thomas Wagner, Andreas Richter, and Gerrit de Leeuw* reported on progress in Task Group 1. *A report is appended.*

4-4 **Task Group 2.** Progress in 2005; proposals for 2006; *Nick Savage* reported on developments in Task Group 2. *A report is appended.*

4-5 **Heidelberg Workshop on Radiation Transfer Modelling.** *Thomas Wagner* gave a report on the recent workshop which had been supported by AT2. *A report is appended.*

4-6 **The Dandelions Campaign.** *Gerrit de Leeuw* reported on the recent workshop for which AT2 had provided some support. *A report is appended.*

4-7 **E-learning.** *Maria Kanakidou* reported on the developments in e-learning which she and *Annette Lodstätter-Weißenmayer* had undertaken. *A report of a meeting of the AT2 e-learning group, held at Urbino is appended.*

4-8 **Workshop Close.** The Coordinator (*John Burrows*) was pleased with the wide variety of activities being undertaken within AT2 and urged principal investigators to pursue the opportunities offered by the collaborative environment. He thanked all those attending. The workshop closed at 12.50.

Peter Borrell
P&PMB Consultants, Newcastle-under-Lyme
3rd October 2005

AT2 Fourth Workshop

AT2 News and Feedback Session

Urbino, Monday 12th September 2005

Report

4-1. Funding for meetings and PIs. Applications approved at the Steering Committee.

For the year 2005-6

Thomas Holzer Popp	DLR-DFD	Visit of 3 students to RIU for aerosol validation modelling	1500.€
Christian Frankenberg	Heidelberg	2nd Intl Workshop on Greenhouse Gas Measurements from Space	1250.€
Annemieke Gloudemans	SRON	AT2 Hosted Workshop on SCIAMACHY CO retrievals	1000.€
Ellen. Brinksma)	KNMI	DANDELIONS validation for NO2 and aerosol (AT2 supported)	20K€
Oleg Postlyakov	Moscow	Attendance at AT2 and Heidelberg workshops	1500.€
Coordinator		Support for the 3rd Workshop, Oberpfaffenhoffen, June 2005	ca. 30 K
Coordinator		Support to attend 5th AT2 workshop at the ACCENT Symposium,	ca. 30 K€
Thomas Wagner	Heidelberg	Heidelberg Workshop on Radiative Transfer Modelling, June 2005	1150.€
Jean-Louis Brenguier (approved by email)	Toulouse	International workshop on cloud diurnal cycle characterization from space observations, November 2005	20K€

For the year 2006-7

Thierry Marbach	Heidelberg	3rd Intl. DOAS Meeting, Bremen, March 2006 (AT2 hosted)	15K€
Coordinator	Geneva	AT2 Joint Meeting with T&TP on Data Assimilation in Support of IGACO, April/May 2006	10K€
Jean-Marie Flaud & Johannes Orphal	Paris	IR retrievals	10K€

AT2 members are invited to apply for funds to facilitate exchanges or to support meetings. An application help sheet is available on the web site and on request together with templates for submitting proposals and reports.

4-2. **Satellite Data Available.** The pages for data collection and display are now live on the AT2 web page.

- ★ The steering committee urges PIs to make tropospheric satellite data available to the community via the new web facility.

4-3 **Web Page & Portal.** The AT2 web page and the ACCENT web portal are run in synchrony, and are regularly updated.

4-4. **Annual Report.** After a variety of delays the report is now finished and will be circulated to PIs in October.

4-5. **Meetings.** The steering committee had approved the attached schedule.

a. **Previous Meetings**

1st AT2 workshop	June 2004	Bremen
SCIAMACHY validation workshop	Dec. 2004 (<i>AT2 supported meeting</i>) Organiser: Ankie PETERS	Bremen
2nd AT2 workshop	Jan. 2005	Bremen
SCIAMACHY CO retrieval intercomparison	April 2005 (<i>AT2 supported meeting</i>) Organiser: Annemieke Gloudemans	Utrecht
DANDELIONS workshop	April 2005 (<i>AT2 supported meeting</i>) Organiser: Ellen Brinksma	Cabauw
3rd AT2 workshop	June 2005	Oberpfaffenhofen
Radiation Transfer Modelling workshop	June 2005 (<i>AT2 supported meeting</i>) Organiser: Thomas Wagner	Heidelberg
Fourth AT2 workshop	12 th September (morning only)	Urbino
First ACCENT Symposium	September 12 th – 17 th , 2005	Urbino

b. **Future Meetings**

International workshop on cloud diurnal cycle characterization from space observations	November 2005 (<i>AT2 supported meeting</i>) Organiser: Jean-Louis Brenguier	Toulouse
5 th AT2 Steering Committee	15 th December 2005	Paris
3 rd International DOAS workshop	20. – 24th March 2004 (<i>AT2 supported meeting</i>). Organiser: Thierry Marbach	Bremen
ACCENT Meeting on Data Assimilation in support of IGACO	April/May 2006 Joint AT2/T&TP meeting	Geneva
Fourth AT2 workshop	June 5 th – 7th 2006	Heraklion
H ₂ O vapour retrieval workshop	2006, Diego Loyola & Thomas Wagner (<i>proposed</i>)	Brussels
IR retrievals	2006	Paris
The Remote Sensing of Tropospheric Chemical Composition from Space.	Dahlem - type meeting, 2006?	?

oOo

Peter Borrell
P&PMB Consultants, Newcastle-under-Lyme
3rd October 2005

AT2 Fourth Workshop

Task Group 1: Progress in 2005, proposals for 2006

Urbino, Monday 12th September 2005

Prepared by Thomas Wagner, Gerrit de Leeuw, Johannes Orphal, Andreas Richter

Overview on structure and aims of task group 1

The aim of task group 1 is to improve existing algorithms for the retrieval of tropospheric information from satellite measurements, to develop new algorithms for tropospheric data products and to support distribution and use of tropospheric satellite data. One important strategy in this direction is to facilitate information exchange on data products and algorithms between the different groups involved and to provide tropospheric satellite products also to a wider community of data users. Since the launch of ENVISAT (and recently also EOS-AURA), improved and new sensors have become available, in particular including new instruments for aerosol properties and for absorbers in the IR spectral range. As a response to the increased number of sensors for IR products and aerosol properties task group 1 was subdivided into three parts:

- Trace gases derived from UV/visible sensors
- Trace gases derived from IR sensors
- Aerosol and cloud products

For all of these sub-groups specific challenges exist and special strategies have to be applied. Detailed algorithm work and exchange of specific information can best be carried out within specialised sub-groups. Besides the activities within the sub-groups, an important goal of task group 1 is the information exchange between the different sub-groups.

The communication and transfer of information is ensured with different strategies.

- The activities of the different sub-groups are reported to a general audience at regular meetings.
- Special workshops on algorithm development including all sub-groups are held.
- The reports of sub-group workshops are distributed.
- Research visits for scientists between different institutions are initiated.
- Products which are available from different sub-groups (*e.g.* O₃, NO₂, H₂O and aerosol properties) are compared.

Besides these activities, the long term aims of task group 1 also include the distribution of data products and documentation to the public. As in the previous TROPOSAT project, a list of the available data products and the respective PIs is collected and posted on the project's web-page. The structure and the aims of the task group were defined in the AT2 Strategy Document, which is available via the AT-2 website (<http://troposat.iup.uni-heidelberg.de>). Also the PI contributions were made available via the web site.

Strategies to encourage cooperation

From the beginning of the project, specific activities were stimulated to initiate and improve cooperation between the groups. Several specific topics were identified, for which the

organization of focused workshops was recommended. So far the following workshops have been held:

- SCIAMACHY CO Retrieval Intercomparison, Utrecht, April 2005
- Radiative Transfer Modelling, Heidelberg, June 2005

Reports from these workshops are already available via the website. These workshops were very successful and included in addition to AT-2 members also other experts from several international institutions. In addition to the organization of workshops, information on different data products and their availability was collected and made available via the AT-2 website.

Progress made in the different PI contributions

For many PI contributions substantial progress was made during the last year. Especially, the quality of the analysed data products was improved and characterized by comparison with similar products from other groups and to independent validation data (e.g. tropospheric NO₂). In addition, new products have been developed, especially in the near and thermal IR (e.g. tropospheric CO), and existing algorithms were applied to new sensors.

In addition to these algorithmic improvements the activities included also the scientific use of the retrieved data. From the raw data sets, e.g. information on global or regional trends, or on the atmospheric lifetime was extracted. Also the global distribution of different trace gases was compared in order to characterize the respective sources. Finally accurate laboratory studies were carried out to resolve potential discrepancies between UV-VIS and IR reference spectra, in particular focusing on O₃.

Aims for the next year

The individual activities as defined in the PI contributions will be continued in the next year. An important role of task group 1 will be to foster cooperation between different groups working on similar topics (e.g. trace gas or aerosol retrieval in selected spectral regions) and to suggest additional intercomparison studies, i.e. by exchange of information, data products, by visits of experts from different groups, and by organizing workshops on selected topics that are considered to be most important.

In the next year, the synergistic analysis of UV-VIS and IR data will be first applied to OMI and TES data from EOS-Aura. The launch of the first MetOp platform in mid-2006 will provide data from two more instruments (GOME2 and IASI) that will be used by the PIs of task group 1 for tropospheric trace gas and aerosol retrieval.

It is intended to hold three workshops under the auspices of task group 1 during the next year:

- Workshop on the comparison of different water vapour retrievals
- Workshop on trace gas retrievals in the thermal IR
- Workshop on the retrieval of cloud properties

These workshops, focusing on selected important topics, will bring together scientists from many different European countries, and are therefore an important tool to achieve the goals of task group 1 as described above.

Highlights of the work of Task Group 1, together with detailed reports from all the principal investigators, are given in the Annual Report of AT2, to be published in October 2005.

AT2 Fourth Workshop

Task Group 2: Progress in 2005, proposals for 2006

Urbino, Monday 12th September 2005

Prepared by Nick Savage

AT-2 has been of great importance to TG2 activities. It has informed potential users about possible data sets that can be used; educated users about appropriate ways of using satellite data, e.g. the use of averaging Kernels, and enabled PIs to learn about other work within AT2 and discuss their own ideas.

There has been much activity in 2005 which is still ongoing. One major focus has been data assimilation (this type of work is also done in TG1 and TG3). Several other pieces of work have centred on uses of modelling. In collaboration with the ACCENT modelling group, GOME NO₂ has been used for model validation. Other studies have been performed as well.

A new web page on NO₂ columns (http://www.atm.ch.cam.ac.uk/~nick/at2_tg2) has been set up to facilitate communication on the use being made of data sets.

TG2 is also a group with very diverse aims and methods of using satellite data. This is the major reason why, unlike TG1, no workshops have yet been organised by TG2. There has been much collaboration with TG1 PIs, but not as much with other TG2 PIs.

Some proposed collaborative activities for 2006 are:

- more detailed work on data set from produced by the ACCENT modelling exercise;
- using satellite and other ICARTT data with models to further investigate the outflow of pollutants from N. America;
- providing model NO₂ profiles and other data (Ozone, CO and HCHO) averaged across several models for retrievals;
- using satellite data to test model transport processes.

These are all good ideas but the key issue is getting 'buy in' from PIs – without enthusiasm and resources to implement these tasks they won't happen.

September 2005

Highlights of the work of Task Group 2, together with detailed reports from all the principal investigators, are given in the Annual Report of AT2, to be published in October 2005.

Task Group 3: Progress in 2005, proposals for 2006

Urbino, Monday 12th September 2005

There was no report from Task Group 3 as the coordinator, *Ankie Piters*, gave a detailed account of validation within the main ACCENT Symposium.

Highlights of the work of Task Group 3, together with detailed reports from all the principal investigators, are given in the Annual Report of AT2, to be published in October 2005.

AT2 Fourth Workshop

The DANDELIONS Campaign

Urbino, Monday 12th September 2005

Prepared by Ellen Brinksma; presentation given by Gerrit de Leeuw

Within the DANDELIONS (Dutch Aerosol and Nitrogen Dioxide Experiments for vaLidation of OMI and SCIAMACHY) project, a 9-week campaign was held. It focused on satellite and ground based retrievals of NO₂, aerosols, and O₃. Participants were KNMI, TNO-The Hague, RIVM, BISA, IFE Univ. Heidelberg and IFE Univ. Bremen.

Preliminary results show that the five MaxDOAS instruments, which were used in this campaign, yield consistent results most of the time, and different results, which may be explained from inhomogeneity in the boundary layer NO₂ fields, on some days.

We plan to compare NO₂ profiles through the boundary layer and lower troposphere that were taken by lidar, MAXDOAS, or derived from different atmospheric models.

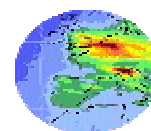
Validation of the OMI aerosol and NO₂ data, the SCIAMACHY NO₂ data, and the AATSR aerosol data with a range of groundbased data is planned. The OMI data will be released for validation soon (Sep/Oct 2005).

A fuller report from the campaign will be published on the AT2 web site shortly.

AT2 provided some support for the DANDELIONS campaign.



Troposat-2



AT2 Fourth Workshop

The Heidelberg Workshop on Radiative Transfer Modelling

Urbino, Monday 12th September 2005

Prepared and presented by Thomas Wagner.

1. Scope of the RTM Workshop

The Heidelberg RTM workshop focused on the comparison of the results of current RTM for DOAS observations of scattered radiation. The main focus was the modelling of various MAXDOAS geometries. Accurate modelling of MAXDOAS observations is important for satellite observations because of two main reasons: first, from the radiative transfer modelling of the rather complex MAXDOAS geometries, important and detailed conclusions on the quality of the different models can be drawn. These conclusions can be directly applied to the various satellite viewing geometries. Second, accurate atmospheric trace gas products are very important for the validation of satellite measurements, especially for tropospheric trace gases.

The workshop had three major aims:

- 1) to compare existing RTM codes for selected (MAXDOAS) case studies
- 2) to investigate the aerosol influence on MAXDOAS observations
- 3) to discuss most necessary future developments for satellite (3-D-) RTM applications

To make the workshop most effective, detailed modelling exercises were sent out to all participants prior to the workshop. People who can not join the workshop were encouraged to participate in the model intercomparison by sending their model results.

2. Agenda

Thursday, 9. June 2005

13:00 Welcome

13:10 Individual presentations of the participating models (each 20 min)

-Hilke Oetjen (Bremen)

-Hitoshi Irie (Japan)

-Oleg Postylyakov (Moscow)

-Michel van Roozendaal (Brussels)

-Greg Bodeker (New Zealand)

-Johannes Keller (Switzerland)

-Klaus-Peter Heue & Tim Deutschmann (Heidelberg)

15:30 Coffea Break

16:00 Talks on specific aspects (30 min)

- Summary from Brussels QUILT-RTM workshop (Michel van Roozendaal)

- Information content of MAXDOAS for aerosol retrieval (Udo Friess)

- Aerosol scattering properties as derived from Mie-theory Modelling (Suniti

Sanghavi)

17:30 Discussion on the settings for the MAXDOAS RTM intercomparison

Friday, 10. June 2005

11:15 Start of RT modelling intercomparison
13:00 Lunch Break
14:00 RT modelling intercomparison
16:00 Discussion of first results
20:00 Dinner

Saturday, 11. June 2005

9:00 Overview talks on '3D-challenges' for satellite retrievals in the UV/vis/NIR
- Influence of intra-pixel heterogeneities on satellite observations (Thomas Wagner)
10:00 Discussion, Summary, Future steps (publication of results?)
12:00 End of workshop

3. Participating models

At the Heidelberg workshop the following models were introduced by the developers or their representatives:

Model name	Responsible person	Institution	Abbreviation in this exercise
SCIATRAN	Hilke Oetjen	IUP Bremen	BR
MCC++	Oleg Postylyakov	Institute of Atmospheric Physics, Moscow	RU
MCARaTS	Hitoshi Irie	Frontier Research Center for Global Change, Yokohama	JP
DISORT package	Michel van Roozendael	IASB, Brussels	BL
Modtran 4	Johannes Keller	Paul Scherrer Institute, Villigen	SW
Nimo	Greg Bodecker	NIWA, Lauder	NZ
TRACY-1/2	Klaus-Peter Heue, Tim Deutschmann	IUP Heidelberg	H1/ H2

In addition, results from the following models (without representation) at the workshop will also be included in the comparison exercise

Model name	Responsible person	Institution	Abbreviation in this exercise
	Chris McLinden	Meteorological Service of Canada Toronto	CA
PROMSAR	Elisa Palazzi	National Research Council, Institute of Atmospheric Science and Climate, Bologna	IT
DAK	Ping Wang	KNMI, Utrecht	NL

4. First Results

Many of the proposed exercises will be finalised after the workshop. In particular, also the exercises have been updated and completed. Nevertheless, first comparison results were achieved during the workshop.

Among the effects investigated were the following.

- Box-AMFs for different altitudes for a zenith-looking instrument in a pure Rayleigh atmosphere
- Larger azimuth effect for weaker aerosol extinction
- Influence of the field of view (FOV)

5. Updates of the exercises and general settings

All updates are included in the new parameter overview at the end of this document. Compared to the previous version the following changes were made:

- It was agreed to limit the field of view to a value of almost zero ($<0.1^\circ$)
- For the selected wavelengths the following values of the O₃ cross sections should be used (from SCIA O₃ cross sections for 273K):

Wavelength [nm]	310	360	440	477	577
O ₃ cross section [cm ²]	9.59e-20	6.19e-23	1.36e-22	5.60e-22	4.87e-21

- The temperature profile should be interpolated linearly; the logarithm of the pressure should be interpolated linearly
- Also for the altitudes between 500 and 1000m Box-AMFs should be calculated
- A new exercise 0 was included: Rayleigh atmosphere, zenith looking instrument, SZA: 70°, ground albedo: 3%, all wavelengths.
- For exercise 2 also case A3 (aerosol extinction: 0.1/km from 0-1km altitude) is included.
- Please provide also the vertical optical depth (VOD) with respect to Rayleigh- and aerosol-extinction.

6. Next steps

- Additional information from the participating groups: A short description of the different models (half page) is requested. This description should contain in particular information on the vertical discretisation used for the exercises.
- Completion of the exercises: Complete results of the exercises should be sent until mid of July.
- -Web page: A web page for the RTM workshop will be set up containing the model results, the descriptions of the models, and the findings of the comparison
- -Publication: It is planned to present the results of the RTM exercise in a scientific publication. The choice of the journal and the specific focus of the paper will depend on the outcome of the comparison exercises and accompanying discussions.

7. Conclusion

The results of the workshop will be worked up and compared during the coming months. The workshop was supported in part by AT2.

AT2 E-Learning Meeting: Report

held in Urbino, Wednesday 15th September 2005; 11.30

1. **Attending.** Maria Kanakidou, Annette Lodstätter-Weißmayer and Peter Borrell.

2. Present Situation.

- Maria and Annette had prepared material for a module on the retrieval of NO₂ columns from space, in the form of overheads in a powerpoint presentation.
- Contracts had been given to Richard Law of PerModum to develop the e-learning authoring tool and a pilot module on tropospheric chemistry, which would be delivered within the next month or so.
- Due to the AT2 financial situation, it is unlikely that funds will be available for any other e-learning activities until September 2006.

3. **Material Review.** Most of the meeting was devoted to reviewing and improving the teaching material prepared by Maria and Annette.

4. Future Activities.

- Maria will go through the presentation and make further suggestions. It will be delivered to Annette before the 21st September.
- Annette will incorporate the new suggestions and improvements into the presentation. She will then show it to Thomas Wagner and Andreas Richter to check for the correctness. It will then be delivered to Peter for comment. Target date: October 15th 2005
- Peter will try out the test material and the authoring module from Richard Law. Target date: November 2005
- Peter will explore, with Evi Schuepbach and John Burrows, the possibility of obtaining additional funding for this activity.
- The group will then review progress with a view to producing the module as soon as feasible. It would be preferable if Richard Law could be directly involved in this part.

The meeting closed at 13.10.

oOo

E-learning presentation at the Urbino Symposium

In the afternoon there was a presentation of the various activities of the Training and Education subproject. This included an excellent demonstration of the AT2 pilot module by one of the presentation team, Asbjorn Arflot of Helsinki University. Peter Borrell gave a brief comment on the progress to date of the AT2 e-learning group, emphasising the need for students to be able to test their comprehension of high-level material by carefully thought out exercises.

Peter Borrell

15th September 2005

Fourth AT2 Workshop

Attendance

Beekmann	Matthias	LISA, Uni Paris, F
Beierle	Steffen	IUP-Heidelberg
Borrell	Peter	P+PMB, UK
Borrell	Patricia	P+PMB, UK
Buchwitz	Michael	IUP -Bremen
Burrows	John	IUP -Bremen
Cacciari	Alessandra	CNR, ISAC, I
Clerbaux	Cathy	LISA, Uni Paris, F
DeLeeuw	Gerrit	KNMI, NL
DiNicolantonio	Walter	CNR, ISAC, I
Drummond	James	Uni Toromto
Hodzic	Alma	LMD Polyt., F
Hvidberg	Martin	NERI/AMI, Roskilde/DK
Junkermann	Wolfgang	IMK, FZK
Kaminski	Jacek	Uni York, CA
Keller	Johannes	Paul Scherrer Inst., CH
Kramer	Louisa	University Leicester, UK
Ladstätter-W.	Annette	IUP -Bremen
Marbach	Thierry	IUP-Heidelberg
Mennt	Laurent	LMD Polyt., F
Pieters	Ankie	KNMI, DeBilt, NL
Petritoli	Andrea	ISAC-CNR, Bologna, I
Richter	Andreas	IUP -Bremen
Theys	Nicolas	BISA, B
Vautard	Robert	LMD Polyt., F
Savage	Nicholas	Cambridge
Kanakidou	Maria	ECPL, Uni-Crete, GR
Gerusopoulos	Evangelos	ECPL, Uni-Crete, GR
Wagner	Thomas	Uni-Heidelberg, D
Gregorski	Michael	Uni-Heidelberg, D
Sfakianaki	Maria	ECPL, Uni-Crete, GR
Vrekoussis	Mikalis	ECPL, Uni-Crete, GR
Tsigaridis	Kostas	ECPL, Uni-Crete, GR