



## 2nd TTorch Summer School: Challenges in measurements of greenhouse gases and their interpretation, final report

Application reference no: 4847

Hyytiälä, 30 September - 10 October 2013



## Table of Contents

Table of Contents .....	2
Summer School: Challenges in measurements of greenhouse gases and their interpretation.....	3
Student participant list.....	5
The final program .....	7
Evaluation of TTorch Summer School Hyttiälä edition 2013 .....	9
Financial information .....	15

## Summer School: Challenges in measurements of greenhouse gases and their interpretation

The second TTORCH Summer School took place between 30 September and 11 October 2013 at Hyytiälä Forestry Field Station, in Finland. Local hosts were Timo Vesala and Ivan Mammarella, local organiser was Pavel Alekseychik, one of the students of the 1st TTorch Summer School!

The school was organized in three sections: Atmospheric composition, Atmospheric measurements and Atmospheric modeling. The last two sections included a practical session. One session of two halve days was oriented on practical measurements using relatively simple sensors for measurement of temperature, humidity and CO<sub>2</sub> concentrations. The second session of two afternoons was oriented on hands on experience with (global) transport models.

The school was mainly oriented to PhD students, but two PostDocs and two master students preparing to start a doctorate were accepted. The school was also open for scientists and technicians that are new in the field and for example just started or soon will start to work on e.g. related ICOS and InGOS projects, but none applied.

The application for the Summer School opened 17 April 2013 and by 1 May the level of 69 applicants had been reached. The school had only place for 35, so a rigorous selection was needed. Each candidate had to prepare a document containing the CV, a short description of her / his work and the motivation to attend this summer school, and a recommendation letter of the supervisor. The selection took into account the connection between the candidate's research subject and the TTORCH focus.

The students have been scored on

- eligibility (contributing ESF member country of residence (1.5), EU member state (1.0), or other country (0.5)),
- motivation score on the basis of the written motivation by the student (1-4)
- the quality of the CV and it's connection to the course (1-4)
- the strength of the recommendation in the letter of the supervisor (1-4)

The score was the calculated as eligibility\*mean score. A cutoff at a score of 3.0 resulted in 37 selected students, that all agreed and showed up except for one. The selected students were 15 male, 22 female. Largest representation were students from Germany (15), followed by UK (4), France (3), Sweden (3), Estonia (2), Denmark (2), and one each from Czech Republic, Finland, Hungary, Iceland, Italy, Poland and Switzerland.

The lecturers at the summer school were: Hermann Bange, Christoph Gerbig, Martin Heimann, Sander Houweling, Maarten Krol, Ingeborg Levin, Anders Lindroth, Greet Maenhout, Ivan Mammarella, Bart Verheggen, Alex Vermeulen, and Timo Vesala. Sylvia Walter and Pavel Alekseychik were important as co-convenors and (local) organisers and assisted the students and teachers during the practical exercises.

Poster abstracts: All students presented a poster and an elevator pitch presentation on the first day. The poster session was well received and students and lecturers had good and lengthy discussions around the poster boards.

All costs (accommodation, catering, organization and lectures) was be covered from TTORCH funds. The students were also offered the possibility to cover the travel costs. The travel to and from the main railway station and airport of Helsinki was arranged by a rented bus.

The TTorch Summer school was endorsed by the European FP7 projects InGOS, ICOS and GHGEurope.

## Student participant list

Name (First)	Name (Last)	Email	Address (Country)
Thomas	Barningham	<a href="mailto:stbarningham@gmail.com">stbarningham@gmail.com</a>	United Kingdom
Florian	Berkes	<a href="mailto:berkesf@uni-mainz.de">berkesf@uni-mainz.de</a>	Germany
Maria del Rosario	Dominguez Carrasco	<a href="mailto:maria.dominguez@helsinki.fi">maria.dominguez@helsinki.fi</a>	Finland
Pavla	Dagsson Waldhauserova	<a href="mailto:pavla@lbhi.is">pavla@lbhi.is</a>	Iceland
Ludovica	D'Imperio	<a href="mailto:ldi@life.ku.dk">ldi@life.ku.dk</a>	Denmark
Laura	Dobor	<a href="mailto:doborl@nimbus.elte.hu">doborl@nimbus.elte.hu</a>	Hungary
Daniela	Franz	<a href="mailto:danifr@gfz-potsdam.de">danifr@gfz-potsdam.de</a>	Germany
Raili	Hansen	<a href="mailto:raili.hansen@ut.ee">raili.hansen@ut.ee</a>	Estonia
Jesica	Hoker	<a href="mailto:hoker@iau.uni-frankfurt.de">hoker@iau.uni-frankfurt.de</a>	Germany
Miriam	Hurkuck	<a href="mailto:miriam.hurkuck@ti.bund.de">miriam.hurkuck@ti.bund.de</a>	Germany
Järvi	Järveoja	<a href="mailto:jarvi.jarveoja@ut.ee">jarvi.jarveoja@ut.ee</a>	Estonia
Alina	Jasek	<a href="mailto:Alina.Jasek@fis.agh.edu.pl">Alina.Jasek@fis.agh.edu.pl</a>	Poland
Panagiotis	Kountouris	<a href="mailto:pkount@bgc-jena.mpg.de">pkount@bgc-jena.mpg.de</a>	Germany
Rong	Lang	<a href="mailto:langrong@mail.kib.ac.cn">langrong@mail.kib.ac.cn</a>	Germany
Lucia Maria	Laurenza	<a href="mailto:l.laurenza@ifac.cnr.it">l.laurenza@ifac.cnr.it</a>	Italy
Benjamin	Lebegue	<a href="mailto:benjamin.lebegue@lsce.ipsl.fr">benjamin.lebegue@lsce.ipsl.fr</a>	France
Xiaoxi	Li	<a href="mailto:Xiaoxi.Li@agrsci.dk">Xiaoxi.Li@agrsci.dk</a>	Denmark
Xin	Lin	<a href="mailto:xin.lin@lsce.ipsl.fr">xin.lin@lsce.ipsl.fr</a>	France
Mark	Lunt	<a href="mailto:mark.lunt@bristol.ac.uk">mark.lunt@bristol.ac.uk</a>	United Kingdom
Eric	Morgan	<a href="mailto:emorgan@bgc-jena.mpg.de">emorgan@bgc-jena.mpg.de</a>	Germany
Liisi	Nõgu	<a href="mailto:liisi.nogu@gmail.com">liisi.nogu@gmail.com</a>	Sweden
Florian	Obersteiner	<a href="mailto:obersteiner@iau.uni-frankfurt.de">obersteiner@iau.uni-frankfurt.de</a>	Germany
Cornelius	Oertel	<a href="mailto:Cornelius.Oertel@ioez.tu-freiberg.de">Cornelius.Oertel@ioez.tu-freiberg.de</a>	Germany
Brian	Oney	<a href="mailto:brian.oney@empa.ch">brian.oney@empa.ch</a>	Switzerland
Sung-Bin	Park	<a href="mailto:spark@bgc-jena.mpg.de">spark@bgc-jena.mpg.de</a>	Germany
Ylva	Persson	<a href="mailto:persson.ylva@gmail.com">persson.ylva@gmail.com</a>	Sweden
Penelope	Pickers	<a href="mailto:p.pickers@uea.ac.uk">p.pickers@uea.ac.uk</a>	United Kingdom
Armelle Reca	Remedio	<a href="mailto:armelle.remedio@zmaw.de">armelle.remedio@zmaw.de</a>	Germany
Ladislav	Sigut	<a href="mailto:sigut.l@czechglobe.cz">sigut.l@czechglobe.cz</a>	Czech Republic
Sarvesh Kumar	Singh	<a href="mailto:sarveshiitd2007@gmail.com">sarveshiitd2007@gmail.com</a>	France
Theomar	Trindade de Araújo Tiburtino Neves	<a href="mailto:neves@muk.uni-hannover.de">neves@muk.uni-hannover.de</a>	Germany
Hella	van Asperen	<a href="mailto:hellavanasperen@gmail.com">hellavanasperen@gmail.com</a>	Germany
Sanam	Vardag	<a href="mailto:svardag@iup.uni-heidelberg.de">svardag@iup.uni-heidelberg.de</a>	Germany
Min	Wang	<a href="mailto:Min.Wang@nateko.lu.se">Min.Wang@nateko.lu.se</a>	Sweden
Angelina	Wenger	<a href="mailto:angelina.wenger@bristol.ac.uk">angelina.wenger@bristol.ac.uk</a>	United Kingdom
Kamal	Zurba	<a href="mailto:zurba@ioez.tu-freiberg.de">zurba@ioez.tu-freiberg.de</a>	Germany



# The final program

Version: 7 Oct '13

## TTORCH summer school 2013 Program

Time	Mon 30-Sep-13	Tue 1-Oct-13	Wed 2-Oct-13	Thu 3-Oct-13	Fri 4-Oct-13	Sat 5-Oct-13	Sun 6-Oct-13	Mon 7-Oct-13	Tue 8-Oct-13	Wed 9-Oct-13	Thu 10-Oct-13	Fri 11-Oct-13
8:00	Breakfast											
9:00		<b>Welcome</b> <b>Lecture</b> Climate system - M. Heimann	<b>Field trip</b> Overview field measurement Hyytiala - T. Vesala	<b>Lecture</b> Other GHG overview - I. Levin	<b>Lecture</b> Measurement approaches overview - A. Vermeulen	<b>Free</b> <b>Lecture</b> 10:00 Concentration meas., isotopes, scale issues - I. Levin	<b>Lecture</b> Anthropogenic emissions - G. Maenhout	<b>Lecture</b> Satellites, FTIRs - S. Houweling	<b>Lecture</b> Modeling overview - M. Heimann	<b>Lecture</b> Regional inversions - C. Gerbig	<b>Practical</b> Processing results, preparing presentations	
10:15	coffee break											
11:00		<b>Lecture</b> Carbon Cycle - M. Heimann		<b>Lecture</b> Biogenic trace gas emissions - H. Bange	<b>Lecture</b> Measurement instrument principles - C. Gerbig	<b>Lecture</b> I. Levin continued.	<b>Lecture</b> Arctic and boreal systems - A. Lindroth	<b>Lecture</b> Flux measurement - T. Vesala	<b>Lecture</b> Global modeling, inversions - M. Krol	<b>Field trip</b> Wetland field trip 2 - T. Vesala	<b>Practical</b> Processing results, preparing presentations	
12:45	Lunch											
14:30		<b>Discussion</b> The Climate debate: sceptic vs. scientist - B. Verheggen	<b>Practical</b> Short elevator pitch of students	<b>Elevator pitch contd.</b> <b>15:30 Poster session</b>	<b>Practical</b> Field measurement (T. Vesala + helpers, A. Lindroth, A. Vermeulen...)	<b>Practical</b> Field measurement (helpers, A. Vermeulen, A. Lindroth, ...)	<b>Practical</b> Processing results, preparing presentations	<b>Field trip</b> Wetland field trip 1 - T. Vesala	<b>Practical</b> Modeling (M. Heimann, M. Krol, A. Vermeulen, C. Gerbig)	<b>Practical</b> Modeling (M. Heimann, M. Krol, A. Vermeulen, C. Gerbig)	<b>Practical</b> Processing results	
16:00	coffee break											
16:30		<b>Discussion</b> The Climate debate: sceptic vs. scientist 2 - B. Verheggen	<b>Lecture</b> Atmospheric physics and chemistry K. Lehtipalo	<b>Poster session</b>	<b>Field measurement contd.</b>	<b>Field measurement contd.</b>	<b>Processing results, preparing presentations</b>	<b>16:45 Surprise</b>	<b>Modeling contd.</b>	<b>Modeling contd.</b>	<b>Student presentations</b>	
18:00	Dinner											
19:00		<b>Movie evening</b>		<b>Poster session (cont)</b>				<b>Dinner / Party</b>		<b>Dinner</b>		
	Cold dinner											
	Bus transport from Helsinki to Helsinki											

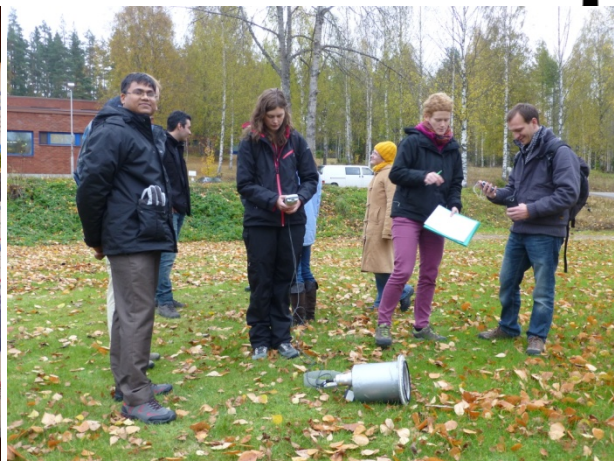
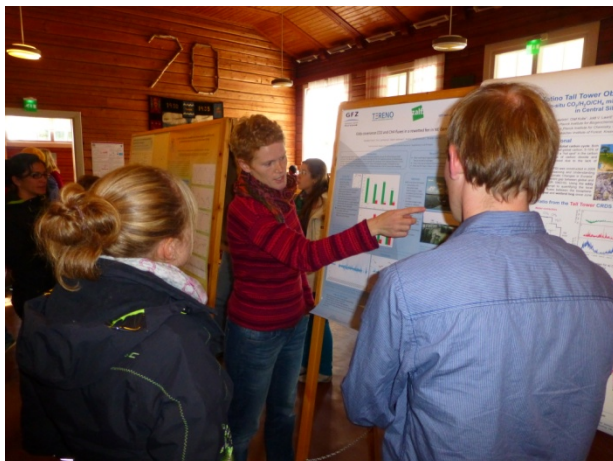


Photo impressions of the T Torch Summer School Edition 2013



## Evaluation of TTorch Summer School Hyttiälä edition 2013

After 21 October we received the last on-line evaluation. 30 students have filled it in (81%, not bad), one admitted he had doubled his submission but as the survey was anonymous this could not be corrected. 19 students provided written comments, that are mostly very helpful for a possible follow-up.

The overall evaluation on a scale of 1-6 was 4.6 (+/- 1.1), on a scale of 1-10 this would be mark 7.7, quite positive. The 2011 TTorch Summer School received a score of 4.8 +/- 0.7. Lowest scores were given to:

- Clarity of the presentation of the field work (3.9 +/- 1.3; = 6.5)
- Fit of information content of the modeling exercises with expectations (4.0 +/- 1.0; = 6.7)
- Overall quality of the modeling exercises (4.1 +/- 1.0; = 6.8)
- Clarity of presentation of modeling exercises (4.1 +/- 1.0; =6.8)

Above average scores were given to:

- Entertainment besides work (5.6 +/- 0.7; =9.3)
- Overall quality of the lectures (5.2 +/- 0.8, =8.6)
- Clarity of presentation of lectures (5.2 +/- 1.1; =8.6)
- Accomodation (5.2 +/- 1.0; =8.6)

The length of lectures was evaluated to be a bit on the long side, the length of the modeling exercises a bit on the short side. The length of the practical field work was judged on average to be a near perfect fit.

Item	Student response																														AVERAGE	Std Dev		
Overall quality of the lectures	6	6	6	5	5	5	4	4	6	6	6	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5.2	0.8
Length of the lectures (1=too short, 6=too long)	6	2	4	4	3	5	3	4	4	5	4	2	6	4	4	4	3	4	6	3	4	6	3	3	4	3	4	4	5	4	3	3.9	1.0	
Fit of information content of lectures with expectations	5	6	5	3	5	3	5	6	4	3	5	6	5	3	6	5	6	6	4	5	5	2	3	5	5	2	3	5	5	4.7	1.1			
Clarity of presentation of lectures	6	6	5	5	5	5	5	6	5	4	5	6	5	5	6	6	6	6	5	5	5	5	5	5	5	5	5	5	5	5.2	0.7			
Overall quality of the field work	5	2	6	5	3	4	5	4	4	5	6	3	3	6	6	4	3	5	3	3	6	4	2	4	6	1	4	4	6	4.2	1.4			
Length of the field work (1=too short, 6=too long)	3	2	6	2	2	3	3	4	4	3	2	3	3	6	3	4	5	3	4	4	3	3	2	3	5	6	4	3	3.5	1.2				
Fit of information content of the field work with expectations	6	2	5	3	2	5	5	4	6	5	6	5	2	6	6	3	3	5	2	3	6	6	2	3	5	4	3	4	4.2	1.5				
Clarity of presentation of the field work	6	2	5	4	3	4	6	4	4	5	4	5	3	3	6	5	4	3	5	2	3	6	3	4	2	5	3	3	3.9	1.3				
Overall quality of the modelling exercises	4	5	5	2	4	2	4	3	5	5	6	2	4	4	5	5	4	4	3	3	4	3	4	3	4	4	4	5	4.1	1.0				
Length of the modeling exercises (1=too short, 6=too long)	4	3	2	2	3	3	3	2	4	3	2	1	1	4	3	4	2	2	4	4	5	3	2	2	4	6	5	4	3.1	1.2				
Fit of information content of the modeling exercises with expectations	2	5	3	2	4	2	4	3	4	5	5	4	4	5	4	4	5	4	3	3	6	4	5	4	3	4	5	4	4.0	1.0				
Clarity of presentation of modeling exercises	5	3	4	1	4	4	5	3	4	4	4	5	2	4	5	6	4	5	4	4	3	4	5	4	4	5	5	4	4.1	1.0				
Accommodation	6	5	5	5	6	5	3	6	6	5	4	5	6	6	6	5	6	6	6	6	6	6	6	6	6	6	6	6	5.2	1.0				
Food	6	6	4	4	6	4	5	4	6	5	4	1	4	5	6	6	4	4	4	6	6	6	3	5	3	6	1	5	4.6	1.4				
Entertainment besides work	6	6	5	3	5	6	6	5	6	6	6	5	6	6	6	5	5	6	6	6	6	6	6	6	5	5	5	5	5.6	0.7				
<b>Average of non-length scores</b>	<b>5.3</b>	<b>4.5</b>	<b>4.8</b>	<b>3.5</b>	<b>4.3</b>	<b>4.1</b>	<b>4.8</b>	<b>4.1</b>	<b>4.8</b>	<b>5.2</b>	<b>4.9</b>	<b>4.7</b>	<b>3.8</b>	<b>4.5</b>	<b>5.4</b>	<b>5.7</b>	<b>4.4</b>	<b>4.4</b>	<b>4.4</b>	<b>5.1</b>	<b>4.5</b>	<b>4.4</b>	<b>4.5</b>	<b>4.4</b>	<b>4.2</b>	<b>4.1</b>	<b>5.1</b>	<b>3.1</b>	<b>4.3</b>	<b>4.4</b>	<b>5.0</b>	<b>4.6</b>	<b>1.1</b>	

### The comments offered by the students:

- "Hi and thanks for a great course! My personal feeling is that you cannot absorb more info after 5 days morning-evening. To digest all the info, it is needed to have at least one morning or afternoon off out of 12 days. Also, have a time to walk more than 1 km from the station to see where you actually are. Anyway, thanks a lot! This was very helpful course!"
- The measurement portion needs better organization. For example, Timo was not able to present the material on measurement chambers, yet we were given these as a means off measuring fluxes. I think that this needs more attention next time. Also, after all of the information on calibration of measurements, this was not emphasized at all when considering our actual measurements. I think it may be interesting to have groups with different (learning) goals, such as absolute concentration, chamber flux, gradient flux, and other types of measurements with an accompanying experienced person. Great lectures! Good modeling exercises! Poster session was good. I would suggest an open-end poster session with alcohol after dinner. It is not like anyone is going anywhere
- The course was great especially for non-measurement students. However, I was too exhausted for trying to understand everything. One suggestion would be that we have half or 1 day as a weekend break to relax our mind, visit a neighboring city. But it was really a great summer school. Many thanks especially to the local organizers: Alex, Timo, Pavel, and Ivan.
- here some constructive criticism; modelling section: provide download links for the needed software one day before the session, then you dont loss so much time during the session; more technical information and discussion about the used chambers, Eddy-Flux-Systems, analysis techniques and so on in the field the 20 minutes for each station was a little bit too short; field work: include a short lecuture about how to calculate fluxes before the field work and not after it, since a lot of us used different units and so on... to work in the wetlands would also be interesting; reports: define at the begining of the course what we have to deliver at the end, this was sometimes a little bit chaotic ;-); a small touristic program would have been also nice (one afternoon or so) e.g. visit to Tampere or also a excursion in the sourrounding area with information about vegetation, Fauna, soil, geology and so on would have been verry interessting. However, it was worth to come to Hyytiläl and I enjoyed it!!!
- The environment is really lovely. I really appreciate the hard work by the organisers. If we get more supervision or feedback from the field measurement exercise, we can learn more out of it. For the modelling exercise, I expect to learn more about how to evaluate the model performance, which means something common in different models. Two weeks is a little bit long to me. It can be a little more intensive in future. All in all, I want to say thank you and I had a very good time with you nice guys.
- Very nice location and good program overall! Time management could be improved at some point (e.g. length of presentations).
- "It was not always clear what was expected from students. What was homework and how it had to be presented. Also next time, it would be nice to have a blackboard for current information (sauna arrangement, movie times etc). Overall summer school was fascinating and profitable. I really liked it. Thanks!"
- I would have enjoyed a bit more modelling and less field work, but that is a personal preference. I especially liked that some lecturers gave additional reading suggestions in their talks, for people who want to learn more about the subject. The elevator pitch talks would

have been better placed on the first morning. Thanks for the organisation, I thoroughly enjoyed it.

- Thanks for the organisation! The only part I did not well understand was the first modeling exercise. There was no clear explanation what the individual variables of model represent and I was in the end just pressing buttons without any insight. Adding more written documentation for the exercise could help to improve it. The following exercise with Moguntia model was great.
- Everything were more than good, but I missed more practical work
- It is very hard to structure perhaps, but for me it was a lot of repetition from the different lecturers (for example about CH<sub>4</sub> and CO<sub>2</sub> lifetime) and of which could have been used differently. The modelling part was also a bit too quick. I was hoping for more, but now it felt rushed. I didn't feel I had enough time to fully understand everything that was said. The overall structure and information beforehand (like length of presentations, lecture halls and so forth) could also have been better.
- I think fieldwork should be better organised, as well as modelling exercises. Other than that, it was awesome :)
- TTorch was great for many reasons: good lectures, qualified professors and good structure. I hope it maintain the quality. Oh ... and if possible try to give a free day to the students. Example, free sunday and later end on friday.
- The lectures were of a good length, although many of the lecturers seemed to struggle to fit everything in. Maybe could have done with a lecture on the physics or dynamics of the atmosphere. There was some stuff in Martin's opening lecture but it would have been good to go into more detail. Maarten Krol's modelling exercises were interesting and worthwhile but the other modelling exercises were not so worthwhile. The quality of the lectures was overall very good, with the highlight being Bart Verheggen's discussion on the climate debate. This was a very interesting and thought-provoking session. The location was perfect and the evening sauna sessions gave the perfect opportunity to relax.
- This is an addition to the previous filled in form (so second form filled in by same person). It might be an idea to split up the group of students into a field and modelgroup. The people with field experience have to model and the other way around. This makes the groups smaller, and students can spend more time on subjects they are unfamiliar with.
- "There was no non alcohol drinks during the films :( BUT it was Excellent"
- Personally expected more modeling exercises and explanation. Field work is too short and the group is too big, expected some exercise about eddy covariance.
- The quality of lectures were satisfied but it would be better to have more time for modelling practical course. before field trip sensors should be tested whether it works well or not. Timo's movie were really good for refreshing and helpful to understand turbulence and aerosol-cloud interaction. Overall, it was really good chance to have good overview for measurement and modeling. Aerosol and their application to transport model improvement would be good to shown as an example of applications.
- "I think, the time for the exercises were too short. We have so much lectures, so there are not enough time to do the work really good. A bit more time will be very nice. The first modeling exercise was really boring ( I am sorry) and for the second -this was really nice - it was too short, because we have to download all this stuff (perhaps it can be the next time

on the HP) Information for posters or presentation on the beginning of the summer school were a bit late ;-) Sooo, but i enjoy it really :-)"



## Financial information

Travel for lecturers:	€ 5 108.90
Travel for students:	€ 10 367.81
Bus transport:	€ 1 520.00
Meals:	€ 17 100.00
Accommodation/meals:	€ 17 074.00

**Total** € **51 170.71**

Travel paid by ESF: € 14 227.86

Advance to ECN € 40 000.00

Travel by ECN: - € 1 248.85

Accommodation/meals by ECN - € 34 174.00

Bus transport by ECN - € 1 520.00

**Excess at ECN** € **3057.15**

