

REPORT ON THE TOSCA TRAINING SCHOOL

Impact of solar variability on climate

Thessaloniki, March 10-15, 2013



COST Action TOSCA ("*Towards a more complete assessment of the impact of solar variability on the Earth's climate*") organized its first training school in Thessaloniki (Greece) based on the successful format of capacity building schools. The objective of this multidisciplinary event was to give young scientists a global understanding of the topical but also controversial role of solar variability in climate change. Students coming from 17 countries, with levels ranging from master to post-docs level, participated in this school.

TOSCA is a pan-European action that brings together over 70 leading European scientists and aims at making progress on scientific understanding of the Sun-climate connection. This connection is a typical example wherein progress has been hampered by the lack of interaction between various scientific communities. For that reason, the multidisciplinary programme of this school addressed various aspects of the Sun-Earth system, emphasizing the need for a global view of the system.

Participants

28 students attended the school, coming from: Armenia (1), Bulgaria (2), China (1), Cyprus (1), Czech Republic (3), Finland (1), France (1), Germany (4), Greece (3), Hungary (1), Israel (2), Italy (1), Norway (1), Romania (1), Russia (3), Sweden (1), Switzerland (1). We received at least twice as many application and so a severe selection was needed. Participants were selected primarily on the likely benefit from participating in that school, rather than on the match between their curriculum and the programme of the school.

With this, we ended up with a very diverse sample of bright students with expertise in topics such as: lightnings and atmospheric electricity, operational space weather, ocean dynamics, geomagnetism, neutron monitors, radiative transfer modeling, regional climate simulations, solar image analysis, and more.

Most participants were second-year master students or PhD students. We were not far from having gender balance, with 12 women out of 28.

Programme

The five-day programme featured lectures, a computer class, a poster session, two movies and a debate, and a daily assessment. To improve the coordination between all lectures, speakers had been asked to share in advance their programme. One week before the school, slides had been made available to all, including to the students.

Lectures addressed various aspects of the Sun-climate connection, with a blend of fundamental physical issues, key questions, and practical aspects such as existing sources of data. The complete list of lectures is:

- I. Ermolli (INAF, Rome, Italy): *The Sun as a star, solar irradiance, and solar data bases*
- K. Georgieva (Bulgarian Academy of Sciences, Sofia, Bulgaria): *Solar dynamo, and other manifestations of solar activity*
- J. Lilensten (IPAG, Grenoble, France): *The space environment*
- K. Tourpali (Aristotle University, Thessaloniki, Greece): *Introduction to the Earth's atmosphere*
- E. Rozanov (PMOD, Davos, Switzerland): *Physics and chemistry of the stratosphere*
- C. Stubenrauch (LMD, Paris, France): *Climatic studies from space observations*
- J.-E. Kristjánsson (University of Oslo, Norway): *Climate impacts of energetic particles*
- H. Schmidt (Max-Planck Institute for Meteorology, Hamburg, Germany): *Climate impacts of solar radiation I*
- K. Matthes (GEOMAR, Kiel, Germany): *Climate impacts of solar radiation II*
- C. Price (Tel Aviv University, Israel): *Global circuit and atmospheric electricity*
- I. Usoskin (University of Oulu, Finland): *Cosmic rays in the Earth's atmosphere*
- C. Stubenrauch (LMD, Paris, France): *The IPCC*

Several weeks before the school, each student had received from one lecturer a question related to one particular process or issue addressed in his/her lecture. This student was then asked to stand up during the lecture and present the answer when invited to do so. This exercise was meant to be a simple tool for getting students more deeply involved. One of its positive side effects was a welcome break in the lectures. Another positive effect - which was not immediately perceived by the students themselves - was that it forced all of them, some for the first time in their life, to openly answer a scientific issue. Some were hesitating, but all of them did a wonderful job. The absence of any evaluation and the supportive attitude of all the lecturers of course helped too.

The computer class was held at the university of Thessaloniki and was given by E. Tanskanen (Finnish Meteorological Institute, Helsinki, Finland). She introduced the students to the Substorm Zoo (<http://www.substormzoo.org>), an interactive web-based tool she used to teach the students how to handle solar-terrestrial data. That visit to the university was followed by an excursion through the old city of Thessaloniki and dinner downtown.

Two evenings were devoted to watching *The great global warming swindle* (directed by M. Durkin) and *An inconvenient truth* (by A. Gore) movies. These movies take quite opposed stands on the causes of climate change issue, with seemingly reasonable facts to support their position. On the third evening, a debate was organised: the students were split into two teams, each of which had to defend the message of one of the movies. Only scientific arguments were allowed, no personal attacks. The debate was animated but progressively got bogged down as it became hard to oppose facts with more facts. A positive outcome of this dissatisfying exercise was the increased awareness for the numerous pitfalls a debate can lead to, and the continuous need for keeping a critical look at all the information we receive. At the end of the debate, Thierry Dudok de Wit showed a detailed argumentation on each approach.

The poster session allowed the students to present their *own* work and thereby reverse the otherwise unidirectional flow of information. Incidentally, such activities, together with the grouping of all participants in the same hotel (with no other guests at that time of the year) greatly helped foster interactions between the students, and between the students and the lecturers.

Finally, each day ended with a 30-minute assessment session, during which students were asked to express what they had learned during the day. This break was appreciated for helping to better assimilate the main message of the lectures.

Financial issues

Participation in this school was entirely free of charge, but students were encouraged to contribute at least partly to their travel expenses. Eventually, 13 students out of 28 asked for (and obtained) full reimbursement of their travel expenses. This brought the total budget of the school to approximately 35 kEuro, out of which 5.5 kEuro were provided by SCOSTEP, IUGG (ICMA) and COSPAR.

The funding of this school turned to be a major challenge because COST has strict rules regarding the countries that are eligible for participation. However, thanks to additional support from SCOSTEP, IUGG and COSPAR, all selected participants could be supported, regardless of their country or origin.

Evaluation

Students were asked to complete an online and anonymous evaluation form. Rather than seeking grades, we asked for explicit suggestions and comments on what went well or should be changed. The general pattern is a high degree of satisfaction. In particular, the various original pedagogical aspects of the school (such as the assessment of the day, the debate, etc.) were well received or at least brought a welcome complement to standard lectures. However, we feel that there still is much room left for improvement. In particular:

- Several students expressed difficulties in following lectures on topics that were outside of their field of expertise, except when there was a focus on commonalities between fields. This highlights the importance of conveying information on the basic physical interpretation of the underlying mechanisms rather than on specific issues and nomenclature.
- The debate showed how unprepared we are for bringing scientific concepts to the public, and when facing opposition. Clearly, more effort should be spent on helping students and lecturers communicate on controversial issues.
- This five-day school was too short to allow for hands-on computer sessions and real team work. The next school to be organised by TOSCA will be twice as long, with several practical sessions, and projects in which students will have to work in teams.
- *"If you're not prepared to be wrong, you'll never come up with anything original"*. This statement by Ted Robinson reflects well our reluctance to try out new ideas for testing the various mechanisms that govern the Sun-Earth system. We need to find new ways of encouraging students to look beyond the field in which they were educated, and be more creative in proposing new ideas.

- Finally, there is a definite need for innovating the pedagogy of such a school, even though all lecturers had at least some experience in teaching. The classical scheme with students listening passively to lecturers (no matter how smart) is still too commonplace and is far from ideal for conveying information. Introducing more tools for letting students participate actively and use their creativity, is a priority.

Acknowledgements

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- Committee for Space Research ([COSPAR](#))
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Stergios Misios (together with Kleareti Tourpali) handled all the local issues and did a marvelous job in preparing the school in every detail.

For more information about the school, see <http://sun2climate.sciencesconf.org>. In particular, the lectures and additional material can be downloaded from that website (after registration).

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Kleareti Tourpali (Aristotle University)
Jean Lilensten (IPAG, Grenoble)

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