ClimEco & MegaCity Young Scientist Summer School (YSSS)

"Multi–Scales and –Processes Integrated Modelling, Observations and Assessments for Environmental Applications"

Location/ Host: Moscow State University (MSU, Moscow, Russia)

	Day 0 Monday 27 Jul	Day 1 Tuesday 28 Jul	Day 2 Wednesday 29 Jul	Day 3 Thursday 30 Jul	Day 4 Friday 31 Jul	Day 5 Saturday 1 Aug	Day 6 Sunday 2 Aug	Day 7 Monday 3 Aug	Day 8 Tuesday 4 Aug	Day 9 Wednesday 5 Aug	Day 10 Thursday 6 Aug
08:30 – 09:15	Arrivals of YSSSchool participants & accommodation	Registration continued at 09:00 - Welcome speech & practical info from local organizers	L4. Earth System Modelling and specific challenges (Risto Makkonen, UHEL/ FMI)	L8. Seamless online integrated modelling and specific challenges (Alexander Baklanov, WMO & Alexander Mahura, UHEL-INAR)	L12. Atmospheric gas-phase chemistry (Andrei Skorokhod, IPA RAS)	L16. Biogenic / natural emissions (Michael Boy, UHEL-INAR & Risto Makkonen, UHEL-INAR/ FMI)	ALL DAY FREE TIME (!) *But Remember About Your Research Projects*	L20. Ground-based observations: basics, approaches, applicability (Natalia Chubarova, MSU)	L25. European strategy in hydro-/meteo, ecosystems and atmospheric composition monitoring (Tuukka Petäjä, Jaana Back, UHEL-INAR)	L29. GIS technologies in environmental sciences (Part 1) (Timofey Samsonov/ Pavel Terskiy, MSU)	SSRPs
09:20 – 10:05		L1. Introduction to Pan-Eurasian EXperiment (PEEX) programme (Sergej Zilitinkevich/ Hanna Lappalainen/ Markku Kulmala, UHEL)	L5. Hydrological modelling and specific challenges (Sergey Chalov, MSU)	L9. Process-based modelling for meteorology-chemistry-aerosol system and specific challenges (Michael Boy, UHEL)	L13. Atmospheric liquid-phase chemistry (Andrei Skorokhod, IPA RAS)	L17. Anthropogenic emissions (Alexander Mahura & Michael Boy, UHEL-INAR)	SOCIAL ACTIVITIES & SIGHTSEEING & EXCURSIONS IN THE CITY	L21. Remote sensing observations: basics, approaches, applicability (Oleg Sizov, UTMN/ MSU)	L26. Russian strategy in hydro-/meteo, ecosystems and atmospheric composition monitoring (Sergey Chalov, MSU)	L30. GIS technologies in environmental sciences (Part 2) (Vsevolod Moreido, MSU)	SSRPs
10:05 – 10:25		Coffee/ Tea Br.	Coffee/ Tea Br.	Coffee/ Tea Br.	Coffee/ Tea Br.	Coffee/ Tea Br.		Coffee/ Tea Br.	Coffee/ Tea Br.	Coffee/ Tea Br.	Coffee/ Tea Br.
10:25 – 11:10		L2. Introduction to ClimEco project, current status & challenges Earth system research (atmosphere) (Sergej Zilitinkevich, UHEL- INAR/ FMI)	L6. Numerical weather prediction and specific challenges (Pavel Konstantinov, MSU & Alexander Mahura, UHEL-INAR)	L10. Atmospheric boundary layer processes, modelling and challenges (Part 1) (Sergej Zilitinkevich, UHEL-INAR/ FMI)	L14. Aerosol properties, dynamics, chemistry and microphysics (Olga Popovicheva, MSU)	L18. Chemical and meteorological data assimilation (Pavel Konstatntinov, MSU & Alexander Mahura, UHEL-INAR)	ALL DAY FREE TIME (!) *But Remember About Your Research Projects*	L22. PEEX and Global SMEAR concept (Hanna Lappalainen, UHEL-INAR)	L27. Meteorological and hydrological measurements (Pavel Konstantinov, Pavel Terskiy, MSU)	L31. Environment assessment – land, water, terrestrial ecosystems (Dmitrii Orlov, MSU)	Students' oral presentations
11:15 – 12:00		L3. Introduction to MegaCity project, current status & challenges Earth system research (hydrosphere) (Sergey Chalov, MSU)	L7. Atmospheric chemical transport modelling and challenges (Alexander Baklanov, WMO & Alexander Mahura, UHEL-INAR)	L11. Atmospheric boundary layer processes, modelling and challenges (Part 2) (Sergej Zilitinkevich, UHEL-INAR/ FMI)	L15. Aerosol - cloud - radiation interactions (Natalia Chubarova, MSU)	L19. Evaluation of models and verification (Pavel Konstatntinov, MSU & Alexander Mahura, UHEL-INAR)	SOCIAL ACTIVITIES & SIGHTSEEING & EXCURSIONS IN THE CITY	L23. SMEAR – atmospheric composition measurements (Part 1) (Tuukka Petäjä, UHEL-INAR)	L28. Urban scale measurements (Pavel Konstantinov, Mikhail Varentsov, MSU)	L32. Human health assessment (Dmitrii Orlov/ Pavel Konstantinov, MSU)	Students' oral presentations
12:00 – 13:00		Lunch	Lunch	Lunch	Lunch	Lunch		Lunch	Lunch	Lunch	Lunch
13:00 – 14:30		Introduction to SSRPs (in separate groups)	SSRPs	SSRPs)	SSRPs	*MSU University Excursion (after lunch)*	ALL DAY FREE TIME	L24. SMEAR – ecosystem measurements (Part 2) (Jaana Back, UHEL-INAR)	Online webinar from SMEAR -I, -II, -III (students & researchers at Varrio, Hyytiala, Helsinki stations)	SSRPs	Students' oral presentations
14:30 – 15:00		Coffee/ Tea Br.	Coffee/ Tea Br.	Coffee/ Tea Br.	Coffee/ Tea Br.			Coffee/ Tea Br.	Coffee/ Tea Br.	Coffee/ Tea Br.	Coffee/ Tea Br

15:00 – 16:30	Registration started & useful info	SSRPs	SSRPs	SSRPs	SSRPs	SSRPs	SOCIAL ACTIVITIES	SSRPs	SSRPs	SSRPs	Awarding diplomas & Official closure of YSSSchool
16:30 – 17:00		SSRPs	*Coffee/ Tea Br.*	SSRPs	*Coffee/ Tea Br.*	*Coffee/ Tea Br.*	&	*Coffee/ Tea Br.*	SSRPs	*Coffee/ Tea Br.*	*Free time & Departures on 6-7 August*
17:00 – 18:00+		*Ice Breaking Party*	*SSRPs*	*Barbeque/ Sports/ Socializing*	*Poster Session/ Socializing*	*Poster Session/ Socializing*	SIGHTSEEING & EXCURSIONS IN THE CITY	*SSRPs*	*Barbeque/ Sports/ Socializing*	*SSRPs*	

	Lectures blocks covering aspects of:	• B1 – Introduction to ClimEco & MegaCity projects, PEEX programme, current status and challenges Earth system research (atmosphere-hydrosphere); • B2 – Modelling (Earth system, numerical weather prediction, atmospheric chemical transport, online integrated, atmospheric boundary layer) and specific challenges; • B3 – Chemistry (gas, liquid) and aerosols (properties, dynamics, chemistry, microphysics, interactions); • B4 – Emissions, data assimilation, models evaluation; • B5 – Ground-based and remote sensing observations; EU and Russian strategies for hydro-meteorological, ecosystems and atmospheric composition monitoring; SMEAR concept and SMEAR stations measurements (including webinars); measurements for atmospheric composition, ecosystems, meteorological, hydrological, urban scale; • B6 - GIS technologies in environmental sciences; Environment (land, water, terrestrial ecosystems) and human health assessment.
	Practical exercises:	as **Small-Scale Research Projects (SSRPs)** on multi-scales and –processes modelling, observations, data visualization, analysis, and assessment for environmental applications (max 4-6 students per each project; max school capacity --- 40 participants/persons for school in total) led by teachers - Risto Makkonen, Michael Boy, Alexander Mahura, Roman Nuterman – whom designed and realized SSRPs with students SSRPs are arranged from 1st day until official oral presentation/ defence of research projects' outcomes on the last day of the school Proposed Models for SSRPs (& responsible teachers): ➢ **Resp. Michael Boy - MALTE-box (2 SSRPs)** (*see Boy et al., 2006, 2011*) is the zero-dimensional version of the original model MALTE (Model to predict new Aerosol formation in the Lower TropospherE). The aerosol dynamics are solved with UHMA (University of Helsinki Multicomponent Aerosol model). This code is a size segregated (hybrid sectional) model, and includes all the basic aerosol dynamical processes: nucleation, coagulation, condensation and dry deposition. The model has been successful in predicting new particle formation events observed at the Hyytiälä measurement station and is being developed actively. The gas-phase chemistry is modelled with MCMv3.3.1 + a unique mechanism that describe the formation of Highly Oxygenated Molecules (HOM) via autoxidation of volatile organic compounds. ➢ **Resp. Alexander Mahura & Roman Nuterman - Enviro-HIRLAM (4 SSRPs)** (*see Baklanov et al., 2017*) is a fully online-coupled ACT-NWP (Atmospheric Chemistry Transport – Numerical Weather Prediction) modeling system for regional-, meso- and urban scale different environmental applications. The NWP part developed by HIRLAM consortium is used for operational weather forecasting. The Enviro-components were mainly developed in a close collaboration with the Universities from different countries. It includes of gas-phase chemistry CBMZ and aerosol microphysics M7 which includes sulfate, mineral dust, sea-salt, black and organic carbon. There are modules of urbanization for land surface scheme, natural and anthropogenic emissions, nucleation, coagulation, condensation, dry and wet deposition, and sedimentation of aerosols. The Savijarvi radiation scheme has been improved to account explicitly for aerosol radiation interactions for 10 aerosol subtypes. The aerosol activation scheme was also implemented in STRACO condensation-convection scheme. The nucleation is dependent on aerosol properties and the ice phase processes are reformulated in terms of classical nucleation theory. ➢ **Resp. Risto Makkonen - EC-Earth (2 SSRPs)** (*see Hazeleger et al., 2010*) is developed jointly by 28 European research institutes. The Coupled Model Intercomparison Project 5 (CMIP5) was the first CMIP for EC-Earth. EC-Earth comprises of atmosphere model IFS, ocean model NEMO and vegetation model LPJ-GUESS, coupled with OASIS coupler. Aerosols and chemistry are included through the global chemistry-transport model TM5. The Integrated Forecasting Model (IFS) is the atmospheric model developed at European Centre for Medium-Range Weather Forecasts. The IFS is coupled to the ocean model NEMO, which is run with 1º horizontal resolution and 42 vertical levels. The ice model LIM is coupled directly to the ocean model. EC-Earth describes aerosols using a 7-mode size distribution (*Vignati and Willson 2004*), with 4 soluble and 3 insoluble modes. TM5 includes most abundant aerosol species: sulfate, black carbon, organic carbon, sea salt and mineral dust. TM5 uses a grid of 3º×2º for aerosols and chemistry.
	Introductions & Finals:	Registration of participants, useful and practical information (participant folder), welcome from the host Oral presentations & defence of SSRPs – with awarding certificates/ diplomas (**5 ECTS credits**) ceremony for students successfully presented and defended their projects, and official closure of the school Note: • YSSS training includes lecture material and realization of practical exercises as SSRPs followed by oral presentations on the last day (6 August) of the school & by completion of a short joint summary report per each SSRP (by each group of students); • For each student the gained experience will include: realization of SSRP; working as an international team of young researchers; utilization of individual best skills; working as a member of a team; learning collaboration and communication skills and attitude between teams involved in other SSRPs; opportunity to address scientific and technical questions to lecturers and teachers; preparation of oral presentations and project report in English. • For young researchers the useful experience will also include: technical aspects of the models setup; steps of compilation; running the model with different settings (reference run, modified runs; with different time steps; horizontal resolutions, selected forecast lengths, etc.) and controlling the model runs (compilation, initialization, climate files generation, preparation of boundary conditions, steps of forecasting, etc. through graphical interface). • Moreover, students will also improve experience on visualization and analysis of modelling results using different research tools (Metgraf, Grads, Metview, Python, MatLab, etc.), spatial-temporal representation of 2D and 3D surface and model levels data for various meteorological, climatological, and chemical/aerosol parameters, etc.
	Socializing events:	• Ice-breaking party /non-alcoholic/ & socializing (28 July); • Barbeque/ sports/ socializing (30 July & 4 August); • Poster session (31 July – 1 August) - students can bring A0-size posters on their on-going or completed research projects (for the best poster award) & for publication in special issue of GES (https://ges.rgo.ru/jour) journal; including possibilities to publish outcomes of SSRPs; • Excursion to MSU University, Faculty of Geography (1 August, Saturday); • Sightseeing and excursion to centrum of the city of Moscow (2 August, Sunday).