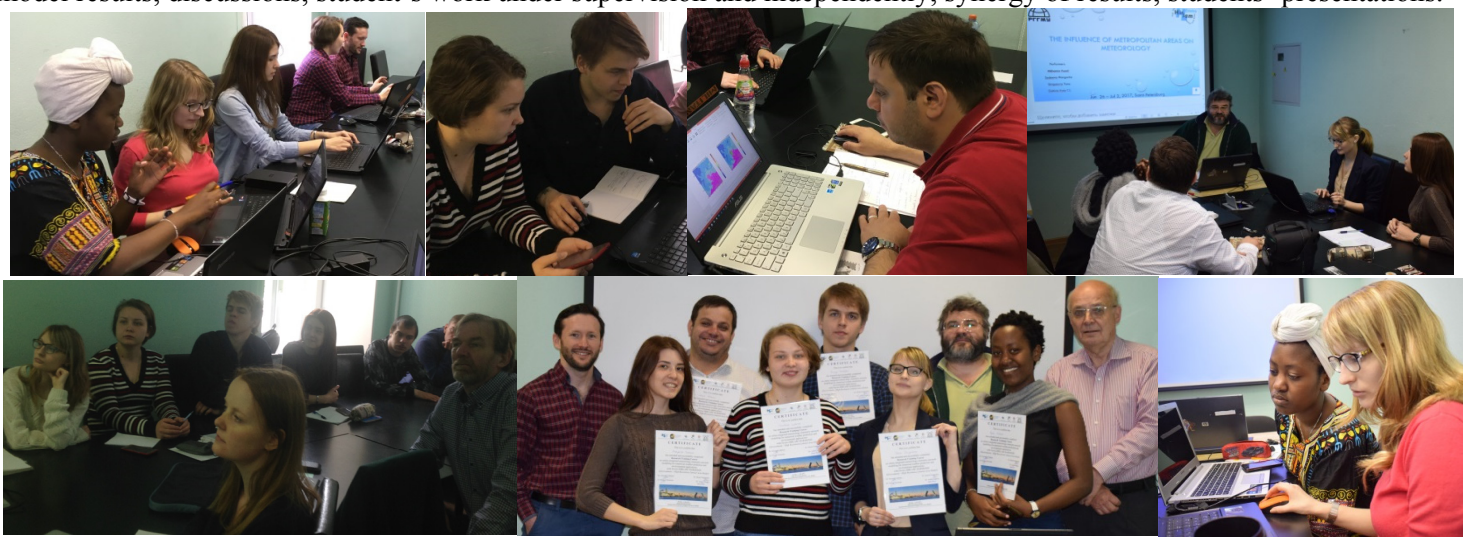
During 26 Jun – 1 Jul 2017 the research training course on seamless/ online integrated meteorology-chemistry-aerosols modelling with the Enviro-HIRLAM (Environment - High Resolution Limited Area Model) for numerical weather prediction and environmental applications was organized and carried out at the Russian State Hydrometeorological University (RSHU, St. Petersburg, Russia). This training is part of the Nordic–Russian cooperation within joint CRAICC (*Cryosphere-atmosphere interactions in a changing Arctic climate*) – CRUCIAL (*Critical steps in understanding land surface – atmosphere interactions: from improved knowledge to socio-economic solutions*) project as integral part of the PEEX Programme (Pan Eurasian EXperiment; https://www.atm.helsinki.fi/peex) research and educational activity. It is performed to strengthen collaboration and build direct links between PEEX Nordic and Russian key investigators and involved institutes; to make design enabling longer-term top-level research activities within PEEX framework; and to establish student training and short-term exchange between institutes.

Drs. Alexander Mahura (University of Helsinki, Finland), Roman Nuterman (University of Copenhagen, Denmark), Anders Persson (University of Uppsala, Sweden) and Eduard Podgaiskii (RSHU) have organized and carried out the training. Training was based on experience of the Young Scientist Summer Schools (YSSS, latest – Jul 2014; http://aveirosummerschool2014.web.ua.pt) and Enviro-HIRLAM Research Training weeks (latest at RSHU – Jun 2015) with realization of small-scale research projects (SSRP). In this case the advanced approach was taken and SSRP projects included 3 main blocks based on the Enviro-HIRLAM model simulations: 1) Impact of metropolitan areas at fine scale on meteorology (with focus on Paris, France), 2) Impact of aerosols at regional scale on meteorology (with focus on St. Petersburg, Russia), 3) Operational meteorology and atmospheric composition forecasting for environmental applications (with focus on Shanghai, China). Training format included lecturing, aspects of modelling, visualization and data analysis of model results, discussions, student's work under supervision and independently, synergy of results, students' presentations.



The course content included the lecturing on advantages of on-line/ seamless modelling; Enviro-HIRLAM model schematics, structure, components, downscaling, collaboration, research and development, science education, dissemination, new products and applications; urban areas and their characteristics, urban boundary layer, approaches and treatment of land-cover/use and urbanization of the models; urban lands, urban districts in metropolitan areas: classification and characteristics; global aerosol cycles, aerosols feedbacks, emissions, aerosol microphysics and implementation in the models; examples of Enviro-HIRLAM applications for Copenhagen, Paris, Shanghai and their metropolitan areas (from completed research projects), computational requirements and resources for operational runs. The lecturing also included a series of educational lectures on the monitoring of the ECMWF forecast system; group velocity thinking (in contrast to PV-thinking); statistical verification and validation of NWP systems; Kalman filtering of operational NWP; Bayesian statistics; Coriolis force and Coriolis effect; questions of concern and importance for dynamical meteorology. In addition, the seminar "Whole atmosphere model predictions with specified meteorology" was given by Dr. Valery Yudin (NCAR, Boulder, USA).

Practical realization of the SSRPs included introduction into exercises with background discussions; analysis of meteorological situations for selected dates; technical aspects of modelling and urban and aerosol modules implementation; analysis of Enviro-HIRLAM model runs for selected dates/cases and different modules; visualization of model output/ results; analysis of urban areas and aerosols impact on meteorology; oral presentation of SSRP results (project defence). All necessary materials (such as lectures notes, workbook on SSRP, supplementary materials, etc.) were freely distributed among the participants (http://rus.ums.rshu.ru/news/EnviroHIRLAM-HARMONIE2017). Training course was done in dual languages - English (lecturing) / Russian (practical exercises and discussions).

The students, whom have attended the lectures, realized all 3 main blocks of the research projects and successfully defended these projects with oral presentations, were awarded the research training certificates.

Especial thanks to the local RSHU organizers – Anastasia Kaptsova (International Relations Office) & Profs. Sergey Smyshlayev and Alexander Pogoreltsev (Department of Meteorological Forecasting)