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Main field: Earth Sciences & Environment

Dr. Mykhailo Savenets, Ukrainian Hydrometeorological Institute, Kyiv, Ukraine

"Integrated Modelling for Assessment of Potential Pollution Regional Atmospheric Transport as Result of Accidental Wildfires"

The study aims to analyze the regional influence of wildfire emissions occurred in the exclusion zone (abandon area) of the Chernobyl nuclear power plant (Ukraine) and to identify the affected territories in case of active fires near and within radioactive polluted spots and in a close proximity to the plant.

Background information

The Chernobyl exclusion zone (CEZ) is the abandon area encircled the Chernobyl nuclear power plant (CNPP, Ukraine). This area is obligatory to be unpopulated due to radioactive pollution after the nuclear accident in spring of 1986. During the last years, the CEZ is often affected by wildfires occurred in the agricultural and forested territories. One of the most severe events was observed in April 2020. The majority of such wildfires appeared after open burning on agricultural lands. Usually, a huge amount of combustion products is emitted into the atmosphere. The firefighting of occurred active fires in the CEZ zone is lengthy, complex, and difficult process, because there is abandon forestry territory with a numerous number of radioactive polluted spots. Therefore, changing atmospheric flows during periods of wildfires lead in multidirectional polluted air masses movement towards various populated regions on national level and bordering European countries. The consequences, including secondary ones, are possibilities and risks of radioactive pollution, health problems, ecosystems damage and possible risks of radioactivity distribution. The Kyiv (capital) metropolitan area is the largest in Ukraine. As it is located rather close to CEZ, and hence, it can be influenced by contaminated air masses arriving from the north and northwestern directions.

Scientific knowledge about the aftermath of wildfires in the CEZ zone plays important role for the society awareness and safety. Firstly, particular scientific results and examples help to explain and educate population on risks from open burning, negative health impact of wildfires and necessity of alternative methods usage in agriculture. Secondly, it allows the government to take effective decisions and measures for wildfires' prevention.

The study requires a series of simulations employing the Enviro-HIRLAM [1] modelling system. Chosen modelling period for each case should cover approximately one month, because usually wildfires in the CEZ zone are lasted for 2-3 weeks. Considering the changing atmospheric transport, the modelling domain for HPC run needs to be enlarged in order to include the CEZ zone, Ukraine and neighboring countries. The Enviro-HIRLAM runs are expected to improve our knowledge about air quality changes during the occurred wildfire episodes. The simulations will also cover episodes with active fires close to nuclear power plant and including radioactive spots. Such runs will include direct aerosol effects for more intense analysis of pollutants' behavior and impact in the atmosphere under unfavorable meteorological conditions.

The proposed study is contribution to the PEEX Modelling-Platform research and development, and in particular, for online coupled integrated meteorology-chemistry-aerosols feedbacks and interactions in weather, climate and atmospheric composition multi-scale modelling [2]. In particular, our recent study showed specific features of spatio-temporal distribution of black carbon atmospheric transport originated from wildfires [3]. Moreover, results of this study will benefit the PEEX programme and, in particular, the Impact on Society platform.

References:

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[2] Mahura, A., Nuterman, R., Nerobelov, G., Sedeeva, M., Smyshlyaev, S., Savenets, M., Pysarenko, L., Krakovska, S., Ivanov, S., Michaelides, S., Ruban, I., Sassi, A.S., Makkonen, R., Baklanov, A., Petaja, T., Zilitinkevich, S., Kulmala, M. (2019): Integrated Multi-Scale Modelling for Meteorology-Chemistry-Aerosol Interactions. Report Series in Aerosol Science (Proceedings of The Center of Excellence in Atmospheric Science (CoE ATM)). No. 226. P.425–429.

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