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Assessing the vulnerability of the transportation industry of Ukraine to future climate change

Inna Khomenko

Odessa State Environmental University, Hydrometeorological institute, Department of Meteorology and Climatology, Odessa, Ukraine (innchom@mail.ru)

Climate change will affect transportation primarily through increases in several types of weather and climate extremes. The impacts will vary by mode of transportation and region of the country, but they will be widespread and costly in both human and economic terms and will require significant changes in the planning, design, construction, operation, and maintenance of transportation systems.
In the study impact of climate change on operation of road transport are analysed on the basis of RCP 4.5 and RCP 8.5 scenarios. Data contains series of daily mean, maximum and minimum temperature, daily liquid (or mixed) and solid precipitation, daily mean relative humidity and daily mean and maximum wind speed, obtained for the period of 2011 to 2050 for 28 cities distributed evenly across Ukraine.
Spatial and temporal distributions of meteorological variables are obtained. The statistic characteristics obtained were compared with the correspondent climate normals and highway-related temporal changeability is determined. Frequency of freezing rain, wet snow, very hot days, droughts, fogs, ice-covered ground, slippery wet ground, ice and snow slippery coat are investigated.
Climate and economic risks to the road transport network are assessed. Maps of spatial distribution of risk assessment are obtained.
The results obtained show typical weather pattern is changed and climate and weather extreme influencing on operation of road transport are more frequent for the both scenarios, but for the RCP 8.5 scenario hazard weather occurs more often. During the period of 2011-2050 significant climate warming (by 2-3°C) is registered. Extreme temperatures are observed more frequently. High temperatures bring on growth in frequency of wildfires and heat waves. Annual precipitation amount decreases, except the western mountain and northern regions, where precipitation amount increase on 35%. Increase in temperature and decrease in precipitation can produce droughts in southern, eastern and central regions. But growth in precipitation in mountain region can cause flooding and landslides. Strong increase in mixed precipitation and significant reduction in ice and liquid precipitation take place for all territory of Ukraine. In the southern region ice precipitation is virtually vanished and observed only 2-3 days per year. Growth of mixed precipitation causes increase in severe weather events such as freezing precipitation, ice-covered ground and snow slippery coat.