MODELLING AND SPATIAL ANALYSIS OF GHG EMISSION PROCESSES: PULP AND PAPER INDUSTRY, FOOD INDUSTRY OF POLAND

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The purpose of this article is the development of mathematical models of greenhouse gas (GHG) emission processes from the production of pulp, paper, food and drink in Polish regions to carry out the GHG spatial distributed inventory, and the spatial analysis of obtained results. The main tasks in the achieving of this goal were: to create a database of major industrial enterprises with their geographical location and the production technology; to construct the digital map of GHG point-type sources (enterprises) using their geographical coordinates; to gather the information on the industrial production volume, and split the statistical data from the country level to the level of an enterprise or elementary area using the specific disaggregation indicator for each category of activity – the production capacity of an enterprise or urban population, respectively; to create the specialized geographic information system (GIS) for spatial analysis of GHG emissions using statistical data on the results of industrial activity, the digital map of voivodeships of Poland, the population density map, the digital map of towns; to carry out computational experiments for the estimation of GHG emissions and make their spatial analysis. The objects of the investigation are the GHG emission processes. The subjects of the investigation are the mathematical models of GHG emission processes during the production of industrial goods (paper, pulp, food and drink) in Poland. The GHG spatial inventory in the industrial sector of Poland hasn't been done yet. The novelty of the article consists in the development of mathematical models of GHG emissions in the industrial sector of Poland that take into account the allocation of emission sources (enterprises), the possibility to use the specific emission factor for the enterprise, and the providing an opportunity to build GHG spatial inventories. The mathematical models of GHG emissions in the industrial sector have a practical value for the government agencies of Poland in solving the complex environmental and economic problems to reduce GHG emissions in their respective territories. In the result of numerical experiments the estimates of GHG emissions for each category of pulp-paper industry and food industry at elementary areas 2×2 km of Poland, and on the level of enterprises have been obtained.

Keywords – geoinformation technology, mathematical modeling, greenhouse gas emission, food industry, spatial inventory, Poland.