


Chapter 3

Program for Analysis of the Total Content of the Atmosphere Gase Components Based on the Data From Sentinel–5P Satellite Instrument

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ABSTRACT

Today, tracking the processes occurring with our planet, especially those things that directly affect not only the quality of our life, but also directly the possibility of life on planet Earth. One of these processes is the gas component of our planet, namely the different content of gas components in the Earth's atmosphere, such as ozone, methane, nitrogen oxide, and so on. The current problem that this work solves is that in the upper atmosphere of planet Earth, the problem of studying long-term trends in its various characteristics and analyzing the causes of these trends is becoming increasingly relevant. An important scientific task at present is to study the global picture of the gas components of the atmosphere and identify the contributions of anthropogenic and natural factors that determine this phenomenon.

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INTRODUCTION

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The study of spatiotemporal variability of gases in the atmosphere is a topical issue due to the influence of various gas components on climate, as well as its toxicity and high oxidizing capacity in the troposphere. The object of the study is the atmosphere of planet Earth (Serreze M.C., 2010, Bilgili M., 2024), and the subject of the study is its gas components, which have a significant impact on the environment depending on their composition and method of use. Some gases, such as carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), are greenhouse gases that contribute to global warming and climate change. These gases enter the atmosphere as a result of various human activities, such as the burning of fossil fuels, deforestation and agriculture. Atmospheric gases such as sulfur dioxide, nitrogen oxides, and volatile organic compounds can contribute to air pollution and have negative impacts on human health and the environment.

These gases enter the atmosphere as a result of industrial processes, transportation, and other human activities. Exposure to high levels of near-earth ozone can cause breathing problems such as coughing and shortness of breath, as well as exacerbation of asthma and other lung diseases. Ozone can also damage crops and other vegetation, reducing their growth and productivity. The practical significance of the dissertation is the importance of tracking and monitoring emissions of gas components into the environment in order to minimize their impact and protect the planet. This can be achieved through a variety of measures, such as reducing emissions, using cleaner technologies, and implementing regulations and policies that promote sustainable practices, but there must be credible ways to monitor and track changes.

Various means are used to measure and track the content of these gas components in the atmosphere. In this work, the Sentinel-5P satellite and the TROPOMI (Veefkind J.P., 2012, Mehrabi M., 2023) device installed on it were chosen as a means of collecting information. The TROPOMI device allows you to create a map of many trace gases, such as nitrogen dioxide, ozone, formaldehyde, sulfur dioxide, methane, carbon monoxide and aerosols - all of which affect the air we breathe, and therefore our health and climate. This work is devoted to the development of a method for obtaining an estimate of the content of a gas component, as well as the development of software with which the user will be able to track the current state of the atmosphere, namely the content of any gas components in it, and also clearly see the process of changing the gas component over a certain period of time. Sentinel-5P (Inness A., 2019) uses an orbit with a high inclination (approximately 98.7 °).

Orbital inclination is the angular distance of the orbital plane from the equator. Sentinel-5P's orbit is a near-polar, sun-synchronous orbit with an equatorial intersection of the ascending node at 13:30 hours mean local solar time. In a sun-synchronous orbit, the surface is always illuminated at the same angle to the Sun. The orbital cycle is 16 days (14 orbits per day, 227 orbits per cycle). An orbital cycle is the time it takes for the satellite to pass over the same geographic point on the earth. The reference altitude of the orbit is approximately 824 km. The instrument has a 108° swath (about 2600 km on the

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