**Critical Review at «Quantifying CO2 Emissions from Individual Power**

**Plants from Space» by Ray Nassar et al. (October, 2017)**

In this paper by Nassar et al. quantitative estimates of anthropogenic carbon dioxide emissions from a number of coal-fired power plants are presented. The issue of controlling the global climate by limiting the emission of greenhouse gases has a wide relevance to the international community. From 1951 to 2010, the increase in the average temperature of the Earth's surface due to the influence of greenhouse gases is estimated at 0.5 – 1.3 ºC, while the greatest anthropogenic contribution is made by CO2, which is the subject of this research. The authors use data from the NASA Orbiting Carbon Observatory 2 (OCO-2) space mission for calculations. The satellite has been functioning since 2014. The OCO-2 instrument has excellent accuracy in measuring the CO2 total column (about 0.1 – 0.4 %), and a very high horizontal resolution (about 1.3 x 2.3 km). In view of the above, the topic raised in this work is important, the data used is very valuable, and requires a comprehensive analysis.

The presented research methodology is quite simple. The authors consider a number of middle- to large-sized coal-fired power plants with emissions more than 10 megatons per year. The authors believe that carbon dioxide transport from a power plant depends on the horizontal wind speed at the plume height. Therefore, they use the wind field ERA reanalysis data, at the emission height. To simulate the plume, the authors use the simplest Gaussian plume, suggesting that the source of emissions is a point. For this purpose, time series of total column CO2 satellite observations from the leeward side of power plants are selected. Authors then model the plumes from power plants and compare them with the increased values in these satellite time series. As a result, the authors determine the amount of anthropogenic CO2 emissions.

In general, the approach of the authors seems reasonable. The point source approximation on the considered scale, is justified. Applying the Gaussian plume model at this scale is a logical step. However, some questions arise.

- The authors use wind speeds practically only at one altitude level (about 250 meters), while more advanced Lagrangian dispersion models show that vertical transport can be significant. In fact, emissions can spread up to the height of the boundary layer. Perhaps the authors lose a lot of information because of this simplification.

- Their method of determining the background CO2 content near the sources is controversial. It must be kept in mind, that carbon dioxide has the property to accumulate, so you can expect, in general, an increased CO2 content near the source. I believe that this issue requires a more thorough analysis of wind speeds, including an analysis of changes in speeds over a long period (1-2 days) before satellite measurements.

- Some of the presented errors in emission estimates are questionable. For example, the authors argue that the emission estimation error for the Westar Jeffrey Energy Center is only about 10%. However, figure 1 clearly shows that they operate with values of anthropogenic contribution to the total column CO2 of about 1-2 ppm (parts per million). But the error of OCO-2 satellite measurements is about 0.4 – 1.5 ppm at best.

Nevertheless, the results of the work, in the main, are in good agreement with the official reported emissions. Given that this is one of the first papers devoted to such interpretation of satellite data, the result is more than good. The main problems faced by the authors are the limited spatial and temporal coverage of satellite data, high uncertainty in the carbon dioxide transfer processes, and relatively low (for this task) error of satellite measurements. Some of these problems may be resolved in the near future, and some are unlikely. In general, we can conclude that the results presented are useful, and further work in this direction is desirable.