

Creating a Global CO₂ Grid from Nighttime Lights Imagery

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The potential use of satellite observed nighttime lights for estimating CO₂ emissions has been demonstrated in several previous studies. However, the procedures for fine resolution global map of fossil fuel CO₂ emissions based on nighttime lights are still in the developmental phase. We report on progress of developing a method for mapping distributed (excluding major point sources) fossil fuel CO₂ emissions at 30 arc-second resolution using nighttime lights data collected by the Defense Meteorological Satellite Program's Operational Linescan System along with population count data from the U.S. Department of Energy's LandScan grid. The Vulcan sectoral carbon emissions data for the continental United States (U.S.), for the year 2002, produced by the Purdue University are being used for modeling CO₂ emissions from nighttime lights imagery. A statistical analysis of the Vulcan sectors indicated that lights and population count are well correlated to the emissions from the mobile, commercial, residential, industrial, and aircraft sectors, which together account for more than 50 percent of non-point sources of carbon emissions in the continental U.S. We are testing the model by aggregating the input data to different resolutions. The regression coefficients derived through the models developed for the U.S. will be applied to the nighttime lights data for the whole world to create a 30 arc-second or 1 km² resolution global grid of estimated CO₂ emissions for the year 2000. The estimated CO₂ emissions from the nighttime lights imagery will be aggregated to the national level and compared with the published CO₂ emission estimates derived from the Carbon Dioxide Information Analysis Center. The resulting CO₂ emission grid may be a useful input to CO₂ flux models.



Figure 1. Nighttime lights of the U.S. (2000). Source: Earth Observation Group, the NOAA, National Geophysical Data Center.



Figure 2. Sum of carbon emissions data of the mobile, commercial, industrial, residential, and aircraft sectors in the U.S. (2002). Source: Project Vulcan, Purdue University, Department of Earth and Atmospheric Sciences.