Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

HGG21-04 Room:101A Time:May 27 15:00-15:15

Improvement of spatial resolution for anthropogenic carbon dioxide emission inventory in Osaka Prefecture

MORI, Yutaka[1*] ; MACHIMURA, Takashi[1] ; MATSUI, Takanori[1] ; ODA, Tomohiro[2]

[1]Graduate School of Engineering, Osaka University, [2]NOAA

1. Introduction

To promote strategic reduction of carbon dioxide emission, MRV (Measurement, Reporting and Verification), which assess, disclose and validate the national emissions, is indispensable. Recently, nations predict the emission by the statistics of fossil fuel consumption, besides the complemental validation methods by satellite and atmospheric observations and inversion models are developed, where emission inventory methodology in the finer spatial and temporal resolution is required to bridge them. Hestia Project in Indiana Polis, US predicting the emissions from every streets and buildings, is the one achieved the finest resolution at present, and EAGrid2010-Japan having the resolution of 1 km is the finest in Japan. This study developed the carbon dioxide emission inventory, MORI-Grid2014 (Multiscale Osaka-Resolving Inventory for Greenhouse gas information and diagnosis), having the variable spatial resolution of 500 m and the finer in Osaka Prefecture, Japan.

2. Method

MORI-Grid2014 classified emission sources into point, line and distributed sources. The point sources consisted of thermal power plants, waste incineration plants and aircrafts (in airports), line source of road traffics (major regional roads and the higher), and distributed sources of road traffics (prefectural roads and the lower), the sectors of manufacturing, construction and mining, agriculture and forestry, business and residents. Annual emissions from the point and line sources was predicted by a bottom-up approach using generated power, the amount of waste by types, the landing and take-off number by aircraft types, the traffic amount by segments and car types, for the power plants, incineration plants, aircrafts and road traffics, respectively, and their unit emissions. Geographic positions of the point sources were determined by air photos on the Google Map, and those of the line sources by National Land Numerical Information. Annual emissions from the distributed sources was predicted by a bottom-up approach dividing the Prefecture total emissions by sectors proportionally to resident number (for road traffics and residents), labor numbers by sectors (for manufacturing, construction and mining, and agriculture and forestry), and total labor number (for business), where the total emissions by sectors were determined by multiplying the energy consumption by sectors and fuel types by carbon dioxide emission coefficients. The resident and labor numbers were based on the fine scale edition of the National Census, where the numbers in the 500 m grid were employed instead in the case the area of cells was the coarser than the 500 m grid. The statistic years of the data were not unified because the study utilized the most recent sources.

3. Result and discussion

The Prefecture total annual emission by MORI-Grid2014 was 73.75 Mt-CO_2 y^{-1}, which was 1.7% smaller than that of 74.99 Mt-CO_2 y^{-1} by EAGrid2010-Japan, and the difference is probably because in statistic years. Annual emission by sources was 39.79, 5.04 and 28.92 Mt-CO_2 y^{-1} from the point, line and distributed sources, respectively. Annual emission by sectors was 26.72, 12.49, 12.85, 0.58, 8.33, 0.05, 0.74, 8.18 and 3.81 Mt-CO_2 y^{-1} from the power plants, incineration plants, road traffics, aircrafts, manufacturing, agriculture and forestry, construction and mining, business, and residents, respectively. Spatial resolution was 0.044 km^2 in average and 0.265 km^2 at maximum showing a remarkable improvement from that of 1.059 km^2 in average by EAGrid2010-Japan.

MORI-Grid2014 improved the accuracy in positioning the point sources (power and incineration plants). Distance between the positions determined in this study and EAGrid2010-Japan, which utilized postal addresses, was 168 m in average. This difference in positioning caused the error of annual emission from the point sources by 22.68 Mt-CO_2 y^{-1} in total on the 1 km gridded map occupying 30.9% of the total emission.

Keywords: point source, line source, distributed source, bottom-up approach, top-down approach