Estimation of global CO2 emission by biomass burning from 2001 to 2015

*Wataru Takeuchi[1], Soni Darmawan[1], Ryoichi Imasu[2]

1.Institute of Industrial Science, The University of Tokyo, 2.Atmosphere and Ocean Research
Institute, The University of Tokyo

As a cause of global warming, CO2 is most effective green house gas and many countries are trying
to reduce emission of that. However, the report of quantitative description is few still because
the amount of CO2 emission is difficult to estimate for their complex process.This research is to
devise a method to estimate the carbon dioxide (CO2) emissions from biomass burning such as forest
fires and field burning in croplands in Global scale. The methodology consists of mainly three
types of bio-physical parameters including (1) fire hotspots and radiative power measurements by
MODIS thermal anomalies, (2) above ground biomass changes calibrated by MODIS NDVI and LAI indices,
(3) ground water table modeled by MTSAT thermal anomalies and GSMaP rainfall measurements. Field
campaigns were carried out from 2012 April to September in four types of land covers in (1)
mangrove forest in Thailand and Vietnam (2) grassland in Mongolia (3) rice paddy field in Indonesia
and Thailand and (4) forested peatland in Indonesia. Above ground biomass mapping of mangrove
forest was investigated by ALOS PALSAR HH and HV polarimetric backscatter coefficients and an
allometric equations derived by in-situ measurement of biomass parameters. That of grassland in
Mongolia was mapped by MODIS LAI and NDVI, grassland height by ICESaT GLAS supplemented by in-situ
observations. Rice paddy fields cropping patterns were mapped by MODIS NDVI and AMSR-E land surface
water coverage parameters. Ground water table (GWT) was mapped to represent dryness over forested
peatlands and the number of peat fires and peat decomposition were modeled with satellite-derived
GWT and that of in-situ measurement. The estimated CO2 emissions from 2001 to 2015 were
demonstrated and compared with Global Fire Emission Database version 4 (GFED 4) and EDGAR global
database, and discrepancy between the models, challenges and technical problems were also
discussed.

Keywords: land cover change, wild fires, emission inventory