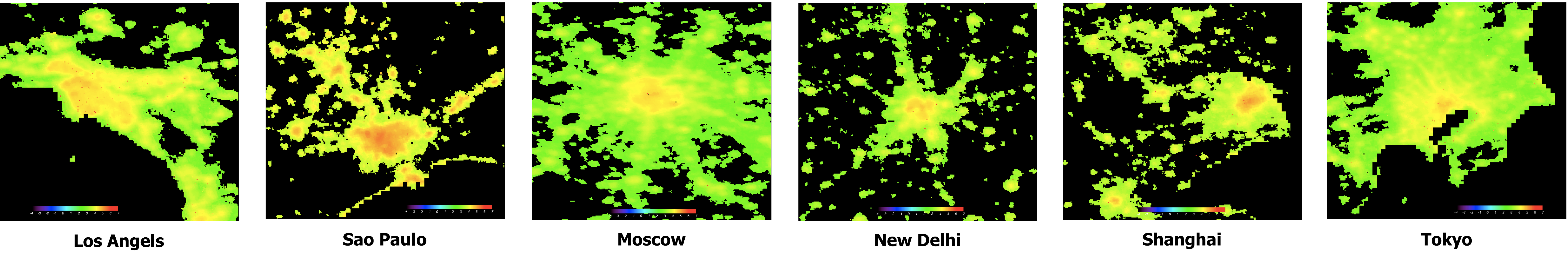
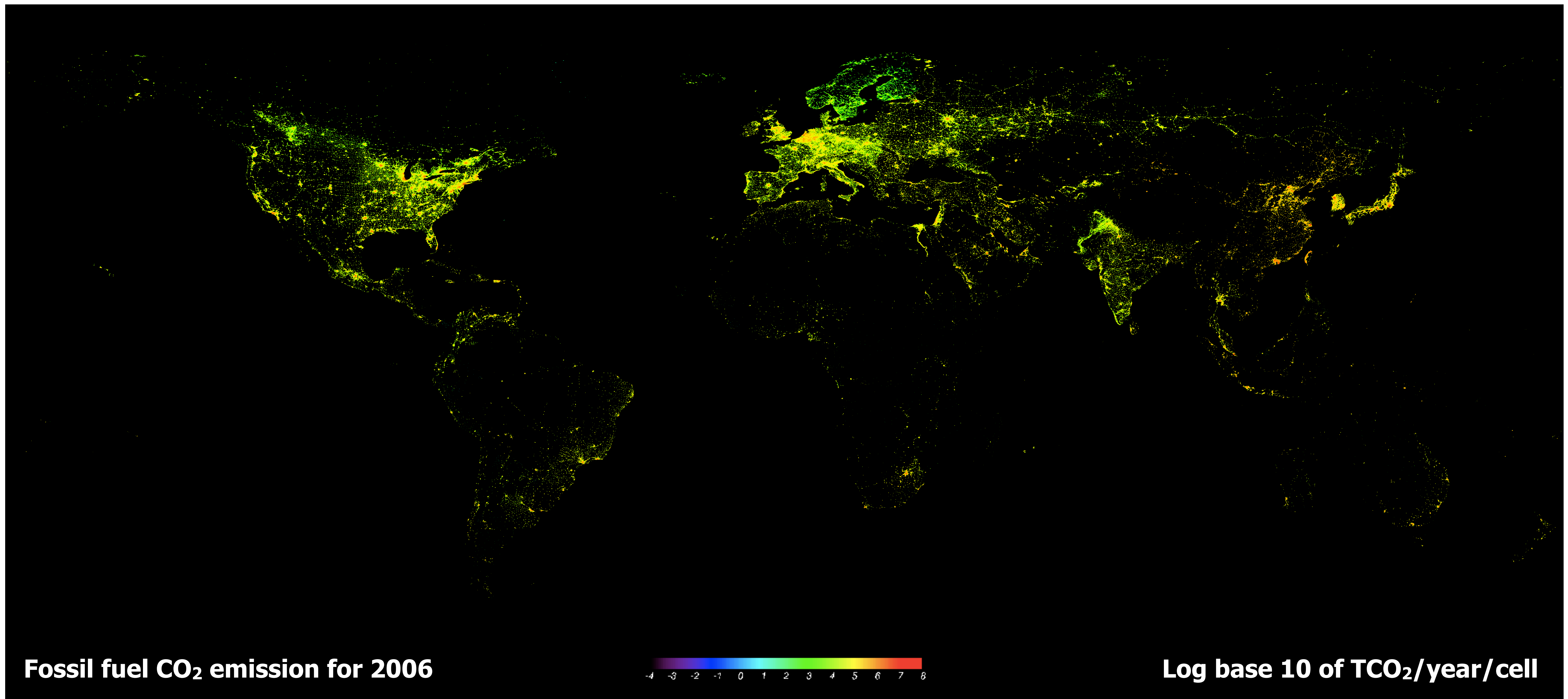


A high-resolution global fossil fuel CO₂ emission mapping using a point source database and satellite-observed nightlight

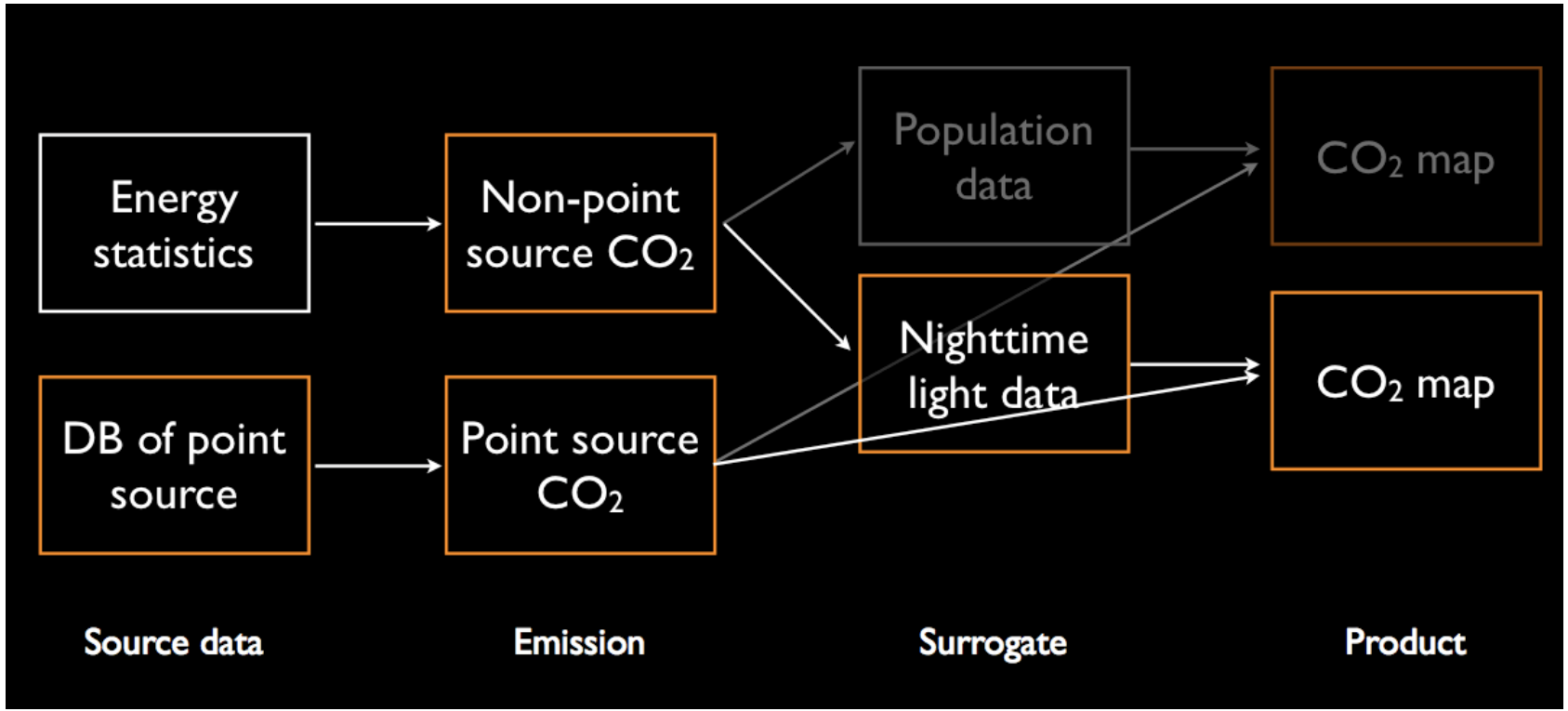


Background and Aim

Global maps of CO₂ fossil fuel emissions are often derived from fuel consumption statistics and population data (e.g., Marland et al., 1984). This is a reasonable approach since global and national total CO₂ emissions from fuel consumption data can be estimated with relatively high accuracy, and population data have reasonable spatial resolution to explain intensity of human activity at state and city spatial scales. Nevertheless, despite a strong correlation between spatial distributions of population and fossil fuel CO₂ emissions, population distribution does not explain emissions from point and line sources such as power plants and heavy transportation. In addition, the relationship between population and emissions is weaker at city level resolutions. In this study, we determine CO₂ emission distributions and subsequently develop a high-resolution global inventory using the CARbon Monitoring for Action (CARMA) database of major CO₂ emission point sources (such as power plants) and Defense Meteorological Satellite Project Operational Linescan System (DMSP-OLS) satellite-observed nightlight data. National emissions from point sources are calculated using the CARMA database and we subtract the point source emission from national total emission calculated from a global fuel consumption statistics. The remaining emissions from non-point sources are distributed using the DMSP-OLS nighttime lights data as a surrogate. The nighttime lights data can indicate the locations of human settlements and activities such as daily land transportations, which do not appear in population distributions. We construct a 27-year inventory by initially determining 2006 emissions distribution and subsequently scaling emissions to worldwide energy statistics (BP p.l.c., 2008) over 1980-2007.



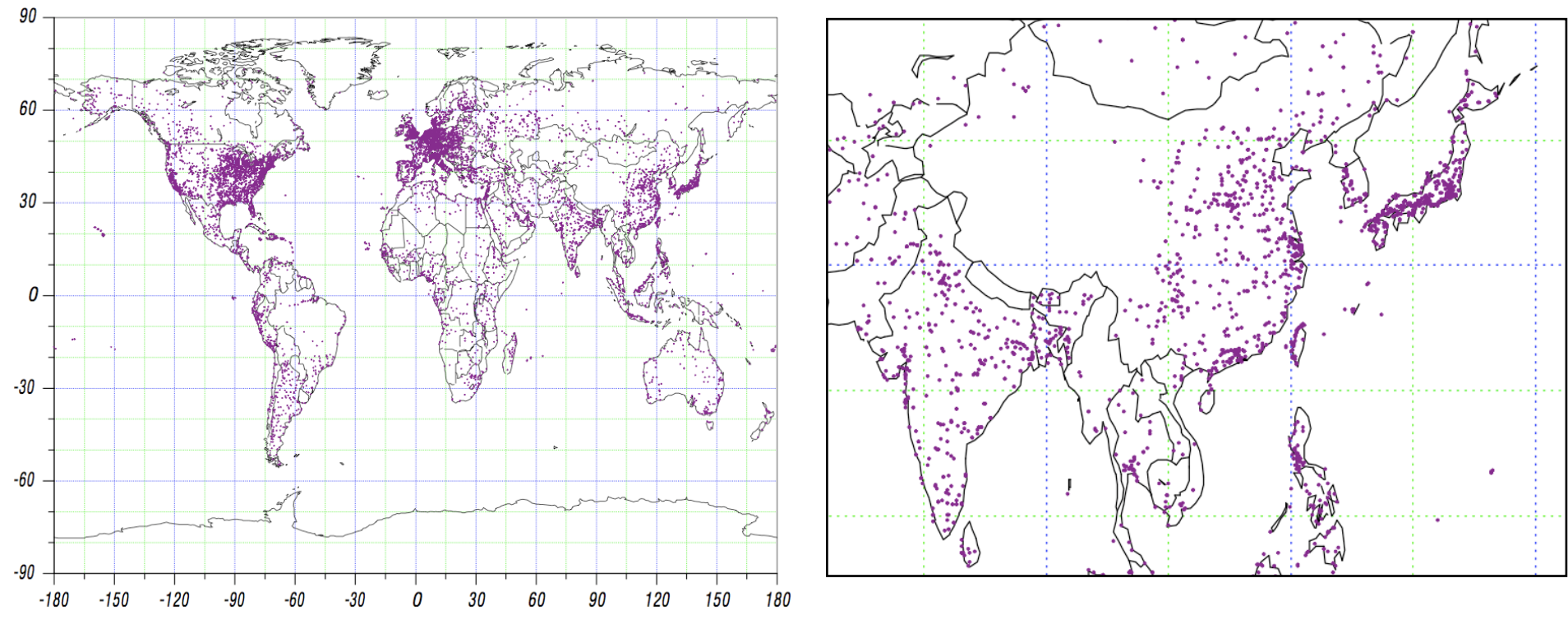
Methodology and Data



Mapping algorithm. Nightlight data was used, instead.

	Data source
Energy statistics	BP Statistical Review of World Energy 2008
Point source data	CARMA (CARbon Monitoring and Action, www.carma.org)
Surrogate	Calibrated radiance: 1996-1997 (1 km, globally) (Eldvige et al. 1999)
National identifier	Gridded Population of the World ver.3 (5 km, globally, year 2000)
Emission factors	IEA (2007), averaged values were also used
Population data	GPWv3 (5 km, globally, year 2005)
National trend	BP p.l.c (2008), 65 countries and 6 geographical regions

Point sources

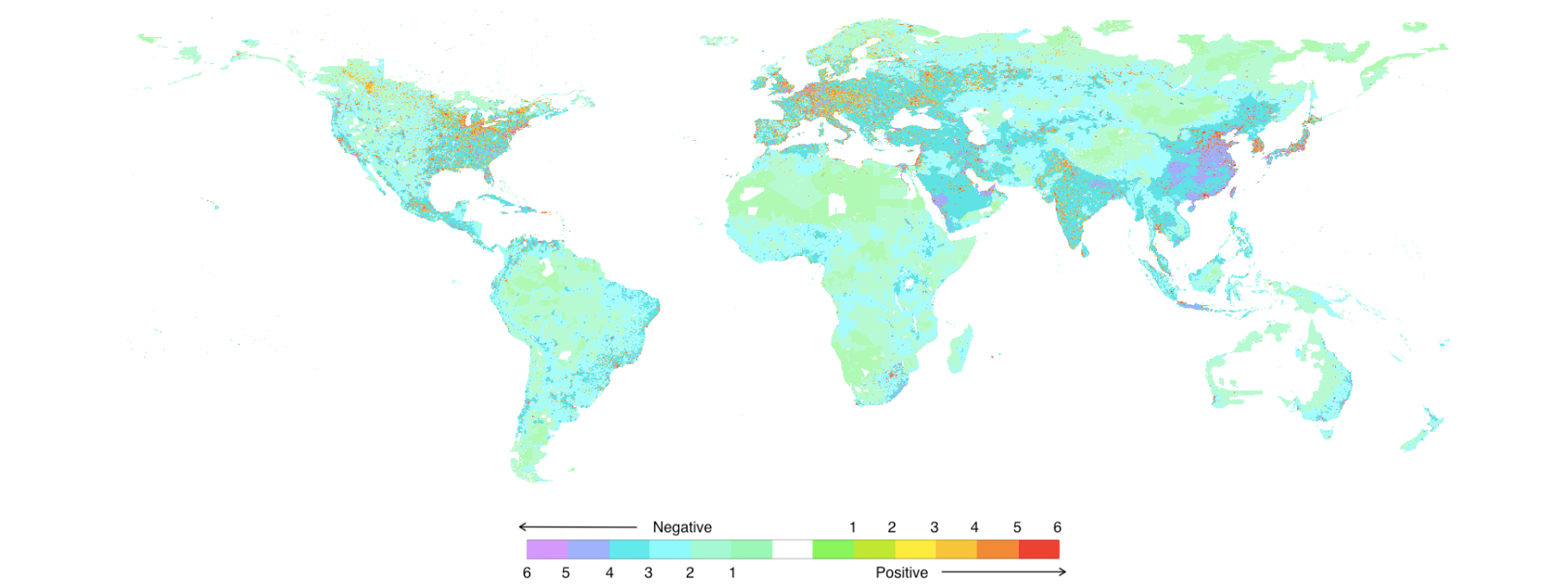


CARMA provides over 50,000 power plants information worldwide.

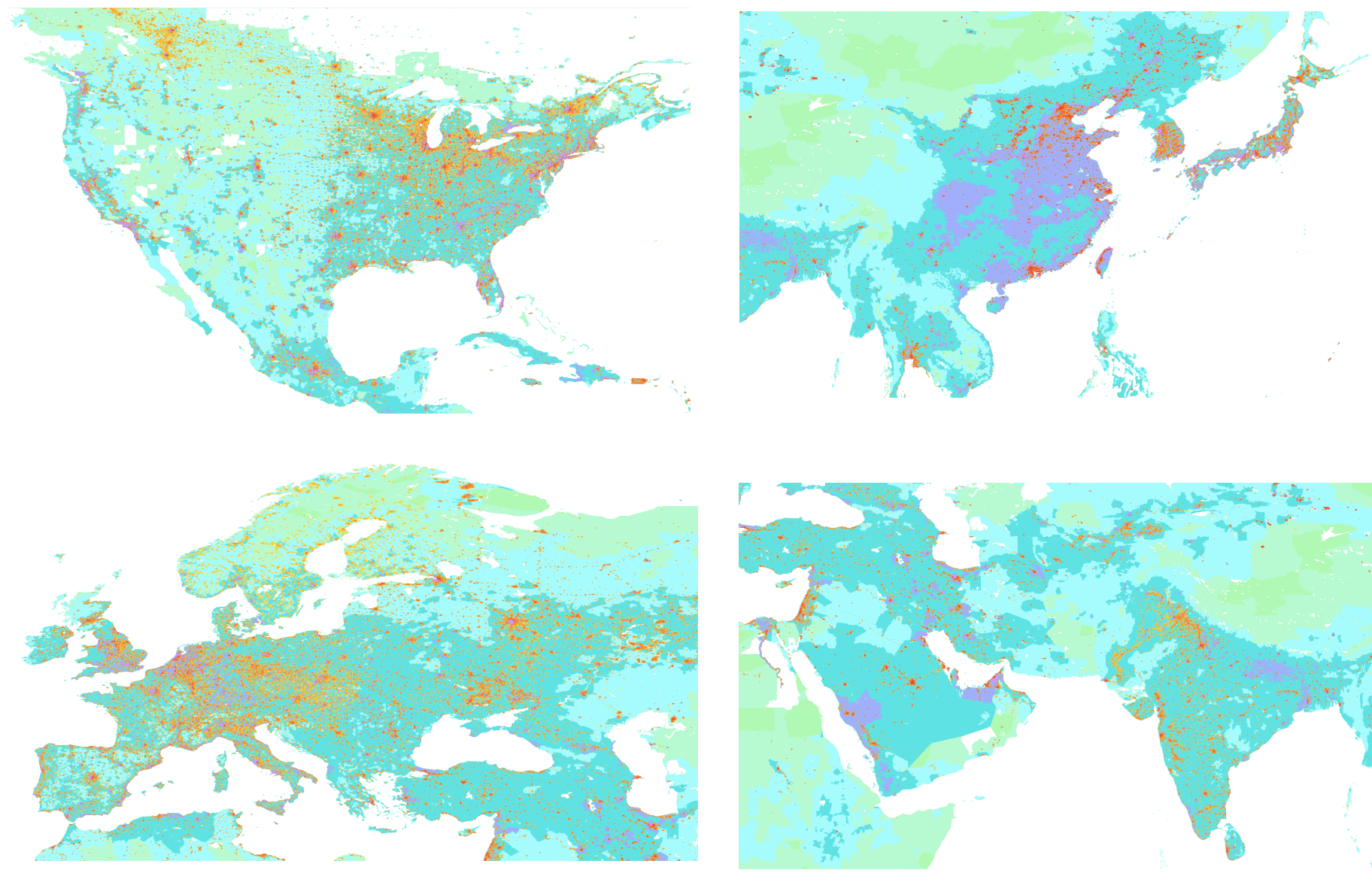
Summary and Future work

- ✓ A 27-year inventory was developed using a point source database and nightlight data.
- ✓ Point sources were directly mapped and only non-point source emissions were distributed using nightlight data.
- ✓ The spatial distribution is considerably different from that of population-based map, especially at city cores and in suburb areas.
- ✓ Monthly emission will be derived using a temporal emission function.
- ✓ High-resolution atmospheric CO₂ modeling using a coupled transport model (see poster #T4-078) will be implemented.

Nightlight minus Population



Difference between nightlight-based and population-based emissions.



More intense emissions at city cores, less emissions in suburb areas

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Tom Oda and Shamil Maksyutov
National Institute for Environmental Studies, Japan
oda.tomohiro@nies.go.jp

Acknowledgment DMSP data was collected by US Air Force Weather Agency and the calibrated radiance data was processed by the National Oceanic and Atmosphere Administration (NOAA) National Geophysical Data Center.