The urgency of the climate change challenge requires a rapid, sustained, and effective transition to lower carbon regional economies. Apart from necessary reduction in greenhouse gases, there is also a need to cut emissions of other pollutants like toxic gases or fine particles that can severely threaten people's health. Regional and city-level policies have a key role to play in this transition.

A look at interregional disparities gives a first rationale for spatially targeted interventions. In fact, it is possible to observe large disparities in carbon dioxide ($CO_2$) per capita produced in different regions. Regions with the highest levels of emissions per capita are located in the United States, the Czech Republic and Canada. For Canada, this result is largely explained by the low levels of population in these regions. Similarly, relative low population explains in part the very high levels observed in Wyoming (United States). The significant degree of geographical concentration of $CO_2$ emissions per capita is evident in several countries, where some regions have a value more than double than the country average (Figure 29.1).

A positive correlation is found between levels of regional gross domestic product (GDP) and emissions, but there are significant differences in the "carbon intensity" of production across regions. In fact, when looking at the ratio of GDP over $CO_2$, it is clear that the production of some regions is much more efficient, in terms of embodied $CO_2$, than the national average (Figure 29.2). This is particularly evident in Turkey, the United States and Mexico and in the Russian Federation and Brazil among emerging economies. In general, the regions with the highest GDP/$CO_2$ host the national capital (where service-intensive industries are concentrated). However, this is not always the case (for example, Bolzano in Italy or Shikogu in Japan). Relatively low values of GDP/$CO_2$ indicate a potential for decoupling emissions from the economic growth of the region (Figure 29.2).

Internationally comparable measures of air quality in regions can be derived from satellite-based measurement of particulate matter finer than 2.5 micrometers (PM 2.5), which can cause cardiovascular and other diseases when inhaled. While these estimates can be less precise than ground-based measurement, they have the clear advantage of being available for the large areas of the globe that are still without air monitoring stations. By overlaying these data on fine particulate matter with data on population distribution at *circa* 1 km resolution, it is possible to conclude that large fractions of the world population breathe air whose pollution exceeds the World Health Organization's recommended level of 10 micrograms of PM 2.5 per cubic meter (Figure 29.3). It is important to emphasise that the measured PM 2.5 concentration comes from both natural and human sources, the fraction imputable to human activity varying significantly among regions. This notwithstanding, the share of people living in areas with health-damaging levels of pollution is worryingly high in several countries (particularly in China, India and Italy).

There are large regional variations in the extent of population exposure to high levels of particulate matters. Regional peaks are clear in China, Italy, India, Mexico and Chile (Figure 29.4).

### *Definition*

$CO_2$ regional emissions are imputed from national emission data allocated to grids of *circa* 10 km x 10 km square. It includes emissions from all sources with the exception of air transport, international aviation and shipping.

Population exposure to air pollution is calculated by taking the weighted average value of PM2.5 for the grid cells present in each region, with the weight given by the estimated population count in each cell.

## Source

$CO_2$ emissions: EDGAR spatial emission datasets, JRC, available at *http://edgar.jrc.ec.europa.eu/*.

Satellite-Derived Surface PM2.5 map derived by Van Donkelaar *et al.* (2010), available at *http://fizz.phys.dal.ca/~atmos/g47.swf*.

LandScan 2009 for population estimates.

See Annex B for references and details on datasets and indicators' definitions.

## Reference years and territorial level

2005; TL2 for $CO_2$ regional emissions.

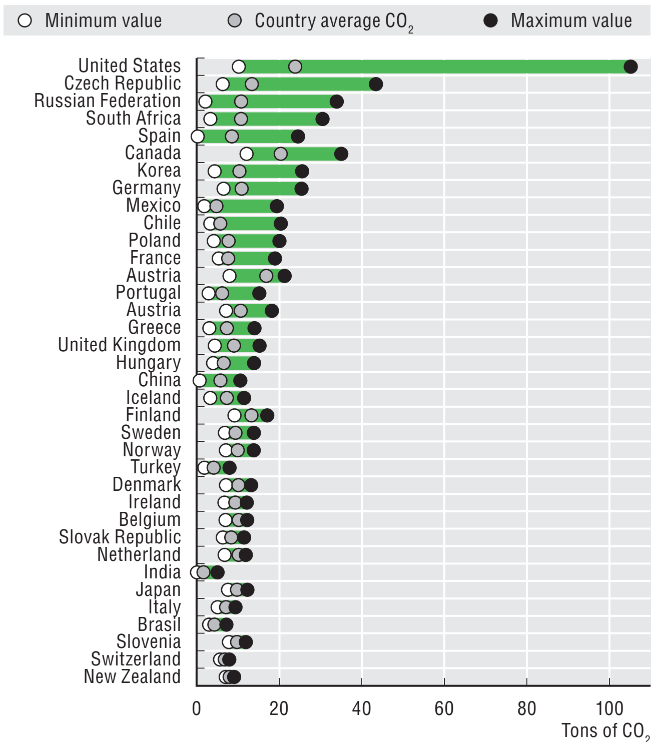
Average 2001-06; TL2 for PM 2.5 values.

## Figure notes

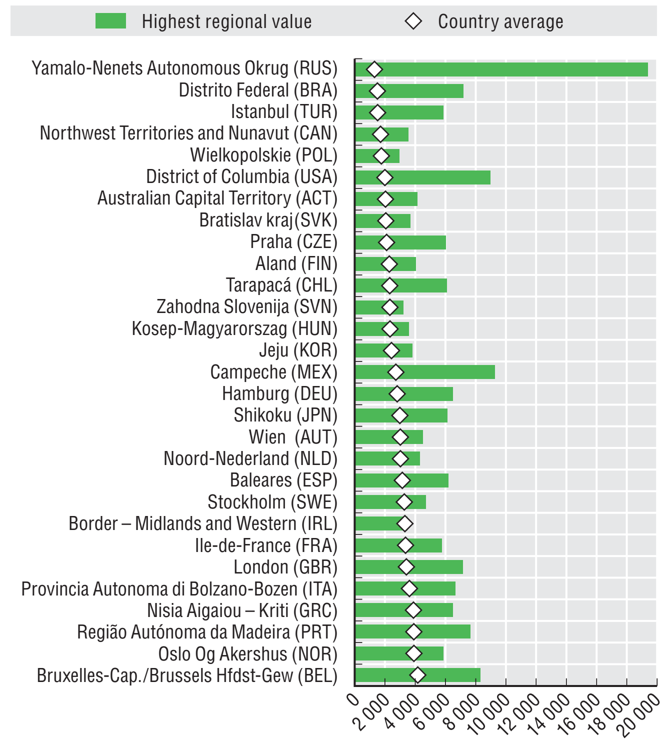
Information on data for Israel: *http://dx.doi.org/10.1787/888932315602*.

29.3, 29.4: **Measurement gap: *Internationally comparable measures of urban carbon emissions:*** While it is increasingly clear that urban areas emanate a growing percentage of the world carbon emissions, we still lack statistics suited for global comparison and monitoring of the carbon footprints of cities. Even if many cities around the world have started collecting inventories of their carbon emissions, differences in the methodologies (techniques, input data, sources included) used to compute total $CO_2$ or $SO_2$ make any comparison of their performance very difficult. Another problem is that cities "delimit" themselves in different ways, so that inventories in different countries can refer to a very narrow (the core municipality) or a very extended (the functional area of influence) definition of city. While supporting international efforts to harmonise urban carbon inventory, the OECD is also using estimates for small geographic units, derived from national data downscaled through the use of spatial datasets. Time-varying statistics for large and medium-sized cities in the OECD are obtained by applying these estimates to urban areas that are defined through a harmonised methodology.

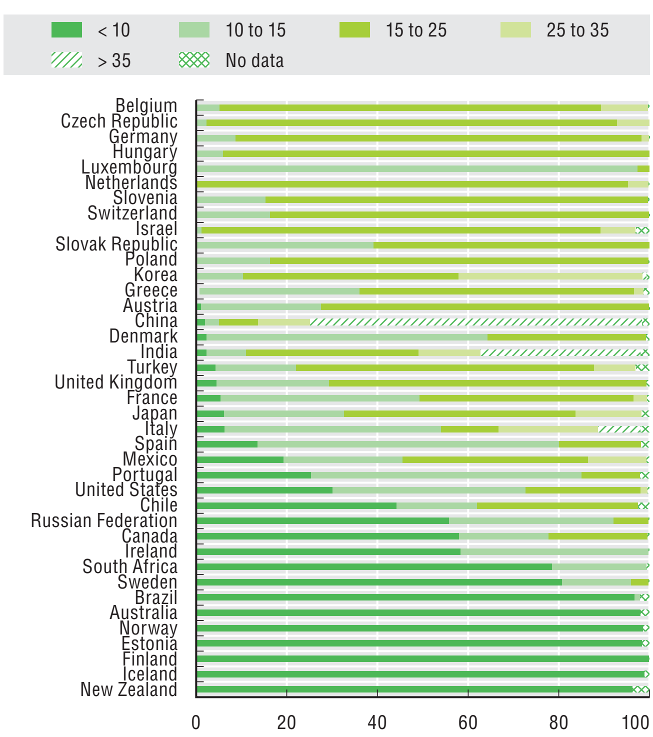
### 29.1. TL2 regional range in $CO_2$ emissions per capita, 2005



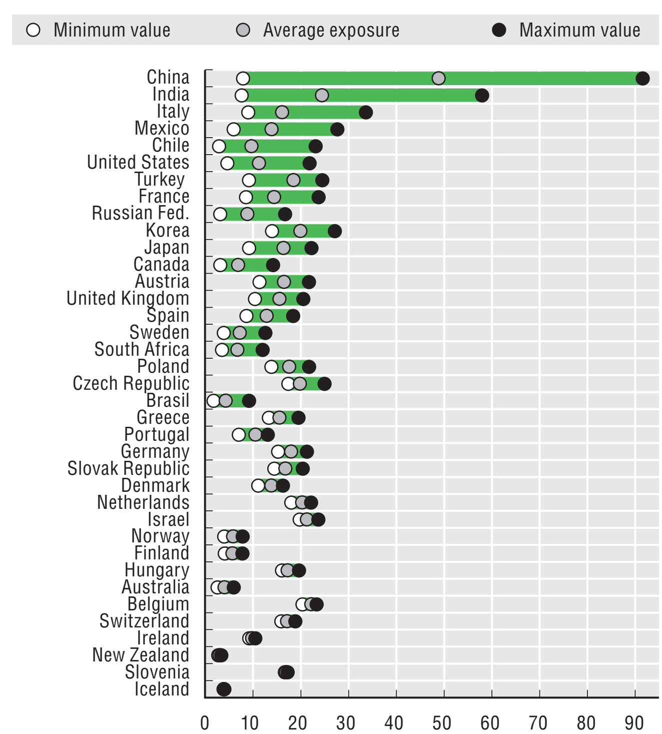

### 29.2. TL2 region with highest GDP to $CO_2$ ratio and country average, 2005




### 29.3. Population exposed to air pollution, by WHO PM2.5 thresholds, average 2001-06



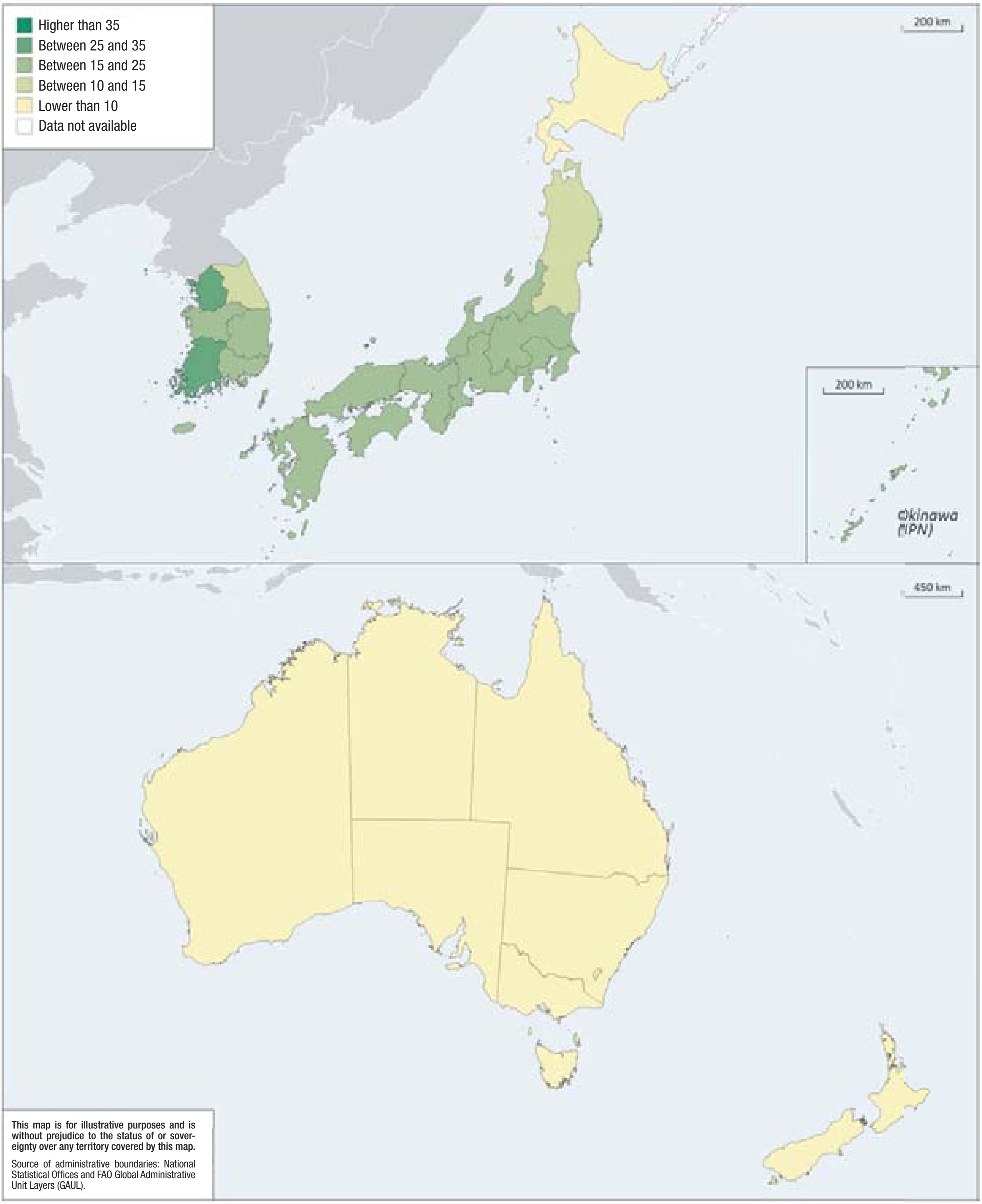

### 29.4. TL2 regional range of population exposure to air pollution, average 2001-06




StatLink http://dx.doi.org/10.1787/888932439938

**29.5. Regional population exposure to air pollution, by WHO PM2.5 thresholds: Asia and Oceania, 2001-06**

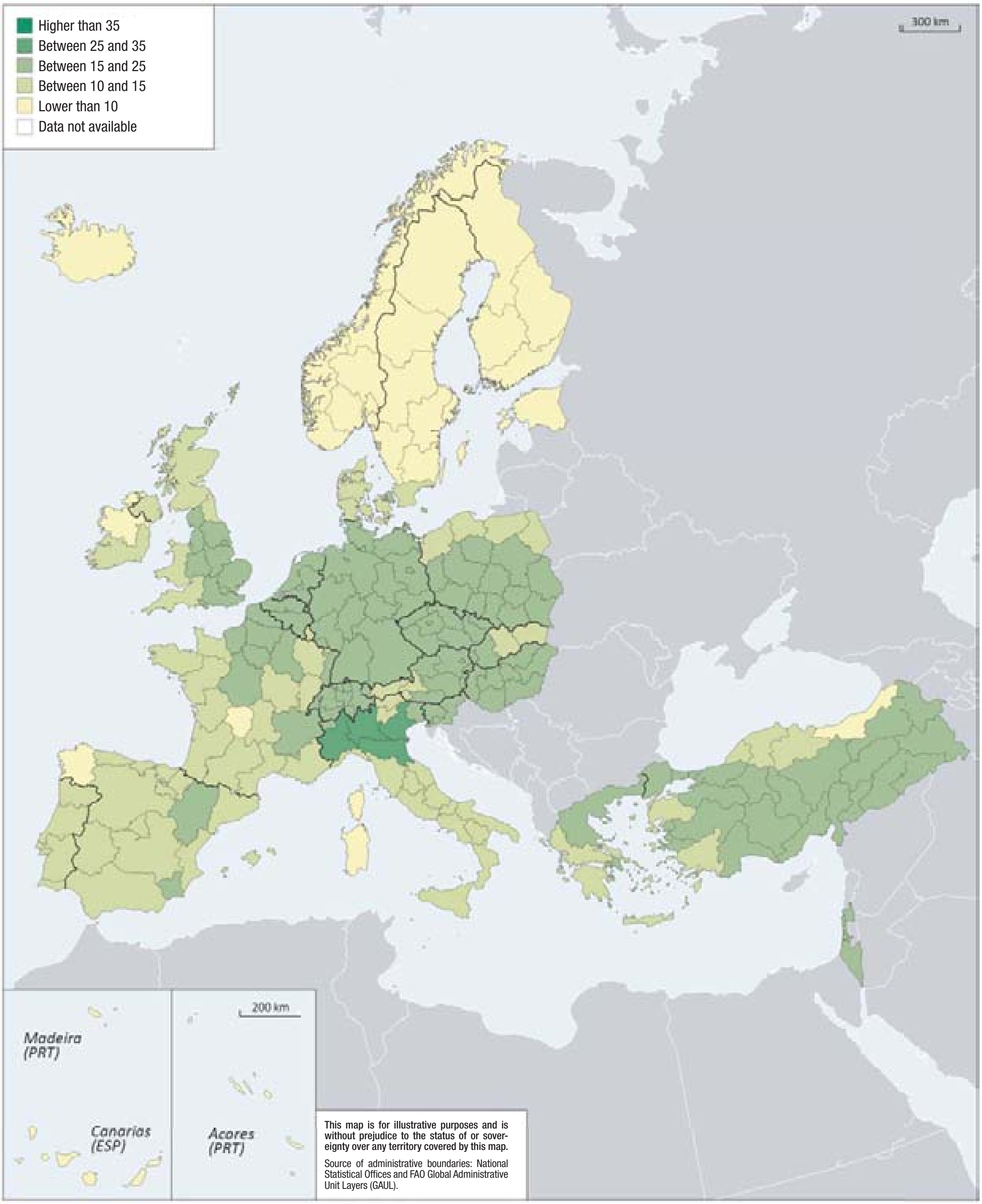
*TL2 regions, average 2001-06*




StatLink http://dx.doi.org/10.1787/888932440280

**29.6. Regional population exposure to air pollution, by WHO PM2.5 thresholds: Europe, 2001-06**

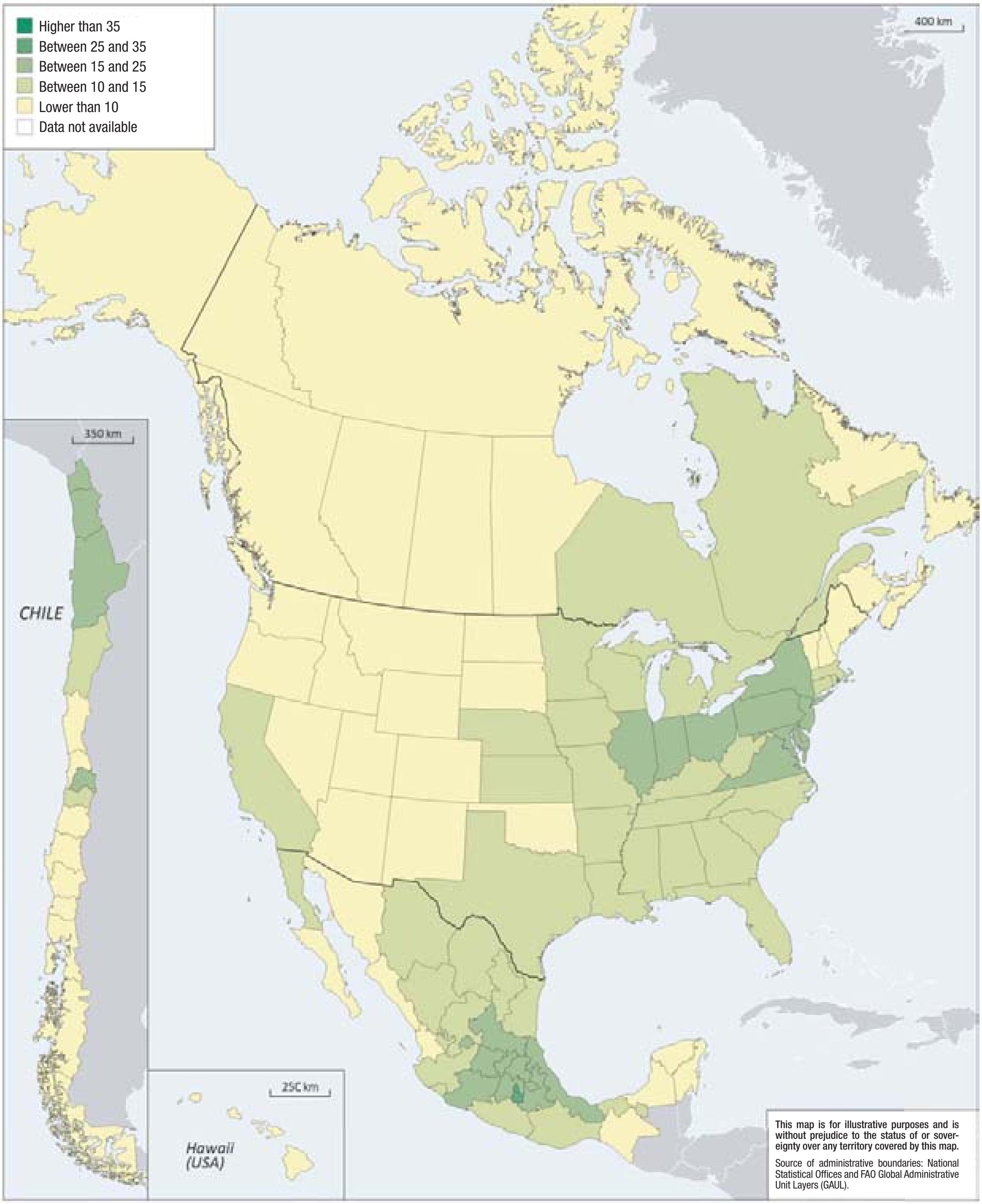
*TL2 regions, average 2001-06*




StatLink http://dx.doi.org/10.1787/888932440280

**29.7. Regional population exposure to air pollution, by WHO PM2.5 thresholds: Americas, 2001-06**

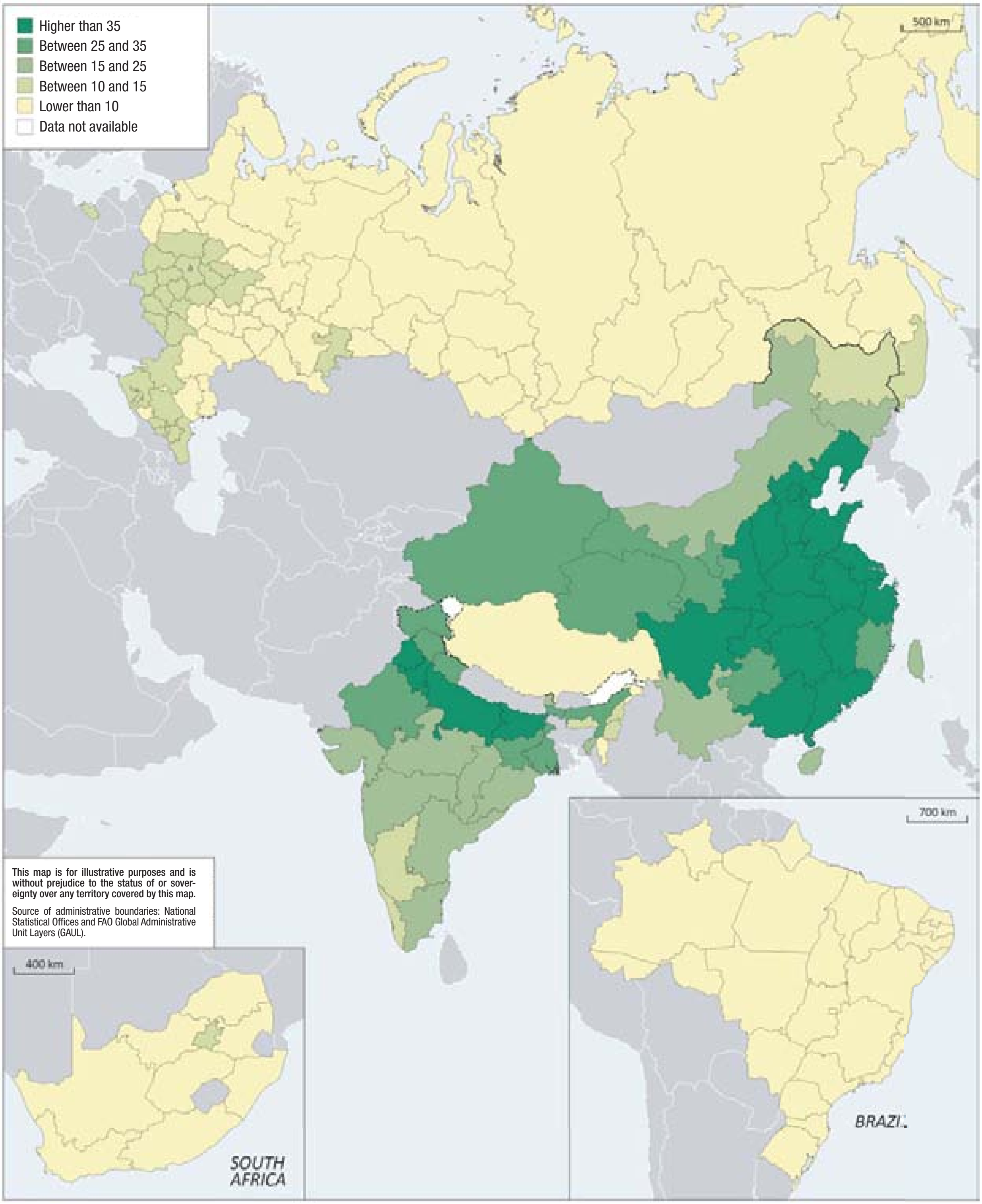
*TL2 regions, average 2001-06*



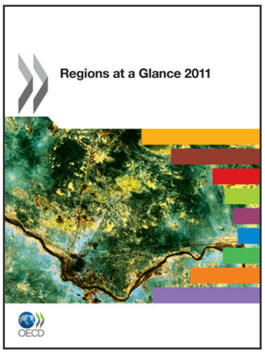

StatLink http://dx.doi.org/10.1787/888932440280

**29.8. Regional population exposure to air pollution, by WHO PM2.5 thresholds: Emerging economies, 2001-06**

*TL2 regions, average 2001-06*




StatLink http://dx.doi.org/10.1787/888932440280




**From:**
# OECD Regions at a Glance 2011

**Access the complete publication at:**
https://doi.org/10.1787/reg_glance-2011-en

**Please cite this chapter as:**

OECD (2011), “Carbon emissions and air quality in regions”, in *OECD Regions at a Glance 2011*, OECD Publishing, Paris.

DOI: https://doi.org/10.1787/reg_glance-2011-34-en



OECD