2.3.3 Source Region Perturbations

In HTAP1 (HTAP, 2010), a set of 4 rectangular regions approximating North America, Europe, South Asia, and East Asia was used for the model perturbations studies. In HTAP2, a two-tiered system of regions has been defined primarily along national boundaries. The first tier consists of the 16 regions and the second tier consists of 60 sub-regions. These regions provide a common set of possible source and/or receptor regions for all experiments.

- The regions are described on the HTAP WIKI (see Annex 1) and in **Annex 4**.
- Masks in netCDF format (outputNC_20130411_1550.rar) are also provided on the HTAP WIKI under Work Package 2.1. We note that the dataset has a 'reversed' projection compared to the HTAP emissions, (longitudes and latitudes starting South instead of North). This should not be a problem if the software correctly uses attribute information.

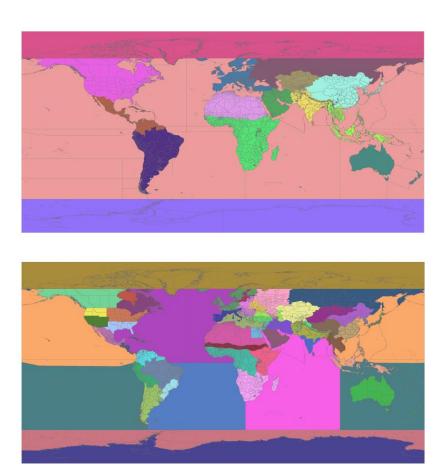


Figure 4: The 16 Tier 1 regions (up) and 60 Tier 2 regions (bottom) defined for HTAP2.

After the global and methane perturbations, the next priorities are perturbations by Tier 1 regions. Six of the Tier 1 regions have been designated as higher priority than the others. These are: North America (NAM), Europe (EUR), South Asia (SAS), East Asia (EAS), Middle East (MDE), and Russia/Belarus/Ukraine (RBU).

With the BASE and GLOALL results and the results from perturbing all anthropogenic emissions in one other region (e.g. NAMALL for North America), we can calculate the following metric, labeled the Response to Extra-Regional Emission Reductions (RERER).

Table A.4.1: HTAP2 regions

	Tier 1		Tier 2	Remark
01	GLO*	World		Not provided as separate mask
02	OCN	Non- arctic/Antarctic Ocean	020 Baltic Sea 021 North Atlantic 022 South Atlantic 023 North Pacific	150 Arctic seas are included in the Arctic receptor region
			024 South Pacific 025 Indian Ocean 026 Hudson Bay 027 Mediterranean Sea 028 Black and Caspian Sea	160 Antartic seas are included in Antartic receptor as Southern Ocean
03	NAM*	US+Canada (upto 66 N; polar circle)	031 NE US 032 SE US 033 NW US 034 SW US 035 E. Canada 036 W. Canada + Alaska up to 66 N.	Division along state lines. Emissions North of 66 N are marginal.
04	EUR*	Western + Eastern EU+Turkey (upto 66 N polar circle)	041 NW Europe 042 SW Europe (France follows province borders at ca. 46 N). 043 Eastern Europe 044 Greece+Turkey+Cyprus	
05	SAS*	South Asia: India, Nepal, Pakistan, Afghanistan, Bangadesh, Sri Lanka	051 North India +Nepal +Bangladesh +Afghanistan +Pakistan (ex. Himalaya) 052 South India+Sri Lanka 053 Indian Himalaya	Himalaya defined as regions above 1500 m altitude
06	EAS*	East Asia: China, Korea, Japan	061 North East China 062 South East China 063 West China +Mongolia (excl. Himalaya) 064 North/South Korea 065 Japan 066 China/Tibet Himalaya	Himalaya defined as regions above 1500 m altitude
07	SEA	South East Asia	071 Indonesia+Malaysia+Singapore 072 Thailand+Myanmar+Vietnam	
08	PAN	Pacific, Australia+ New Zealand	081 Pacific 082 Australia 083 New Zealand	
09	NAF	Northern Africa+Sahara+Sah el	091 Egypt 092 Rest of Northern Africa 093 Sahel	Sahel identified as important dust source region.
10	SAF	Sub Saharan/sub Sahel Africa	101 West and Central Africa: Côte d'Ivoire, Angola, Benin, Burkina Faso, Cameroon, Cape Verde, Chad, Congo Brazzaville, Democratic Republic of Congo, Equatorial Guinea, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo (excluding Sahel) 102 East Africa: Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Sudan, Rwanda, Uganda, Somalia and Tanzania. 103 Southern Africa: Angola, Botswana, Lesotho, Madagascar, Malawi,	Parts of these countries included in Sahel region.

			Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania,	
			Zambia, and Zimbabwe	
11	MDE*	Middle East: S.	111 Lebanon, Israel, Jordan, Syria.	
		Arabia, Oman,	112 Saudi Arabia; Yemen; Oman;	
		etc, Iran, Iraq	Emirates, Quatar, Bahrein.	
			113 Iran, Iraq	
12	MCA	Mexico, Central	121 Mexico	
		America,	122 Central America	
		Caribbean,	123 Caribbean	
		Guyanas,	124 Guyanas, Columbia, Venezuela	
		Venezuela,		
		Columbia		
13	SAM	S. America	131 South Brazil	
			132 Rest of Brazil	
			133 Uruguay, Paraguay, Argentina, Chile	
			134 Peru, Ecuador	
14	RBU*	Russia, Belarussia,	141 Russia West	
		Ukraine	142 Russia East	
			143 Belarussia+Ukraine	
15	CAS	Central Asia	151 Uzbekistan, Kazakhstan, Kyrgyzstan,	Pamir mountains not
			Tajikistan, Turkmenistan	included in Himalaya
16	NPO	Arctic Circle (North	150 Arctic (includes ocean and all of	Defined as Tier 1;
		of 66 N)+Greenland	Greenland)	but mainly relevant
				as receptor
17	SPO	Antarctic	160 Antarctic	Defined as Tier 1;
			161 Southern Ocean, south of 60S	but mainly relevant
				as receptor

^{*}Regions in bold characters defined as priority regions for TF HTAP Phase 2 simulations.