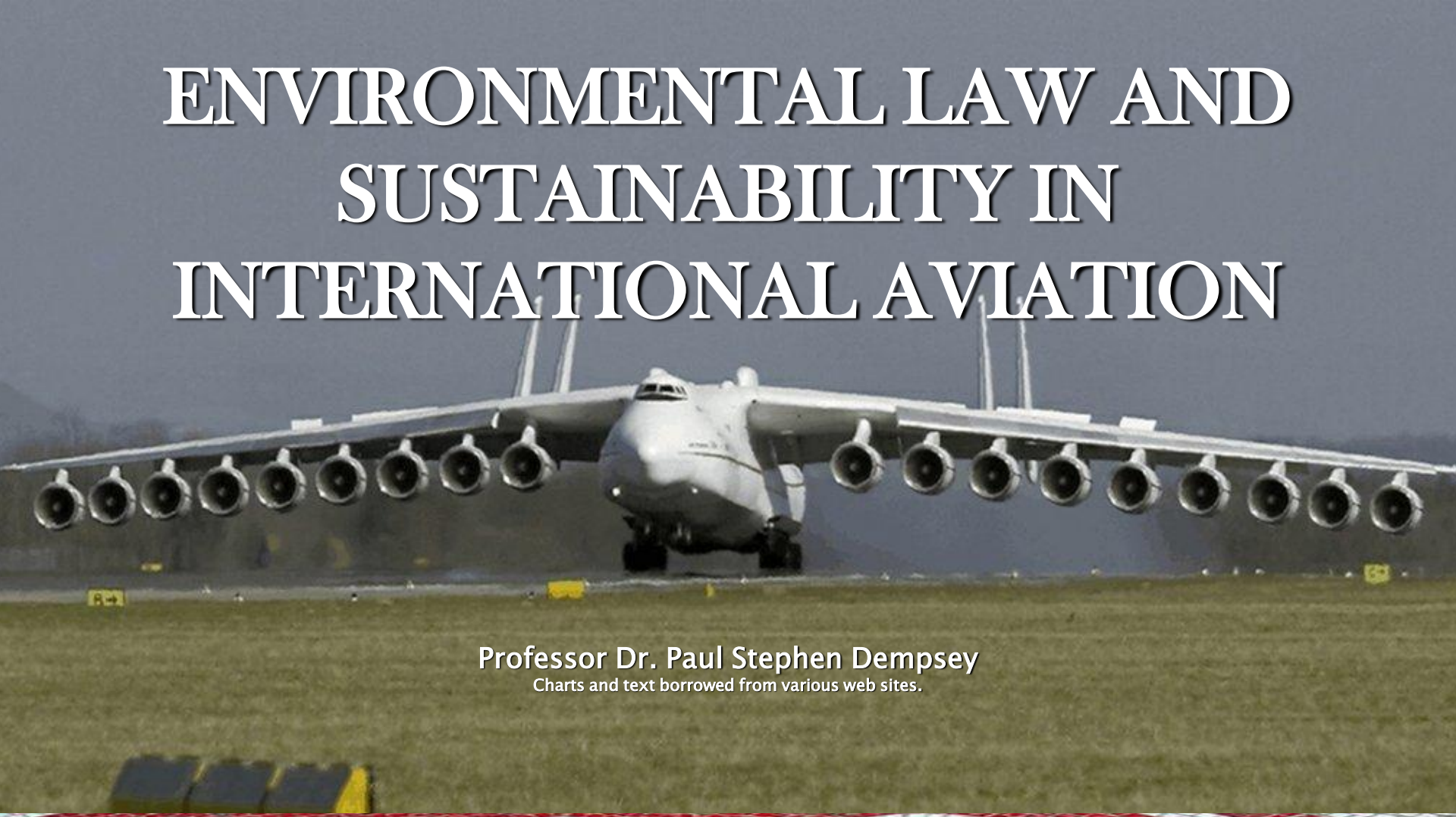
ENVIRONMENTAL LAW AND SUSTAINABILITY IN INTERNATIONAL AVIATION



Professor Dr. Paul Stephen Dempsey

Charts and text borrowed from various web sites.

Noise

dB

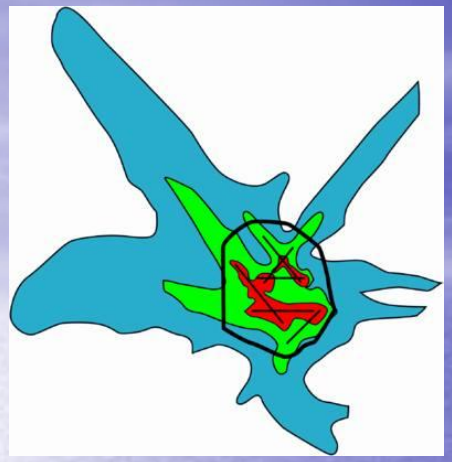
Key Environmental Issues

CO HC CO2 NOx

Aircraft Engine Emissions

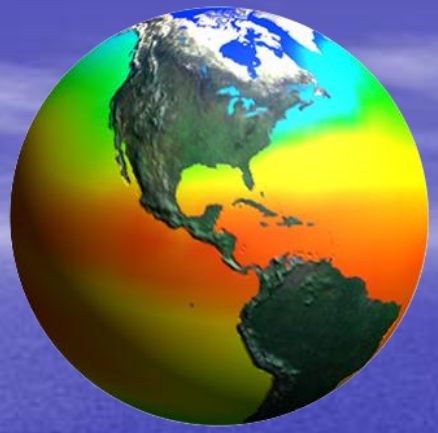
Source: ICAO

Aviation Environmental Issues



Community Noise Impacts

Dealing with significant aircraft noise impacts around airports



Global climate

The potential impact of aviation on global climate

Water Quality

Limiting or reducing impact of aviation on water quality

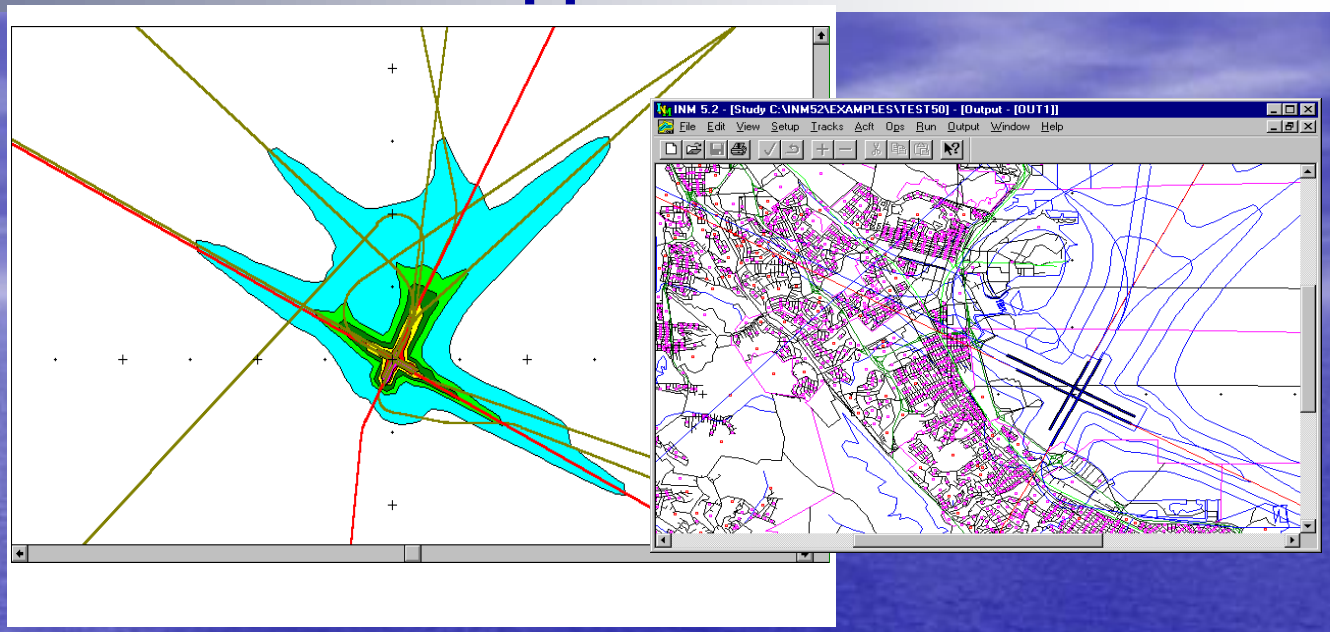
Air Quality

Limiting or reducing impact of aviation on local air quality

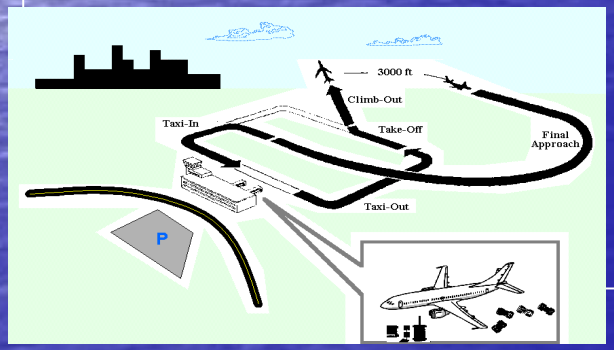
Source: US FAA

Where We Have Been: Local Applications

Individual Airport Noise Contours & Emissions Inventories/ Concentrations



3000 ft



1978

2005

Receptor Name	X (meters)	Y (meters)	Concentration (µg/m³)	Elevation (meters)	Height (meters)	Averaging Period	Source Group	Date/Time
Receptor 1	489.81665	1608.40820	23.33610	13.41	2.13	1-HR	ALL	02/23/1996 04:00 AM
Receptor 1	489.81665	1608.40820	8.89725	13.41	2.13	1-HR	ALL	02/01/1996 12:00 AM
Receptor 1	489.81665	1608.40820	5.81899	13.41	2.13	1-HR	ALL	02/01/1996 01:00 AM
Receptor 1	489.81665	1608.40820	4.14971	13.41	2.13	1-HR	ALL	02/27/1996 06:00 AM
Receptor 1	489.81665	1608.40820	3.66566	13.41	2.13	1-HR	ALL	02/28/1996 04:00 AM
Receptor 1	489.81665	1608.40820	3.37504	13.41	2.13	1-HR	ALL	02/27/1996 11:00 PM
Receptor 1	489.81665	1608.40820	3.10159	13.41	2.13	1-HR	ALL	02/29/1996 04:00 AM
Receptor 1	489.81665	1608.40820	2.80075	13.41	2.13	1-HR	ALL	02/29/1996 05:00 AM
Receptor 1	489.81665	1608.40820	2.50360	13.41	2.13	1-HR	ALL	02/04/1996 12:00 AM
Receptor 1	489.81665	1608.40820	2.47405	13.41	2.13	1-HR	ALL	02/23/1996 03:00 AM
Receptor 1	489.81665	1608.40820	2.11021	13.41	2.13	1-HR	ALL	02/27/1996 10:00 PM
Receptor 1	489.81665	1608.40820	2.07827	13.41	2.13	1-HR	ALL	02/15/1996 02:00 AM
Receptor 1	489.81665	1608.40820	2.06971	13.41	2.13	1-HR	ALL	02/01/1996 05:00 AM
Receptor 1	489.81665	1608.40820	1.88823	13.41	2.13	1-HR	ALL	02/04/1996 05:00 AM

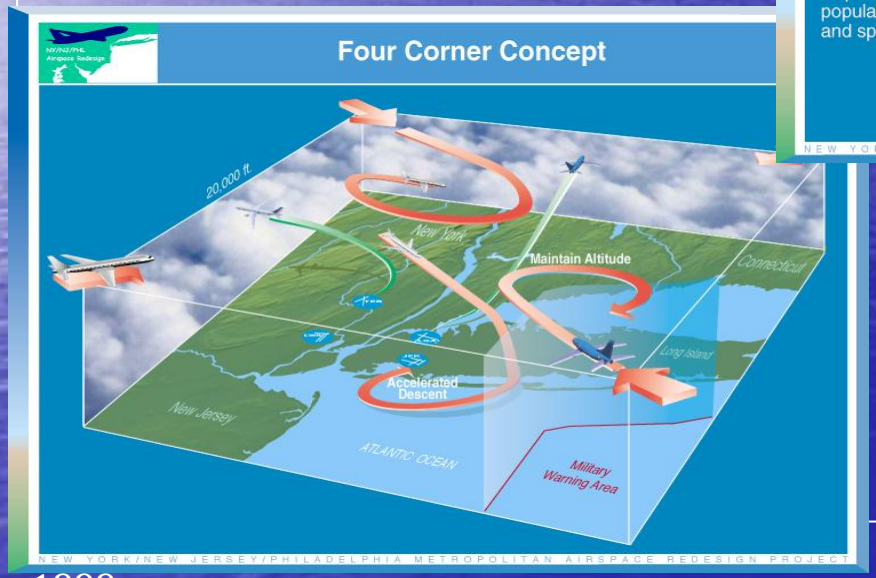
Source: US FAA

Where We Are Today: Airspace Applications

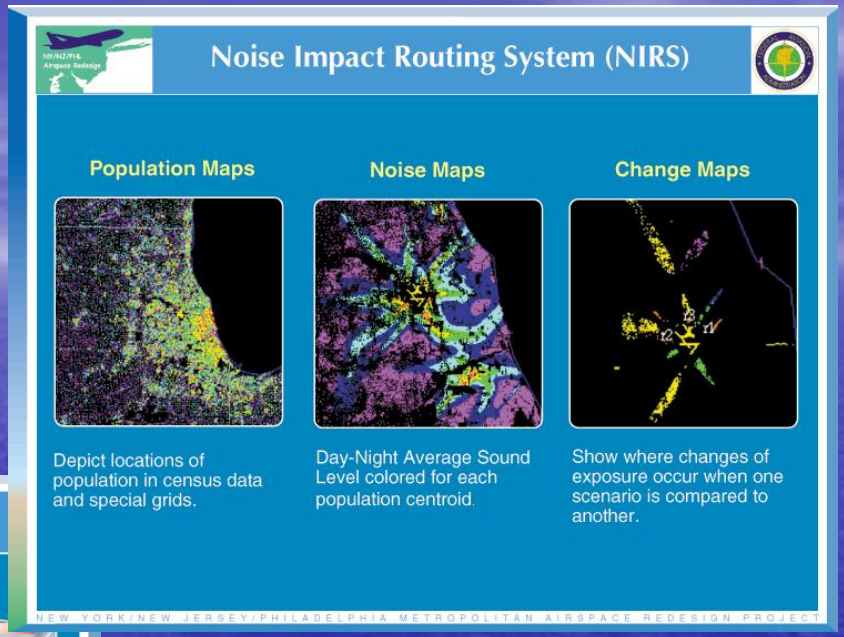
Assess impacts of airspace redesign and benefits of mitigation options

18000 ft

3000 ft



1999



2005

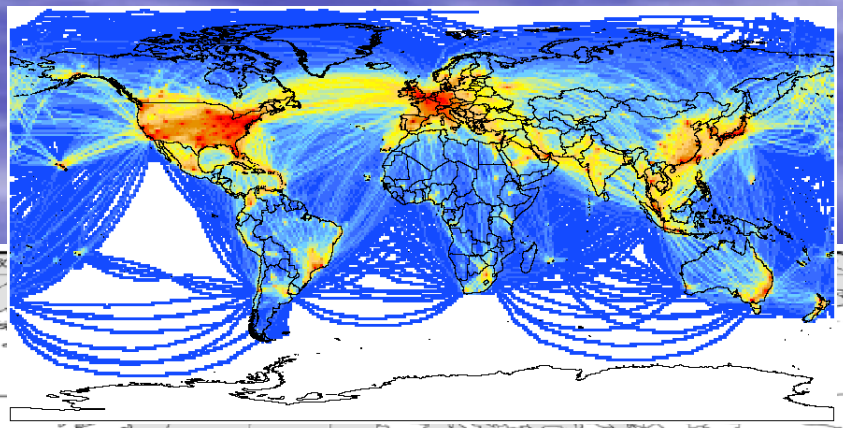
Source: US FAA

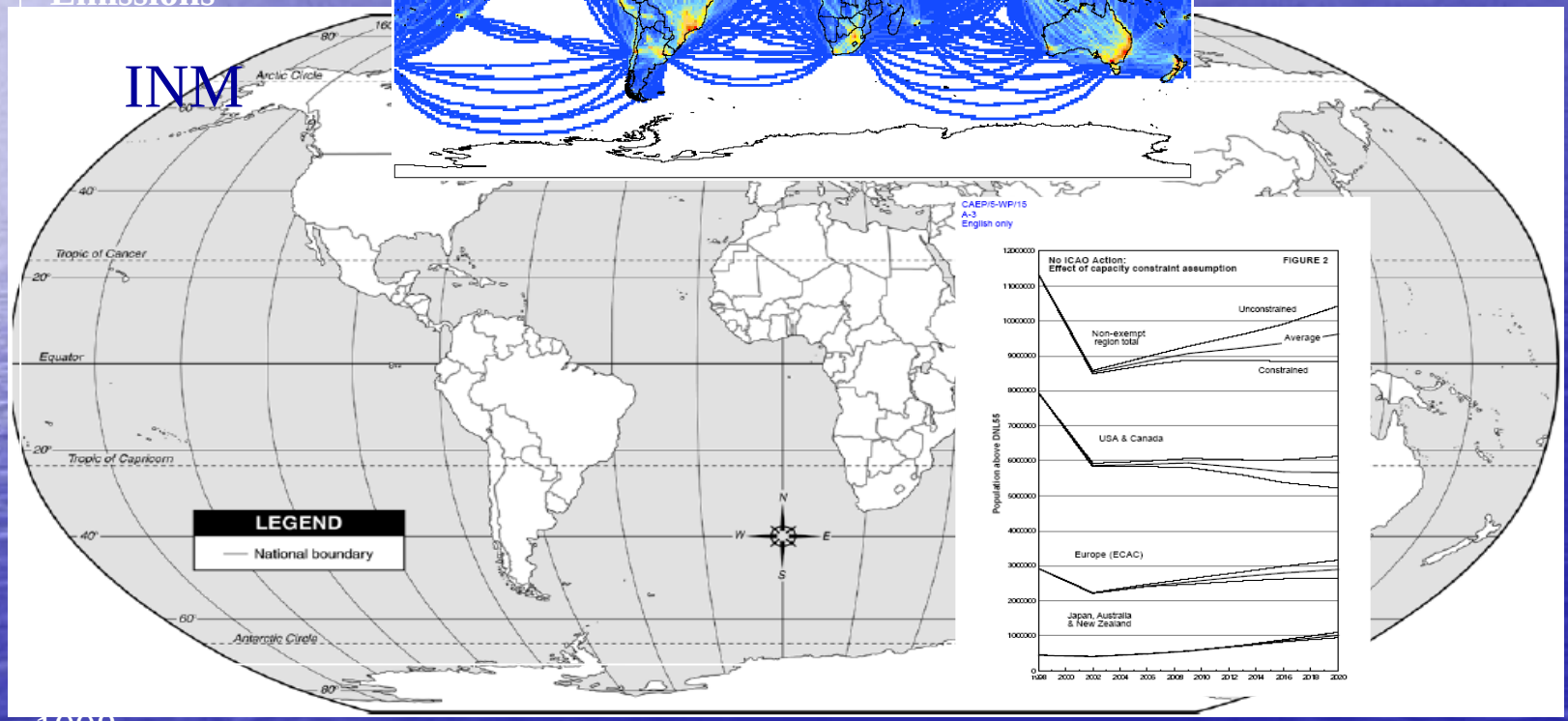
Where We Are Today: Global Applications

Global Noise Exposure & Emissions

18000 ft

INM





3000 ft

1998

2005

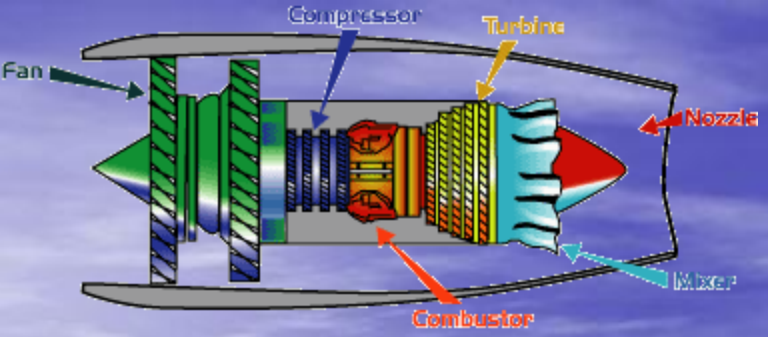
Source: US FAA

NOISE

People who live close to airports suffer more than mere annoyance from ascending and descending aircraft. Aircraft noise may significantly impact the mental and physical health of people who live below the flight paths of commercial and private airplanes. Since the 1970s, numerous studies have found aircraft noise linked to:

- stress
- hypertension
- sleep disturbances
- work-related performance
- learning and academic performance

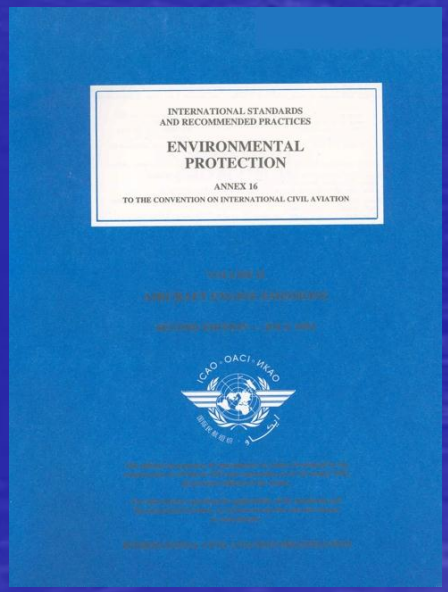
Source: Alliance for Residents Concerning O'Hare



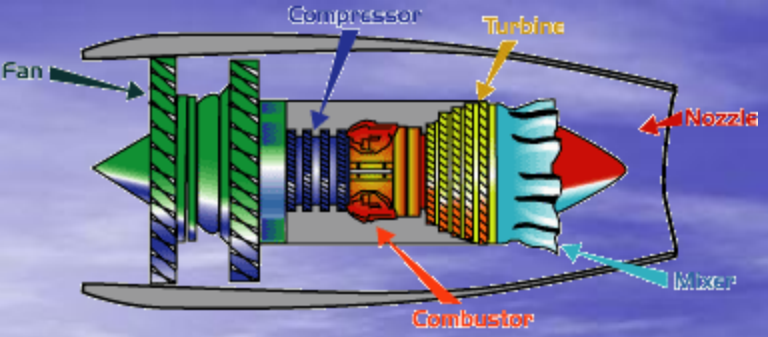
Annex 16 Environmental Protection - Noise

Annex 16, Volume I addresses aircraft noise. In 2001, the ICAO General Assembly adopted a "balanced approach" to environmental harm, attempting to "achieve a balance between the benefit accruing to the world community through civil aviation and the harm caused to the environment in certain areas through the progressive advancement of civil aviation". Each airport identifies a noise problem based on objective data, considers all available alternatives for addressing the noise issue, and selects the most cost-effective approach. Four approaches are recommended:

1. Reduction at source (quieter aircraft);
2. Land-use planning and management;
3. Noise abatement operational procedures;
4. Operating restrictions.



Source: ICAO

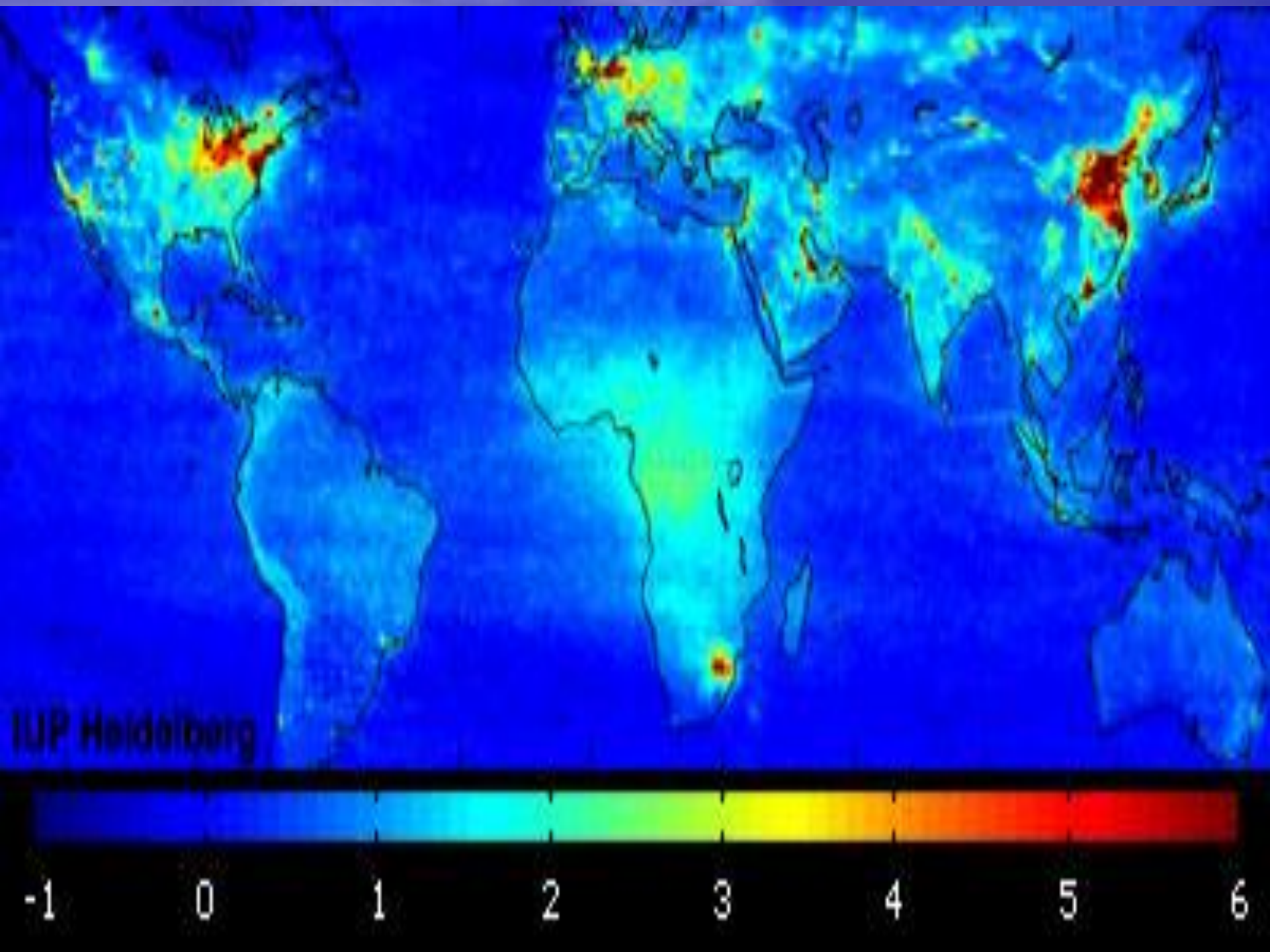


Annex 16 Environmental Protection- Emissions

Annex 16 , Volume II was originally designed to respond to concerns regarding air quality in the vicinity of airports. As a consequence, they establish limits for emissions of oxides of nitrogen (NOx), carbon monoxide, unburned hydrocarbons, for a reference landing and take-off (LTO) cycle below 915 metres of altitude (3 000 ft). There are also provisions regarding smoke and vented fuel.

While these standards are based on an aircraft's LTO cycle, they also help to limit emissions at altitude. Of particular relevance is the standard for NOx, a precursor for ozone, which at altitude is a greenhouse gas. The standard for NOx was first adopted in 1981. In 1999, the Council further tightened the standard by about 16 per cent on average for engines newly certificated from 31 December 2003. In 2005, the Council adopted NOx standards – effective in 2008 - that were 12% more stringent still

Source: ICAO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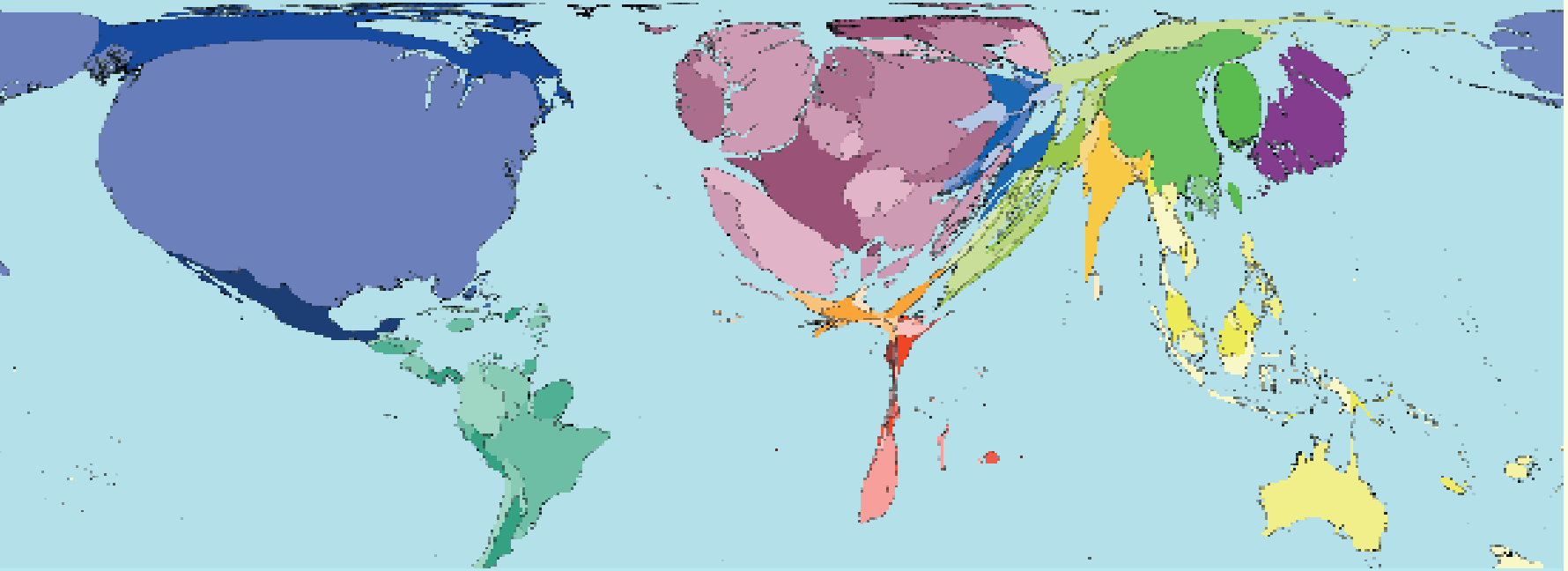
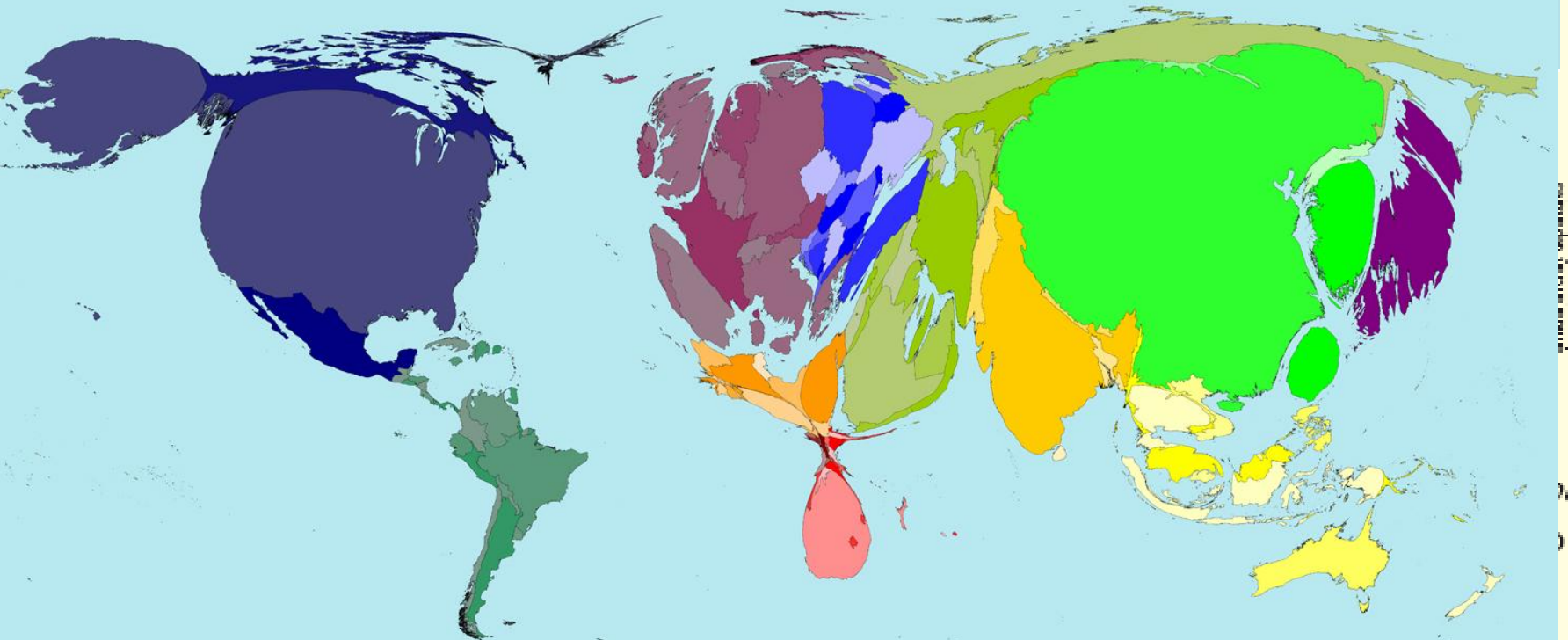


Global CO_2 Emissions



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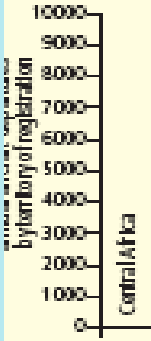

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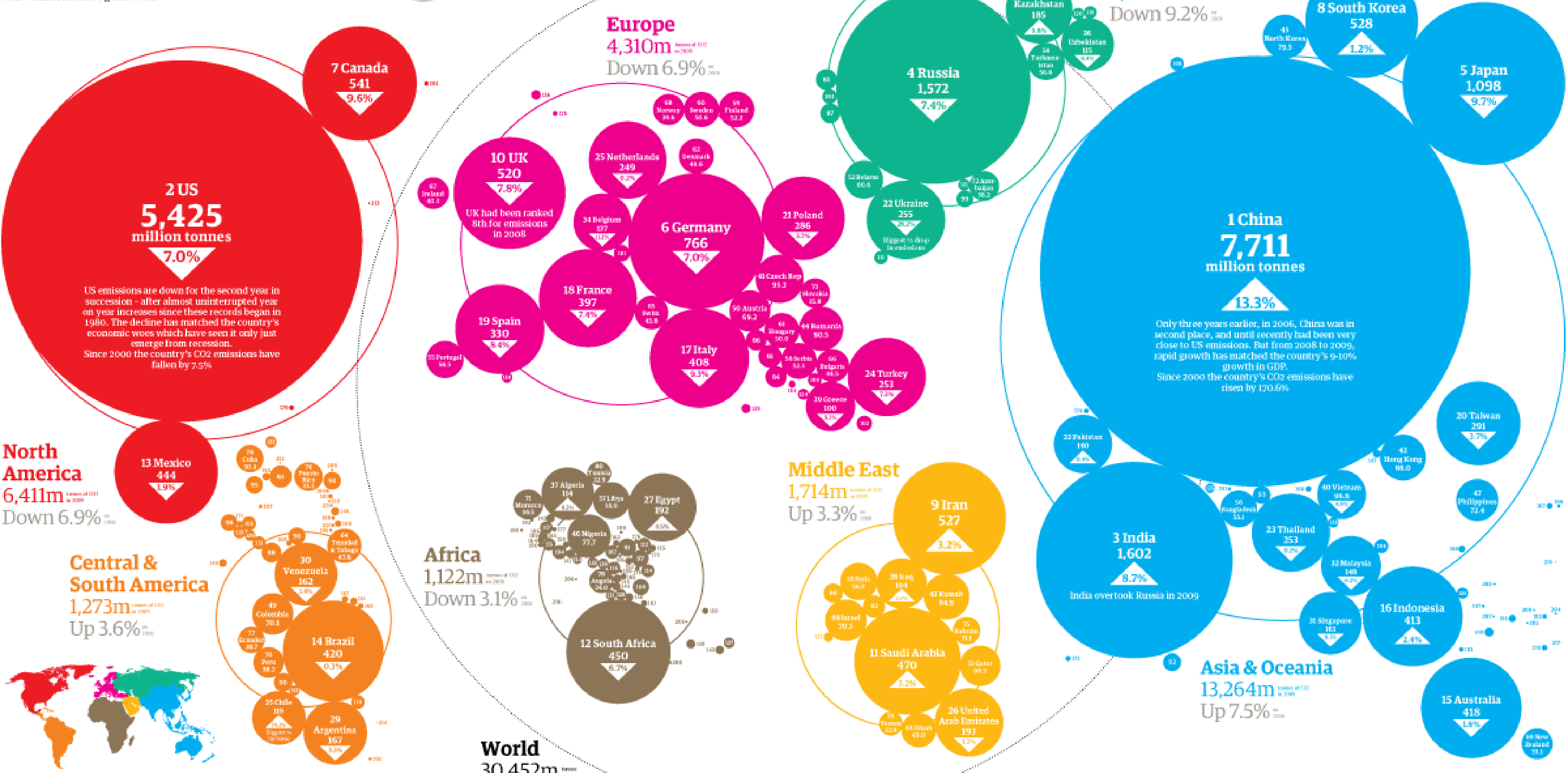
An atlas of pollution: the world in carbon dioxide emissions

Latest data published by the US Energy Information Administration provides a unique picture of economic growth - and decline. China has sped ahead of the US, as shown by this map, which resizes each country according to CO2 emissions. And, for the first time, world emissions have gone down



Detailed data

Full list of each country's CO2 emissions and movement in the world emissions league table

Rank/change on 2008	Country	Million tonnes 2009	Percent change 08–09
= 1	China	7,711	13.3
= 2	US	5,425	-7.0
▲ 3	India	1,602	8.7
▼ 4	Russia	1,572	-7.4
= 5	Japan	1,098	-9.7
= 6	Germany	766	-7.0
= 7	Canada	541	-9.6
▲ 8	South Korea	528	1.2
▲ 9	Iran	527	3.2
▼ 10	UK	520	-7.8
▲ 11	Saudi Arabia	470	3.2
▼ 12	South Africa	450	-6.7
= 13	Mexico	444	-1.9
▲ 14	Brazil	420	-0.3
▲ 15	Australia	418	1.8
▲ 16	Indonesia	413	2.4
▼ 17	Italy	408	-9.3
▼ 18	France	397	-7.4
= 19	Spain	330	-8.4
▲ 20	Taiwan	291	-3.7
▲ 21	Poland	286	-5.7
▼ 22	Ukraine	255	-28.2
▲ 23	Thailand	253	-0.1
▼ 24	Turkey	253	-7.3
= 25	Netherlands	249	-0.2
= 26	United Arab Emirates	193	-1.2
= 27	Egypt	192	3.5
▲ 28	Kazakhstan	185	9.6
▼ 29	Argentina	167	-4.2
= 30	Venezuela	162	-1.4
= 31	Singapore	160	-0.1
▲ 32	Malaysia	148	-0.2
▲ 33	Pakistan	140	0.4
▼ 34	Belgium	137	-11.2
▲ 35	Chile	119	24.1
▼ 36	Uzbekistan	115	-9.4
▼ 37	Algeria	114	6.2
▲ 38	Iraq	104	3.7
▼ 39	Greece	100	-6.3
▼ 40	Vietnam	98.8	-4.9
= 41	Czech Republic	95.3	-3.8
▲ 42	Hong Kong	86.0	10.3
= 43	Kuwait	84.9	6.3
▼ 44	Romania	80.5	-16.6
▲ 45	North Korea	79.5	16.3
▼ 46	Nigeria	77.7	-22.6
▼ 47	Philippines	72.4	-2.9
▲ 48	Israel	70.5	4.8
▲ 49	Colombia	70.1	7.9
▼ 50	Austria	69.2	-2.5
▲ 51	Qatar	66.5	4.8
▼ 52	Belarus	60.6	-9.5
▲ 53	Syria	56.9	6.1
▼ 54	Turkmenistan	56.8	-1.2
▲ 55	Portugal	56.5	1.5
▲ 56	Bangladesh	55.1	9.4
▼ 57	Libya	55.0	-3.9
▲ 58	Serbia	52.3	-3.2
▼ 59	Finland	52.2	-4.9
▼ 60	Sweden	50.6	-7.7
▼ 61	Hungary	50.0	-10.7
▼ 62	Denmark	48.6	-8.6
▲ 63	Oman	49.0	9.9
= 64	Trinidad and Tobago	47.8	-4.1
▲ 65	Switzerland	45.8	1.0
▼ 66	Bulgaria	44.5	-11.9
▼ 67	Ireland	40.3	-11.2
= 68	Norway	39.6	-0.3
▲ 69	New Zealand	39.1	-4.1
▲ 70	Peru	38.3	4.0
▲ 71	Morocco	36.5	-2.2
▼ 72	Azerbaijan	36.2	-8.9
▼ 73	Slovakia	35.8	-4.5
= 74	Puerto Rico	33.3	-3.2
= 75	Bahrain	31.1	1.6
= 76	Cuba	30.4	4.7
= 77	Ecuador	28.7	1.7
= 78	Angola	24.0	1.8
▲ 79	Yemen	22.9	10.5
▲ 80	Tunisia	22.9	5.7
▼ 81	Croatia	21.5	-4.7
▲ 82	Jordan	20.0	2.4
▲ 83	Dominican Republic	19.9	2.6
▼ 84	Bosnia and Herzegovina	18.3	-13.9
▼ 85	Estonia	17.5	-18.8
▲ 86	Slovenia	17.4	0.5
▼ 87	Lithuania	15.8	-12.8
= 88	Panama	15.5	1.7
= 89	Lebanon	14.8	3.6
= 90	Bolivia	13.9	-2.7
▲ 91	Sudan	13.0	7.0
▲ 92	Sri Lanka	12.8	1.7
▼ 93	Burma	12.5	-8.5
▼ 94	US Virgin Islands	12.5	-3.5
▼ 95	Jamaica	12.1	-4.6
= 96	Netherlands Antilles	11.6	-4.1
▲ 97	Kenya	11.5	2.4
= 98	Guatemala	11.3	-1.4
▲ 99	Armenia	11.2	1.5
▲ 100	Zimbabwe	10.6	18.6
▼ 101	Luxembourg	10.6	-11.2
= 102	Cyprus	9.4	-3.5
▲ 103	Latvia	8.5	8.1
▲ 104	Ghana	8.1	5.6
= 105	Honduras	7.9	-2.4
▼ 106	Brunei	7.6	-20.1
▲ 107	Cameroon	7.5	-1.9
= 108	Mongolia	7.4	-3.8
▼ 109	Macedonia	7.3	-20.1
▼ 110	Uruguay	7.2	-30.2
= 111	Moldova	7.1	-4.1
▲ 112	Ethiopia	6.9	7.1
▼ 113	Costa Rica	6.8	-4.4
▲ 114	Tanzania	6.7	7.1
▼ 115	Ivory Coast	6.6	2.2
▲ 116	Congo	6.3	3.8
= 117	Senegal	6.2	1.8
▼ 118	Tajikistan	6.1	-10.4
= 119	El Salvador	5.9	0.0
= 120	Kyrgyzstan	5.7	-0.4
= 121	Georgia	5.3	-4.9
= 122	Bahamas	5.2	3.1
▲ 123	Papua New Guinea	4.8	6.7
▲ 124	Albania	4.6	3.8
▼ 125	Equatorial Guinea	4.6	-2.1
▼ 126	Gabon	4.6	-3.2
▼ 127	Mauritius	4.6	-4.0
▲ 128	Botswana	4.5	7.7
▼ 129	Nicaragua	4.5	-2.9
▼ 130	Gibraltar	4.4	-3.8
▲ 131	Namibia	4.1	3.7
▲ 132	Paraguay	4.0	3.7
▼ 133	Cambodia	3.9	-6.1
▲ 134	Benin	3.5	4.3
▲ 135	Nepal	3.4	3.8
▼ 136	Iceland	3.4	-7.4
▲ 137	Palestine	3.2	4.3
▲ 138	Madagascar	3.1	13.4
▼ 139	Malta	3.1	-2.5
▼ 140	New Caledonia	3.0	0.0
▲ 141	Togo	2.8	5.6
▼ 142	Reunion	2.8	0.0
▲ 143	Mauritania	2.7	3.3
▲ 144	Zambia	2.7	18.8
▼ 145	Congo, Dem Rep	2.7	-2.6
▼ 146	Martinique	2.6	6.3
▼ 147	Macau	2.4	1.3
▲ 148	Mozambique	2.3	4.6
▼ 149	Guadeloupe	2.2	-5.1
▲ 150	Haiti	2.1	2.5
▲ 151	Suriname	2.0	4.0
= 152	Uganda	1.9	-3.0
▼ 153	Fiji	1.9	-6.2
= 154	Montenegro	1.9	4.3
▲ 155	Djibouti	1.8	3.4
▼ 156	Guam	1.7	-3.5
= 157	Guyana	1.6	0.0
▲ 158	Burkina Faso	1.6	3.1
▲ 159	Seychelles	1.6	8.1
▼ 160	Barbados	1.6	-4.0
▲ 161	Swaziland	1.6	17.0
= 162	Niger	1.5	3.5
▼ 163	Guinea	1.3	-1.2
▲ 164	Sierra Leone	1.3	5.9
▼ 165	Malawi	1.3	4.6
= 166	Laos	1.2	1.1
▼ 167	Wake Island	1.2	-4.3
= 168	French Guiana	1.1	6.1
= 169	Aruba	1.1	4.3
▲ 170	French Polynesia	1.1	7.7
▼ 171	Belize	0.96	-5.4
= 172	Maldives	0.92	3.4
= 173	Somalia	0.90	3.4
= 174	Afghanistan	0.83	-2.9
= 175	Faroe Islands	0.80	6.4
▲ 176	Eritrea	0.77	6.4
▲ 177	Mali	0.74	6.4
▼ 178	Rwanda	0.74	0.0
= 179	Bermuda	0.71	4.2
= 180	Liberia	0.69	2.2
= 181	Antigua and Barbuda	0.69	4.4
= 182	American Samoa	0.67	2.2
▲ 183	East Timor	0.63	8.7
▼ 184	Greenland	0.62	-4.8
▲ 185	Guinea-Bissau	0.46	0.0
▲ 186	Gambia	0.44	15.4
▼ 187	Cayman Islands	0.43	-11.8
▼ 188	Saint Lucia	0.42	0.0
▲ 189	Burundi	0.37	4.0
▲ 190	Cape Verde	0.34	4.5
▼ 191	Bhutan	0.33	-11.1
▲ 192	Western Sahara	0.32	0.0
▲ 193	Antarctica	0.31	17.6
▲ 194	Saint Kitts and Nevis	0.30	11.1
= 195	Grenada	0.30	4.8
▼ 196	Central African Republic	0.29	-10.0
▲ 197	Solomon Islands	0.29	25.0
▼ 198	US Pacific Islands	0.29	0.0
▼ 199	Chad	0.29	10.3
▼ 200	Lesotho	0.27	-3.9
= 201	Saint Vincent/Grenadines	0.27	10.6
▲ 202	Nauru	0.20	9.1
▼ 203	Tonga	0.15	-23.1
▲ 204	Cook Islands	0.15	66.7
▲ 205	Comoros	0.15	25.0
▼ 206	Sao Tome and Principe	0.15	11.1
▲ 207	Vanuatu	0.15	25.0
▲ 208	British Virgin Islands	0.15	25.0
▼ 209	Samoa	0.15	-16.7
= 210	Montserrat	0.15	58.7
▼ 211	Dominica	0.14	11.1
▼ 212	Saint Pierre and Miquelon	0.11	16.7
= 213	Turks and Caicos Islands	0.08	0.0
= 214	Falkland Islands	0.05	0.0
= 215	Kiribati	0.04	0.0
= 216	Saint Helena	0.01	11.2
= 217	Niue	0.01	2.9

Table shows total carbon dioxide emissions from the consumption of energy

GRAPHIC: MARK McCORMICK, PAUL SCRUTON SOURCE: EIA

Engine Exhaust

Jet Engine Combustion

A jet engine is an internal combustion engine, like an automobile engine. In a jet engine, the fuel and an oxidizer combust (or burn) and the products of that combustion are exhausted through a narrow opening at high speed. Modern jet engine fuel is primarily kerosene, the same fuel used to heat homes in portions of the U.S. Kerosene, a flammable hydrocarbon oil, is a fossil fuel. Burning fossil fuels primarily produces carbon dioxide (CO_2) and water vapor (H_2O). Other major emissions are nitric oxide (NO) and nitrogen oxide (NO_2), which together are called NOx, sulfur oxides (SO_2), and soot.

Source: NASA

The main greenhouse gases

Greenhouse gases	Chemical formula	Pre-industrial concentration	Concentration in 1994	Atmospheric lifetime (years)***	Anthropogenic sources	Global warming potential (GWP)*
Carbon-dioxide	CO_2	278 000 ppbv	358 000 ppbv	Variable	Fossil fuel combustion Land use conversion Cement production	1
Methane	CH_4	700 ppbv	1721 ppbv	12,2 +/- 3	Fossil fuels Rice paddies Waste dumps Livestock	21 **
Nitrous oxide	N_2O	275 ppbv	311 ppbv	120	Fertilizer industrial processes combustion	310
CFC-12	CCl_2F_2	0	0,503 ppbv	102	Liquid coolants. Foams	6200-7100 ****
HCFC-22	$CHClF_2$	0	0,105 ppbv	12,1	Liquid coolants	1300-1400 ****
Perfluoromethane	CF_4	0	0,070 ppbv	50 000	Production of aluminium	6 500
Sulphur hexa-fluoride	SF_6	0	0,032 ppbv	3 200	Dielectric fluid	23 900

Note : pptv= 1 part per trillion by volume; ppbv= 1 part per billion by volume, ppm v= 1 part per million by volume

* GWP for 100 year time horizon. ** Includes indirect effects of tropospheric ozone production and stratospheric water vapour production. *** On page 15 of the IPCC SAR. No single lifetime for CO_2 can be defined because of the different rates of uptake by different sink processes.**** Net global warming potential (i.e., including the indirect effect due to ozone depletion).

GRID Arendal UNEP

Source: IPCC radiative forcing report ; Climate change 1995. The science of climate change, contribution of working groupe 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university, 1996.

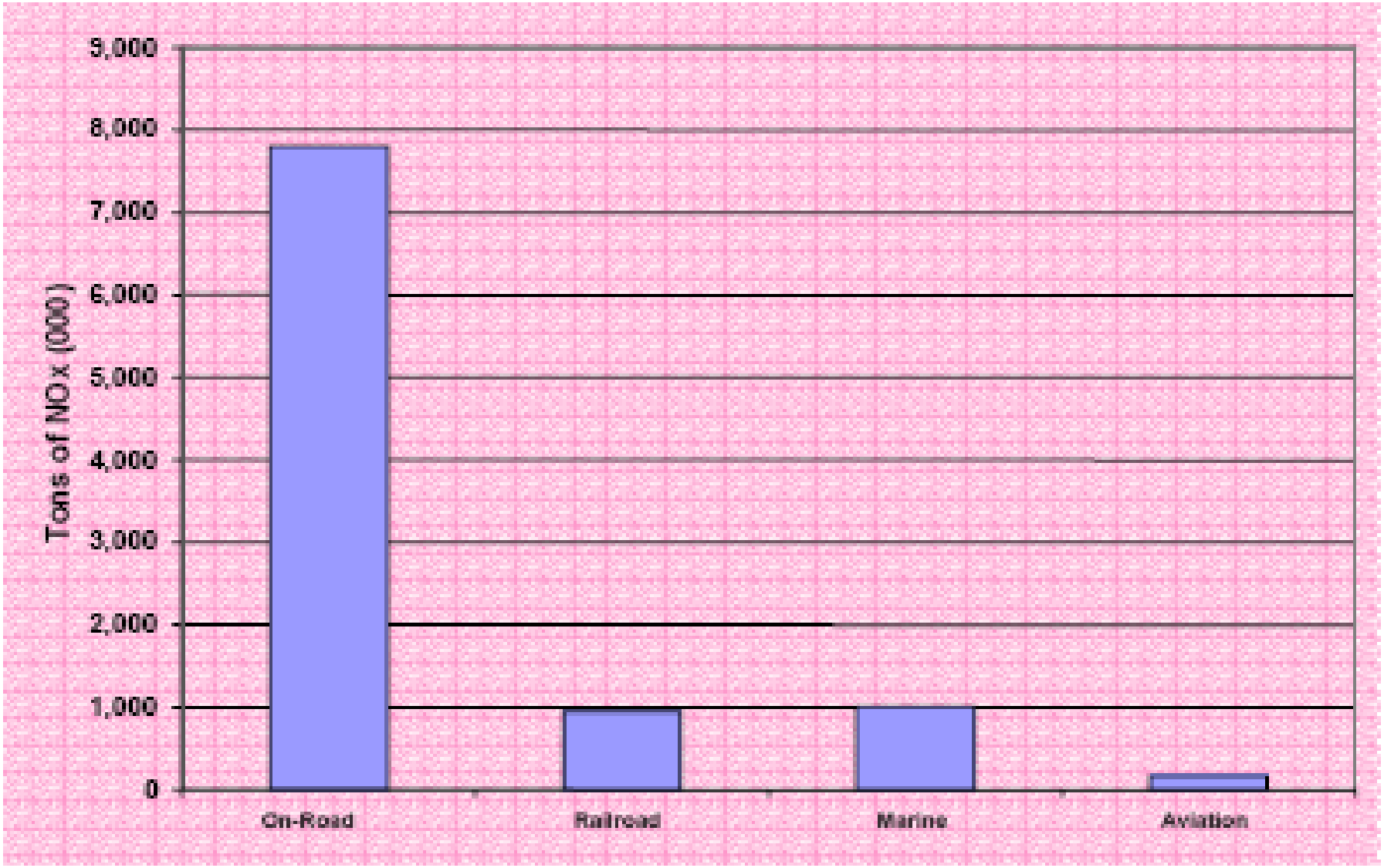
Aviation is responsible for:
2% of global carbon dioxide (CO_2) emissions
13% of CO_2 emissions from all transport sources, compared to 75% from road transport
3.5% of the total man-made contribution to climate change

Source: IATA

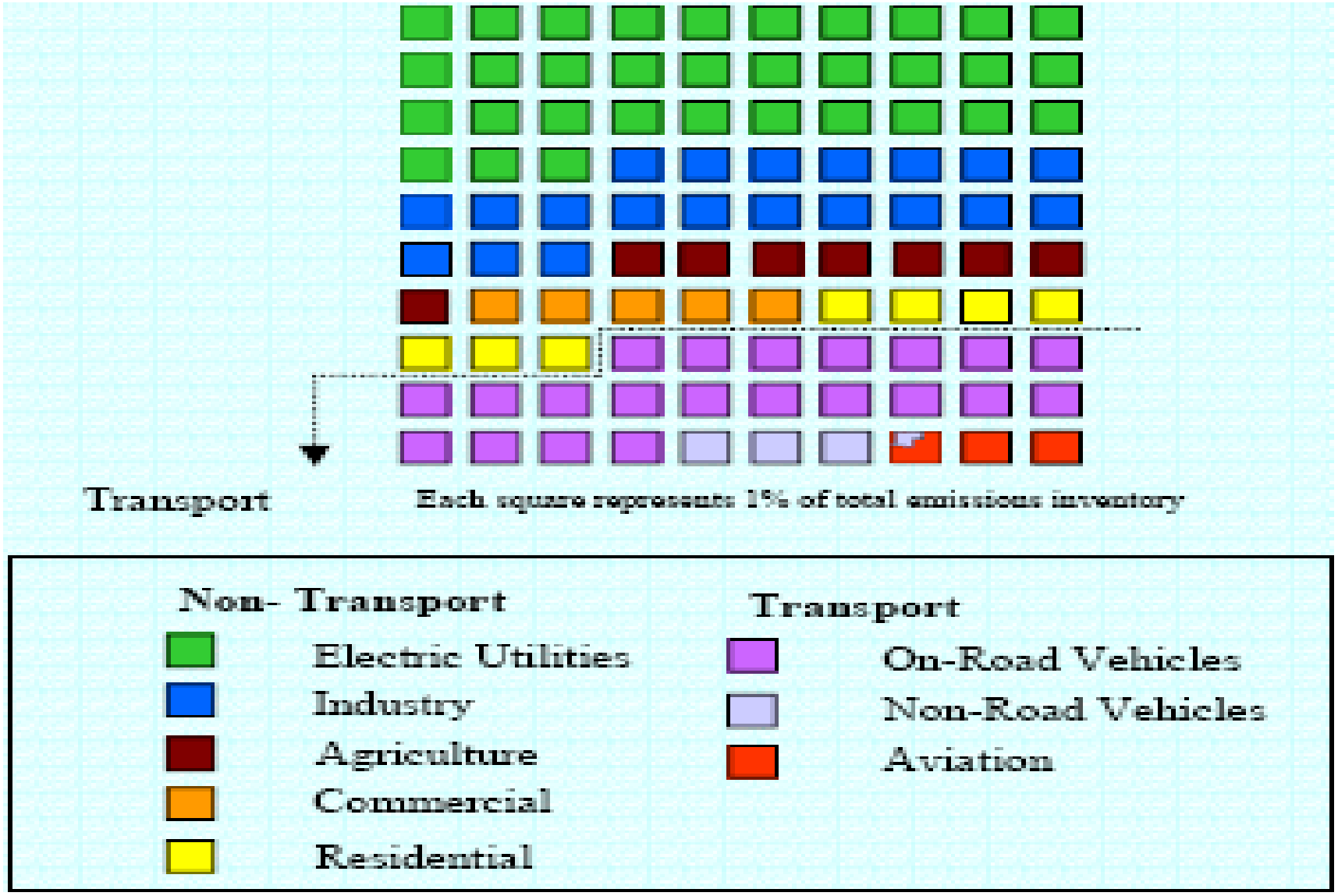
Although emissions from aviation currently account for about 3% of total EU greenhouse gas emissions, they are increasing fast – by 87% since 1990 – as air travel becomes cheaper without its environmental costs being addressed.

Source: European Union

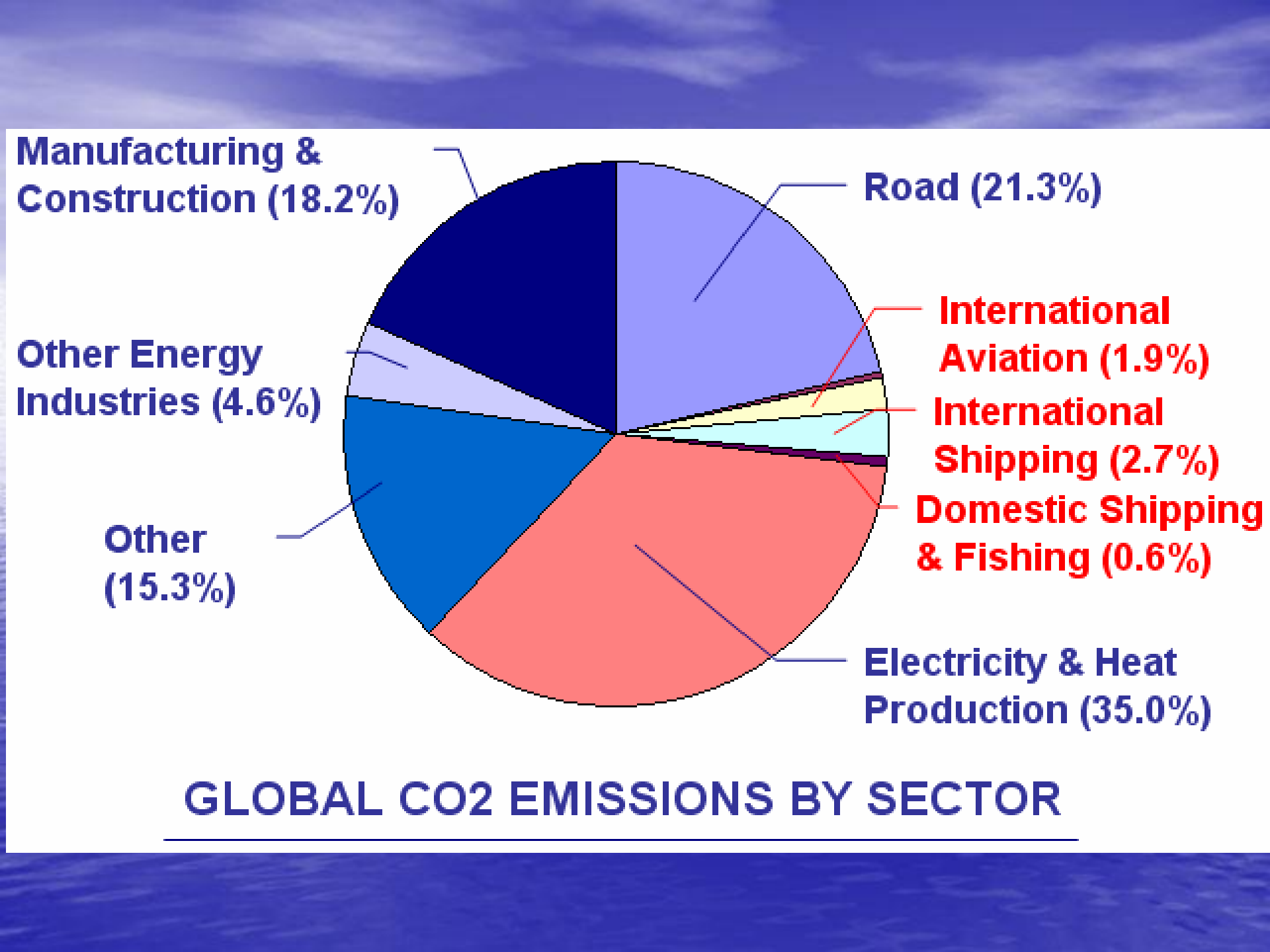
Aviation is the fastest growing producer of noxious emissions, with traffic growing at 3.4-6.6% annually. Aviation will account for 5% by 2050.



Total NO_x emissions from on-road transportation dwarf emissions from all other transportation modes combined (1998 data).



National greenhouse gas emissions in 2001 came from all sectors of the economy with all transportation equal to 27% of the total



GLOBAL CO2 EMISSIONS BY SECTOR

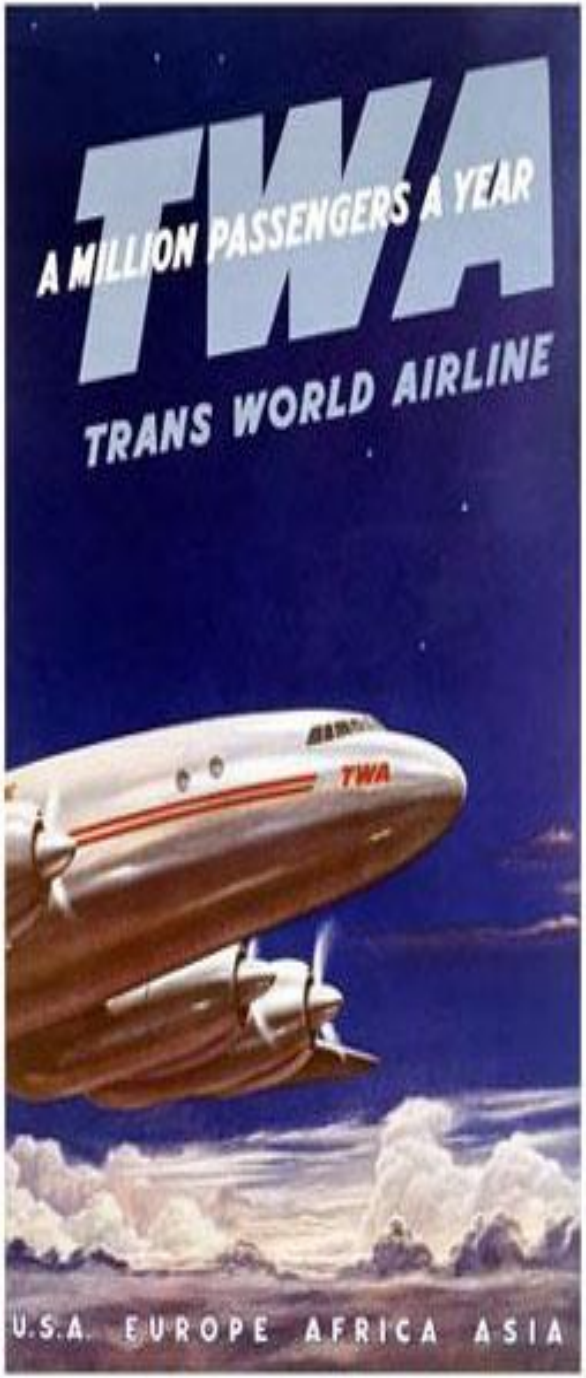
The Impact of Aircraft Engine Emissions in the Upper Atmosphere

Present commercial aircraft fly at altitudes of 8-13 km. The emissions from such air traffic can change the atmospheric composition:

Directly: by emitting carbon dioxide (CO_2), nitrogen oxides (NO_x = NO + NO_2), water vapour, unburnt hydrocarbons, soot, and sulfate particles.

Indirectly: by a chemical reaction chain similar to smog-formation the greenhouse gas ozone (O_3) can be formed. In this reaction chain nitrogen oxides act as a catalyst under the influence of sunlight. As a result of these chemical reactions also the concentration of methane (CH_4), another greenhouse gas, decreases.

Source: **R**oyal **N**etherlands **M**eteorological **I**nstitute
Section of **A**tmospheric **C**omposition



Contrails

- Both SO2 (which forms sulfate particles) and soot particles from aircraft exhaust are aerosols—microscopic particles suspended in air. They act like seeds. Water molecules can condense or freeze on them to form cloud particles.
- Aircraft exhaust produces contrails—condensation trails in the atmosphere about 5 miles above the Earth's surface. At these high altitudes, contrails and cirrus clouds form depending on the quantity of water vapor and atmospheric conditions.
- Contrails and cirrus clouds both reflect sunlight that would otherwise warm the Earth's surface. At the same time, they absorb heat from the ground instead of allowing it to escape. Do they contribute to global warming or global cooling? The scientific community is still trying to answer that question.
- Contrails contribute to the phenomenon known as "global change." Right now this effect is small, but it is growing. Although scientists are uncertain about the impact of contrails on global change, they believe that persistent contrails, those that last longer than a few minutes, gradually develop into cirrus clouds. Over the past 40 years, cloudiness seems to have increased. If this is in fact true, then this continual increase in cloudiness may lead to global climate change because it will change the amount of radiation entering and leaving the Earth's atmosphere. This characteristic of aircraft engine exhaust may act in a way similar to the effects produced by greenhouse gases.
- What effect, if any, do contrails have on weather? Answering this accurately is difficult because so many factors affect weather. However, many meteorologists believe increased jet traffic and the contrails it produces have altered the weather. They point out that areas of high jet traffic show the greatest change.

Source: NASA

These changes can have effects on climate:

Ozone, CO2, and water vapour are greenhouse gases and their increase has a warming effect.

Methane is also a greenhouse gas and its decrease has a cooling effect.

Aerosols (sulfate particles, soot) could have a cooling effect.

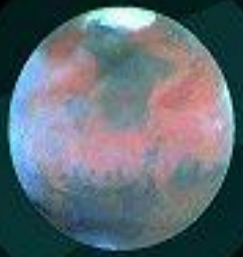
Contrails formed due to the emission of particles and water vapour can increase the cloud cover in the upper troposphere. This may result in a cooling or heating depending on the size and optical depth of the ice crystals of which the contrails consist. Presently it is believed that contrails lead to a net warming effect.

There may be changes in (non-contrail) upper level clouds: Most contrails decay after minutes to hours, but some continue to exist and are then not distinguishable anymore from natural cirrus clouds (thin upper level clouds) for the human eye. The climate effect of changes in cirrus cloud cover due to aviation are not well known.

Source: **R**oyal **N**etherlands **M**eteorological **I**nstitute
Section of **A**tmospheric **C**omposition

Planets and atmospheres

Mars
Thin atmosphere
(Almost all CO_2 in ground)
Average temperature : - 50°C



Earth
0,03% of CO_2 in the atmosphere
Average temperature : + 15°C

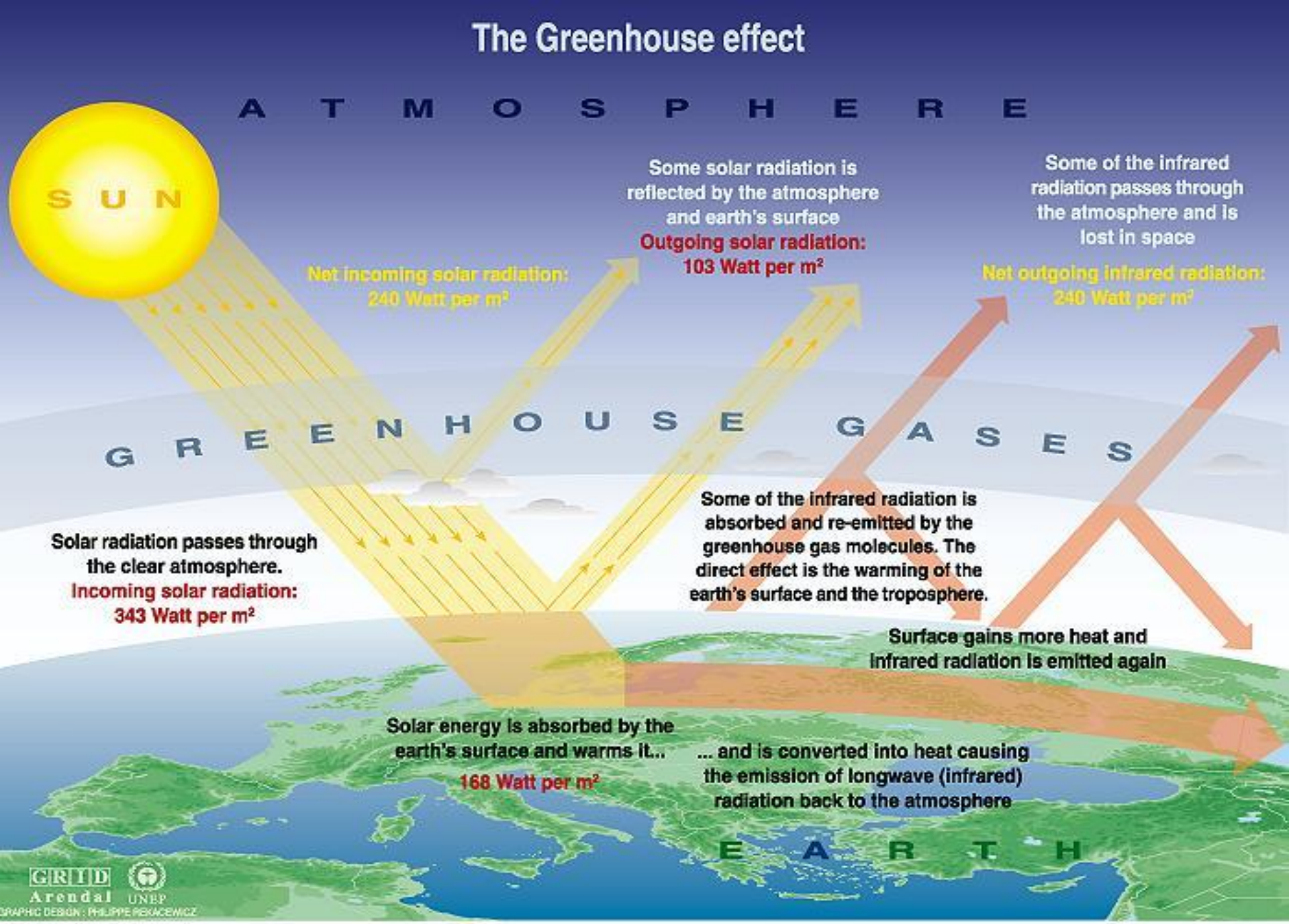
Venus
Thick atmosphere
containing 96% of CO_2
Average temperature : + 420°C

GRID Arendal UNEP

GRAPHIC DESIGN : PHILIPPE REKACEWICZ

Sources: Calvin J. Hamilton, Views of the solar system, www.planetscapes.com; Bill Arnett , The nine planets, a multimedia tour of the solar system, www.seds.org/billa/tnp/nineplanets.html

The Greenhouse effect

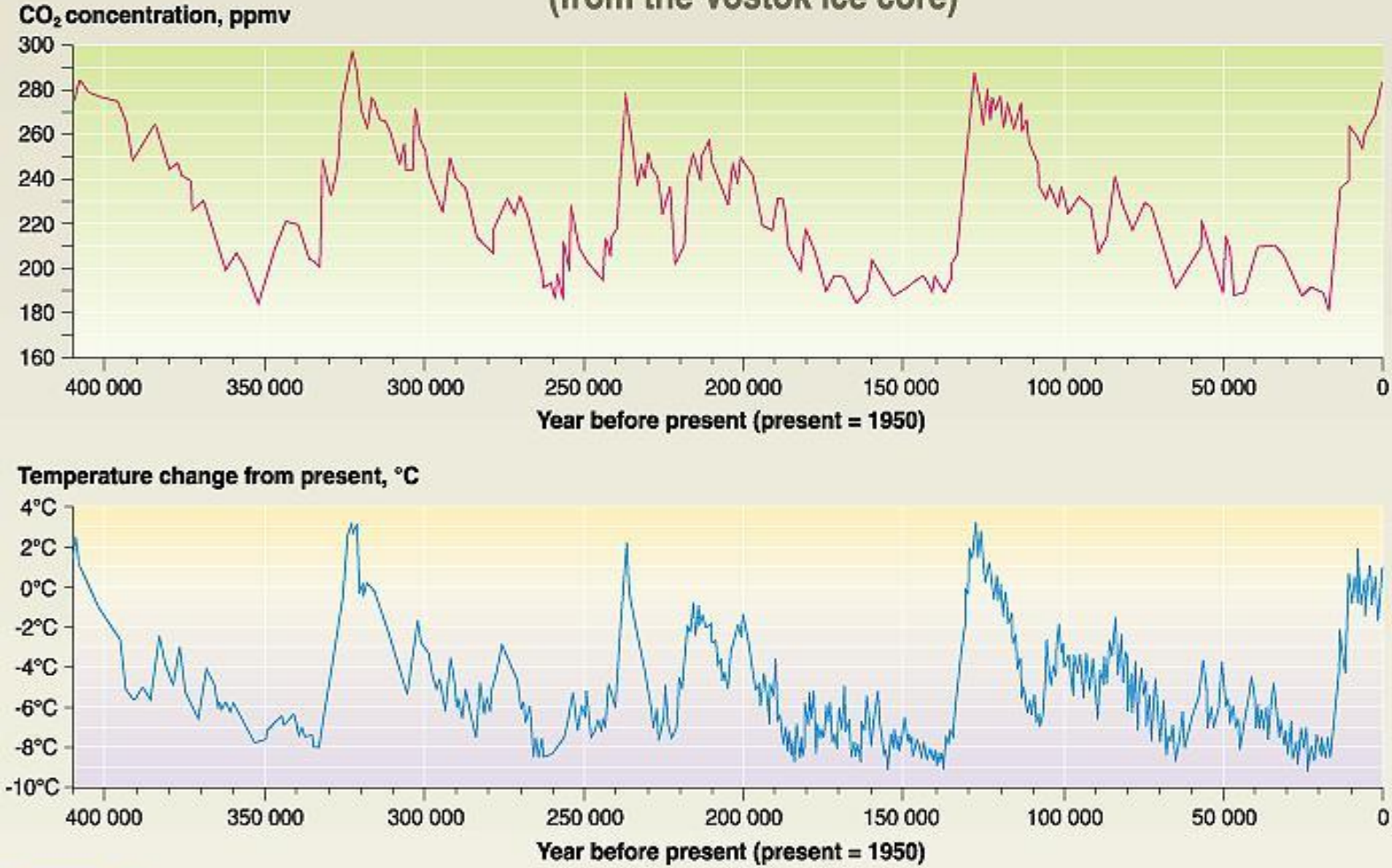


Sources: Okanagan university college in Canada, Department of geography, University of Oxford, school of geography; United States Environmental Protection Agency (EPA), Washington; Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.


GLOBAL WARMING
It's A Bitch...One Drop At A Time.


STOP GLOBAL WARMING

Temperature and CO_2 concentration in the atmosphere over the past 400 000 years (from the Vostok ice core)

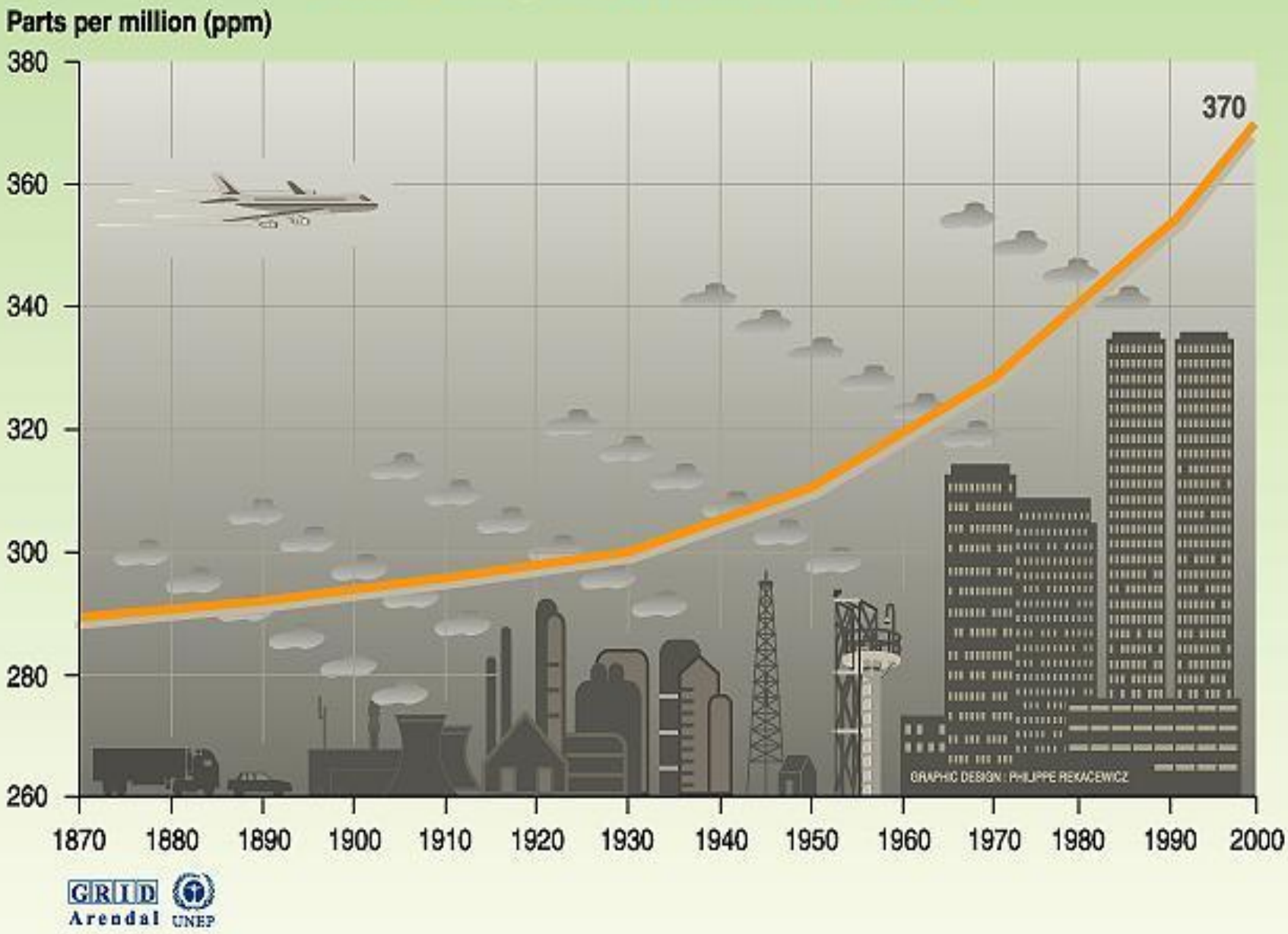


GRID Arendal UNEP

GRAPHIC DESIGN : PHILIPPE REKACEWICZ

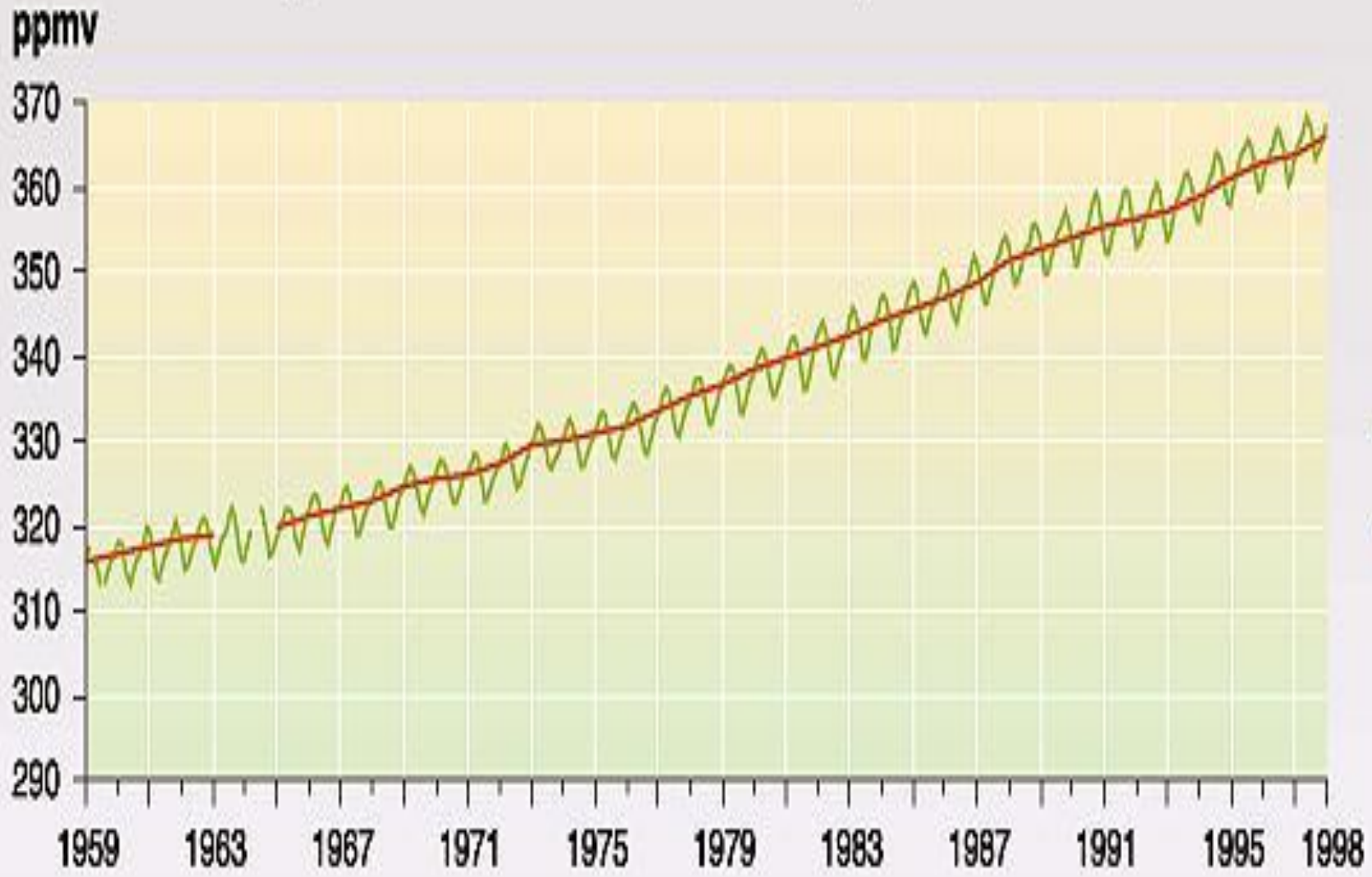
Source: J.R. Petit, J. Jouzel, et al. Climate and atmospheric history of the past 420 000 years from the Vostok ice core in Antarctica, Nature 399 (3JUne), pp 429-436, 1999.

Global atmospheric concentration of CO_2

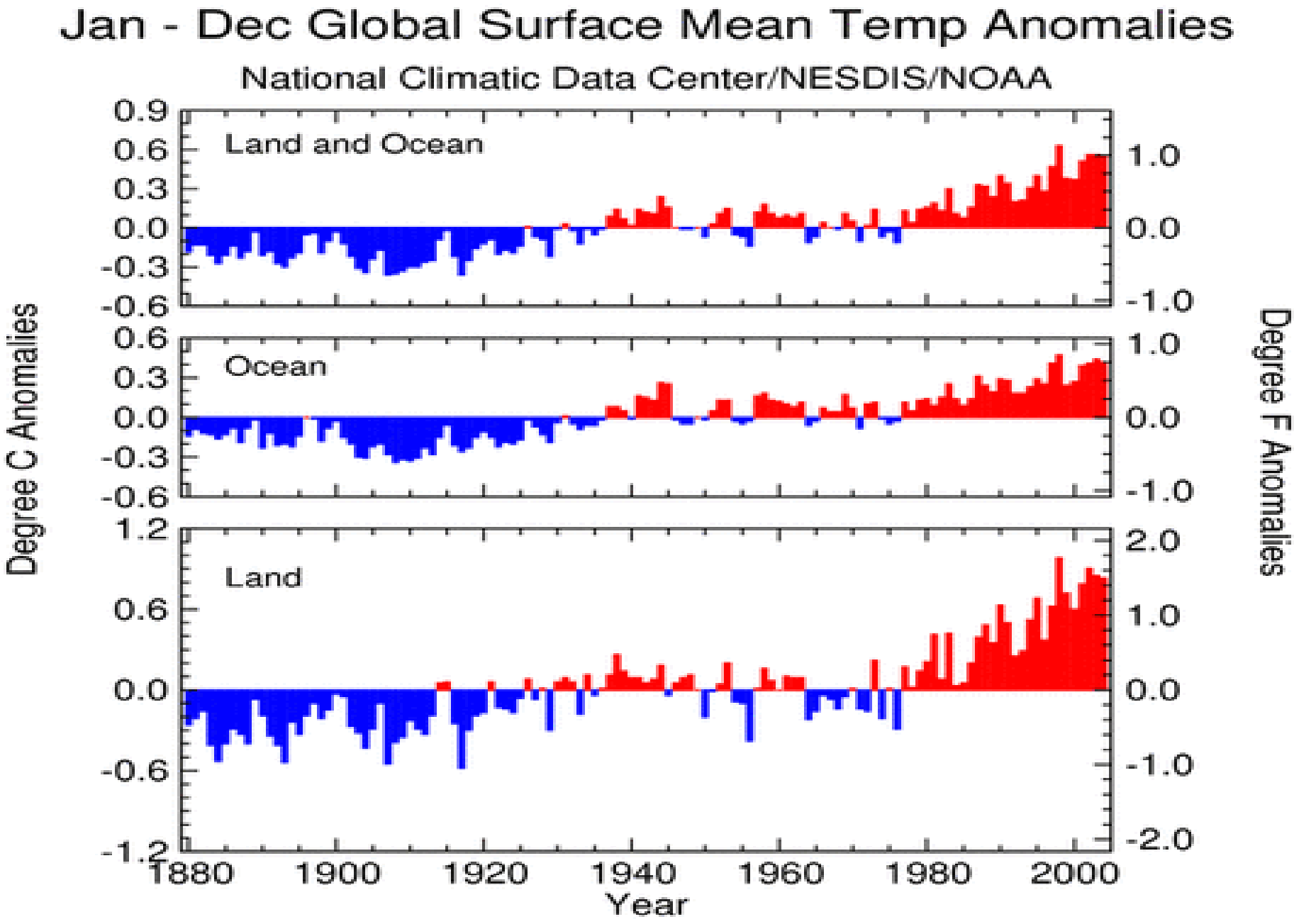


Sources: TP Whorf Scripps, Mauna Loa Observatory, Hawaii, institution of oceanography (SIO), university of California La Jolla, California, United States, 1999

CO_2 concentration in the atmosphere: Mauna Loa curve

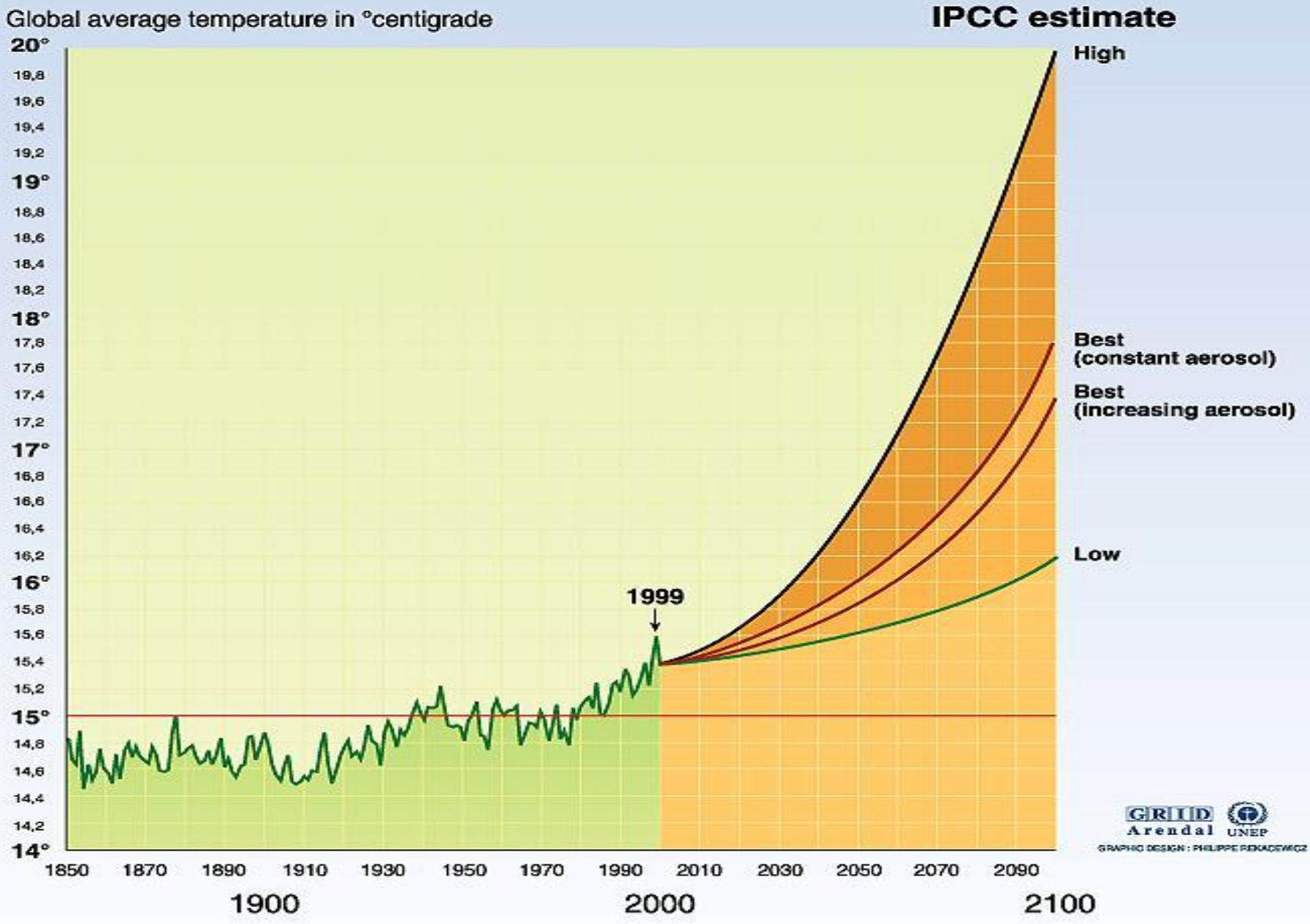


Source : Scripps Institution of oceanography (SIO), University of California, 1998.


Jan - Dec Global Surface Mean Temp Anomalies
National Climatic Data Center/NESDIS/NOAA
Land and Ocean
Ocean
Land
Degree C Anomalies
Degree F Anomalies
0.9
0.6
0.3
0.0
-0.3
-0.6
1.0
0.0
-1.0
1.2
0.6
0.0
-0.6
-1.2
2.0
1.0
0.0
-1.0
-2.0
1880
1900
1920
1940
1960
1980
2000
Year

Projected changes in global temperature:

global average 1856-1999 and projection estimates to 2100

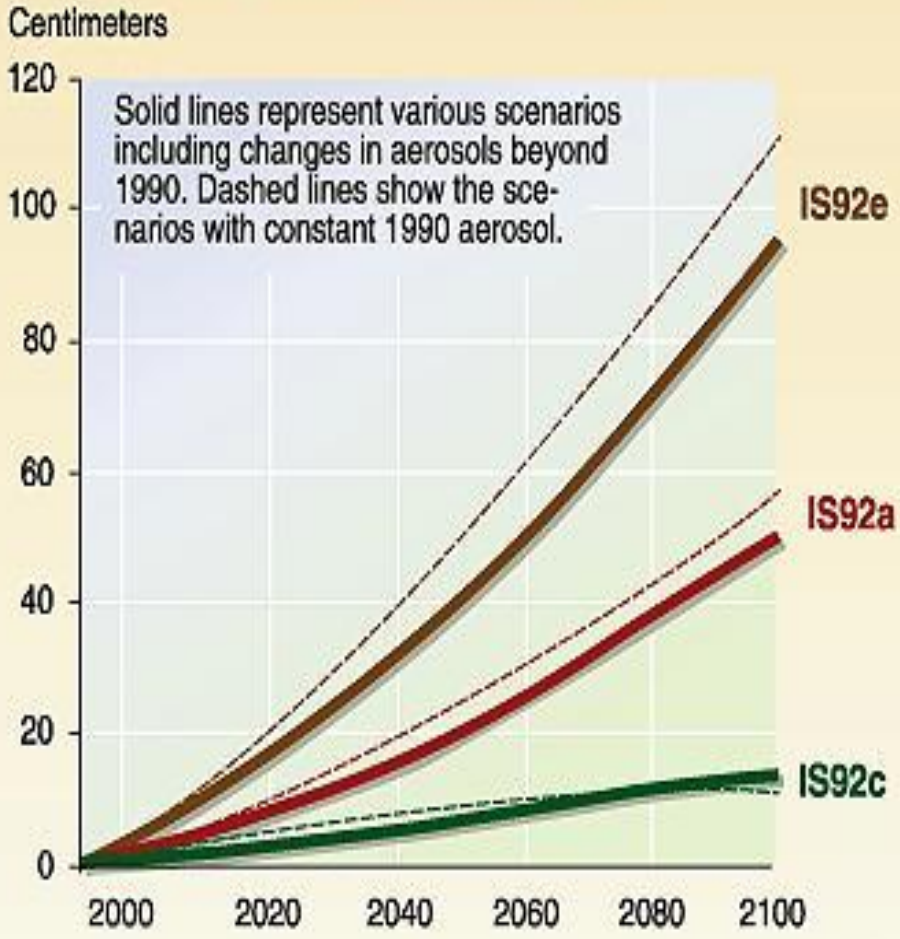


Source : Temperatures 1856 - 1999: Climatic Research Unit, University at East Anglia, Norwich UK. Projections: IPCC report 95.

Sea level rise due to global warming

Sea level rise over the last century

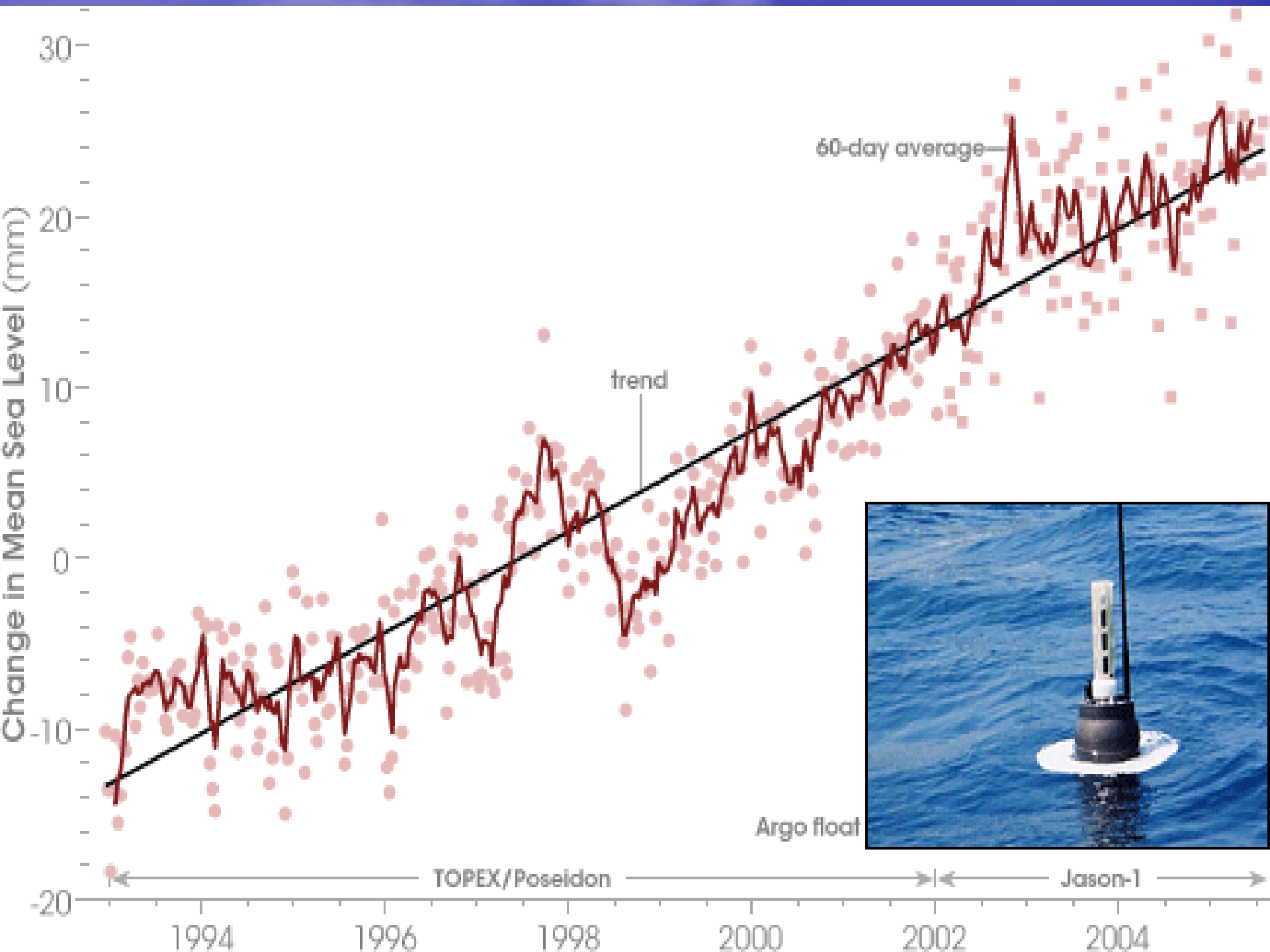
Sea level rise scenarios for 2100



GRID Arendal UNEP

GRAPHIC DESIGN : PHILIPPE REKACEWICZ

Source: Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996; Sea level rise over the last century, adapted from Gornitz and Lebedeff, 1987.

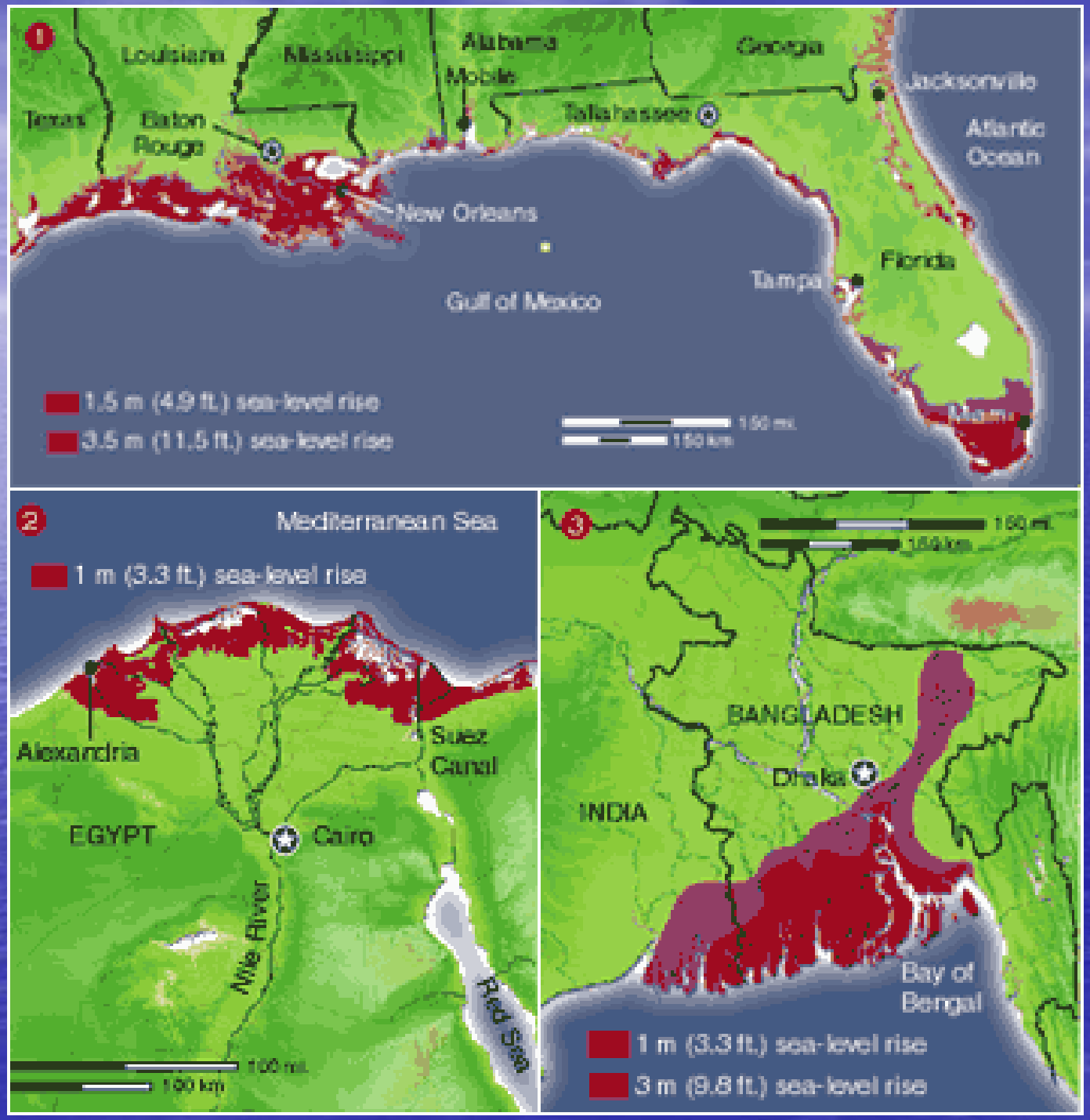

30
20
10
0
-10
-20
Change in Mean Sea Level (mm)
60-day average
trend
Argo float
TOPEX/Poseidon
Jason-1
1994
1996
1998
2000
2002
2004

The Impact of Global Warming on Sea Levels

Higher temperatures are expected to raise sea level by:

- expanding ocean water,
- melting mountain glaciers and small ice caps,
- causing portions of the coastal section of the Greenland and Antarctic ice sheets to melt or slide into the ocean.
- Higher temperatures are also likely to increase the amount of snowfall over central Greenland and Antarctica. The higher snowfall is likely to offset part of the sea level rise from other factors because the additional snow is comprised of water that would otherwise be in the ocean.

Source: US EPA


1
Louisiana
Mississippi
Alabama
Georgia
Mobile
Jacksonville
Texas
Baton Rouge
Tallahassee
Atlantic Ocean
New Orleans
Florida
Tampa
Gulf of Mexico
1.5 m (4.9 ft.) sea-level rise
3.5 m (11.5 ft.) sea-level rise
150 mi
150 km
Miami
2
Mediterranean Sea
1 m (3.3 ft.) sea-level rise
Alexandria
Suez Canal
EGYPT
Cairo
Nile River
Red Sea
100 mi
100 km
3
150 mi
150 km
BANGLADESH
Dhaka
INDIA
Bay of Bengal
1 m (3.3 ft.) sea-level rise
3 m (9.8 ft.) sea-level rise

UN Intergovernmental Panel on Climate Change

- Eleven of the twelve years in the period (1995-2006) rank among the top 12 warmest years in the instrumental record (since 1850).
- Warming in the last 100 years has caused about a 0.74 °C increase in global average temperature. This is up from the 0.6 °C increase in the 100 years prior to the Third Assessment Report. "Warming of the climate system is unequivocal"
- "Most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations."

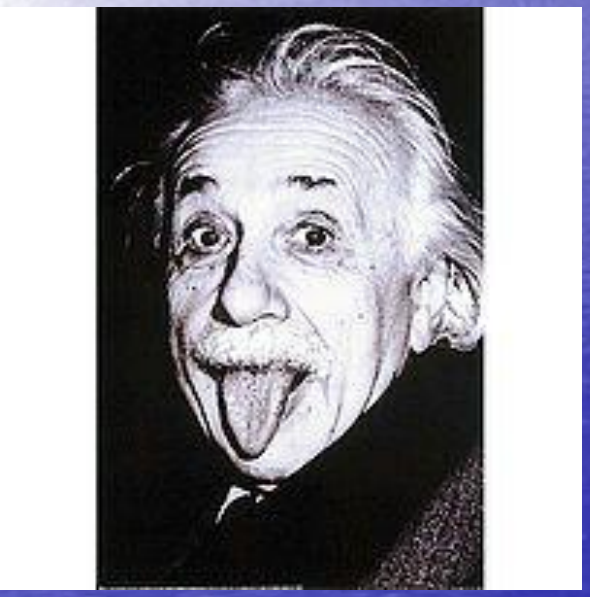
Climate Change 2007: The Physical Science Basis,
the report of Working Group I

Emissions at Altitude

- Jet aircraft are the primary source of human emissions deposited directly into the upper atmosphere. . . . [S]ome of these emissions have a greater warming effect than they would have if they were released in equal amounts at the surface – by, for example, automobiles.
- Carbon dioxide . . . survives in the atmosphere for about 100 years and contributes to warming the earth. . . . [G]lobal aviation's carbon dioxide emissions . . . are roughly equivalent to the emissions of certain industrialized countries.
- Carbon dioxide emissions combined with other gases and particulates emitted by jet aircraft – including water vapor, nitrogen oxide and nitrogen dioxide (collectively termed NOx), and soot and sulfate – could have two to four times as great an effect on the atmosphere as carbon dioxide alone. . . .
- [T]he increase in aviation emissions attributable to a growing demand for air travel would not be fully offset by reductions in emissions achieved through technological improvements alone.

Source: U.S. General Accounting Office, Aviation and the Environment: Aviation's Effects on the Global Atmosphere Are Potentially Significant and Expected to Grow (Feb. 2000).

But there are scientific uncertainties



- Although the natural greenhouse effect is vital for human existence, many scientists believe that additional warming linked to human activity may cause our climate to change irreversibly. However scientists disagree over the amount, probability and nature of these changes.

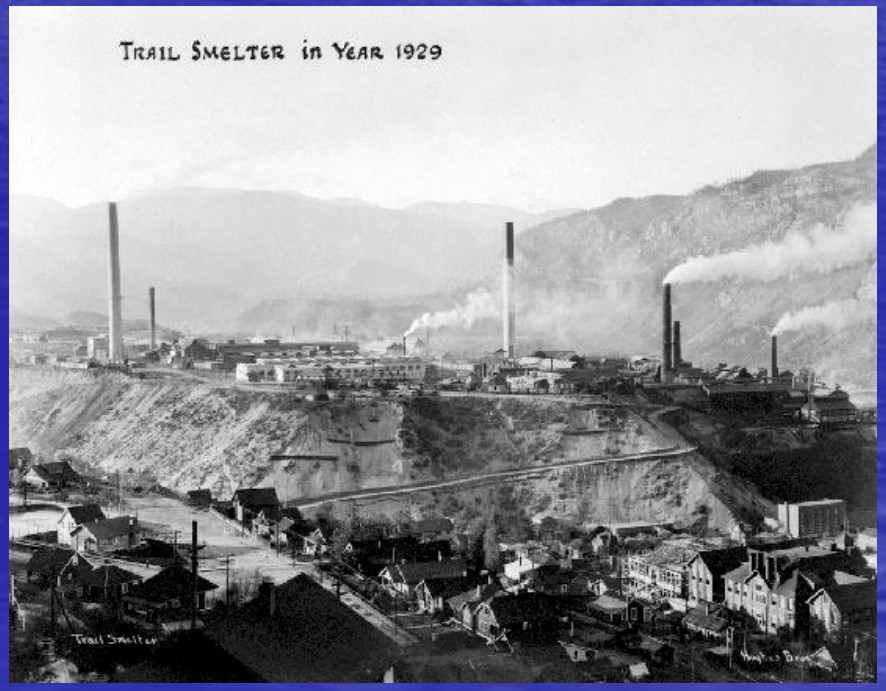
  There is also disagreement over aviation's contribution to climate change. There is a good understanding of CO2 emissions, which contribute directly to the greenhouse effect, along with water vapour. Nitrogen oxides (NOx) contribute indirectly by creating ozone. But little is known about the effect of contrails, cirrus cloud formation and the methane-reducing capabilities of NOx.
- The best estimate of aviation's climate change impact is about 3.5% of the total contribution by human activities. This may grow to 5% by 2050.

Source: IATA

Customary International Law: The Polluter Pays Doctrine

- Trail Smelter Arbitration (US v. Canada, 1941)– a State is liable for damages caused by transboundary pollution to other States.

Principle 16 of the Rio Declaration of 1992: "National authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution . . . ."



The Rio Declaration on Environment and Development - 1992

Calls upon States, in a spirit of global cooperation, to protect, conserve and restore the health of the Earth's ecosystems.

The Kyoto Protocol

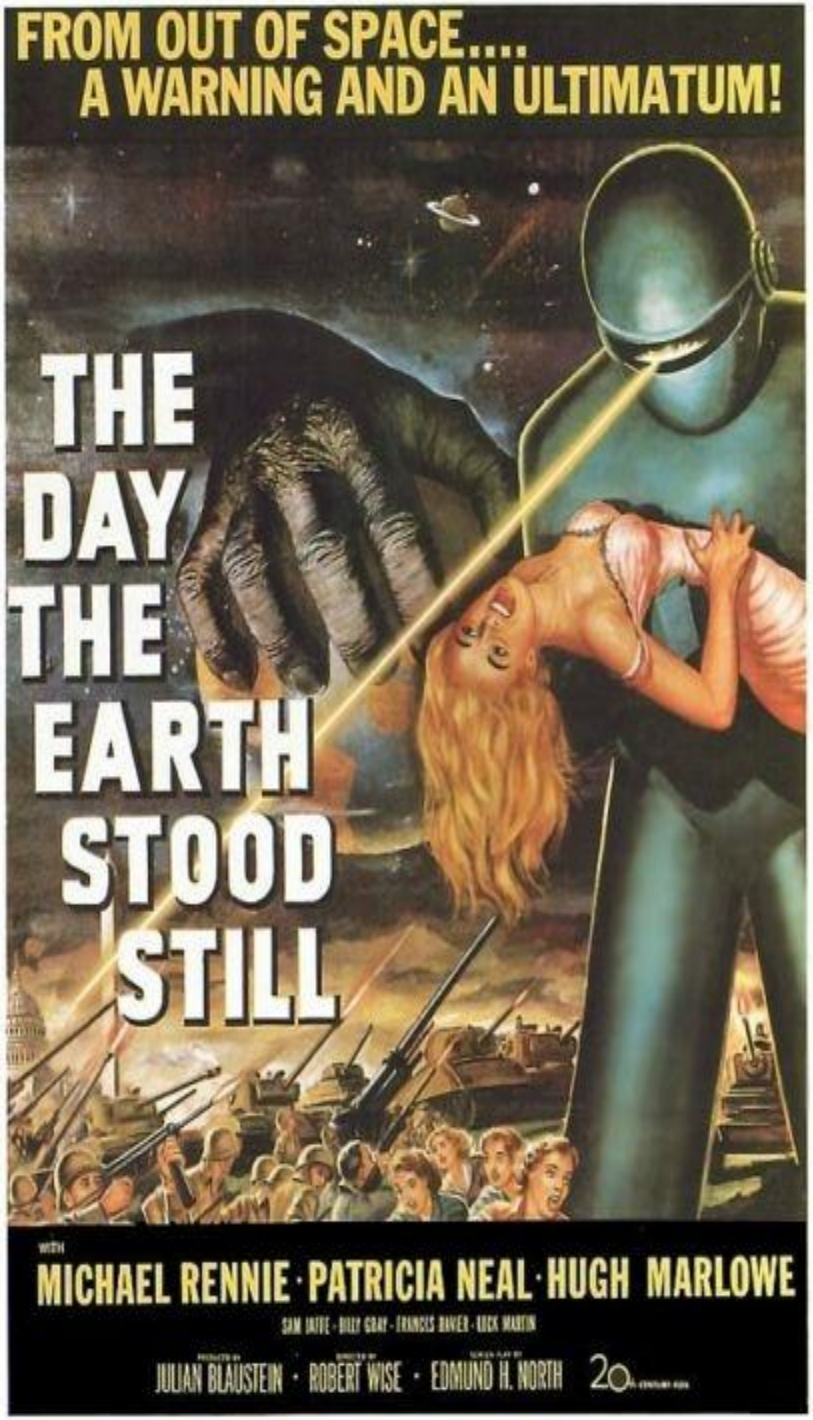
- Adopted in 1997, the Kyoto Protocol to the United Nations Framework Convention on Climate Change promises to move the international community closer to achieving the Convention's ultimate objective of preventing "dangerous anthropogenic [man-made] interference with the climate system".
- The developed countries commit themselves to reducing their collective emissions of six key greenhouse gases by at least 5% compared to 1990 levels, of which CO2 is most relevant to aviation. Each country's emissions target must be achieved by the period 2008-2012.
- Countries will have a certain degree of flexibility in how they make and measure their emissions reductions. In particular, an international "emissions trading" regime will be established allowing industrialized countries to buy and sell emissions credits amongst themselves.

Source: EU Commission

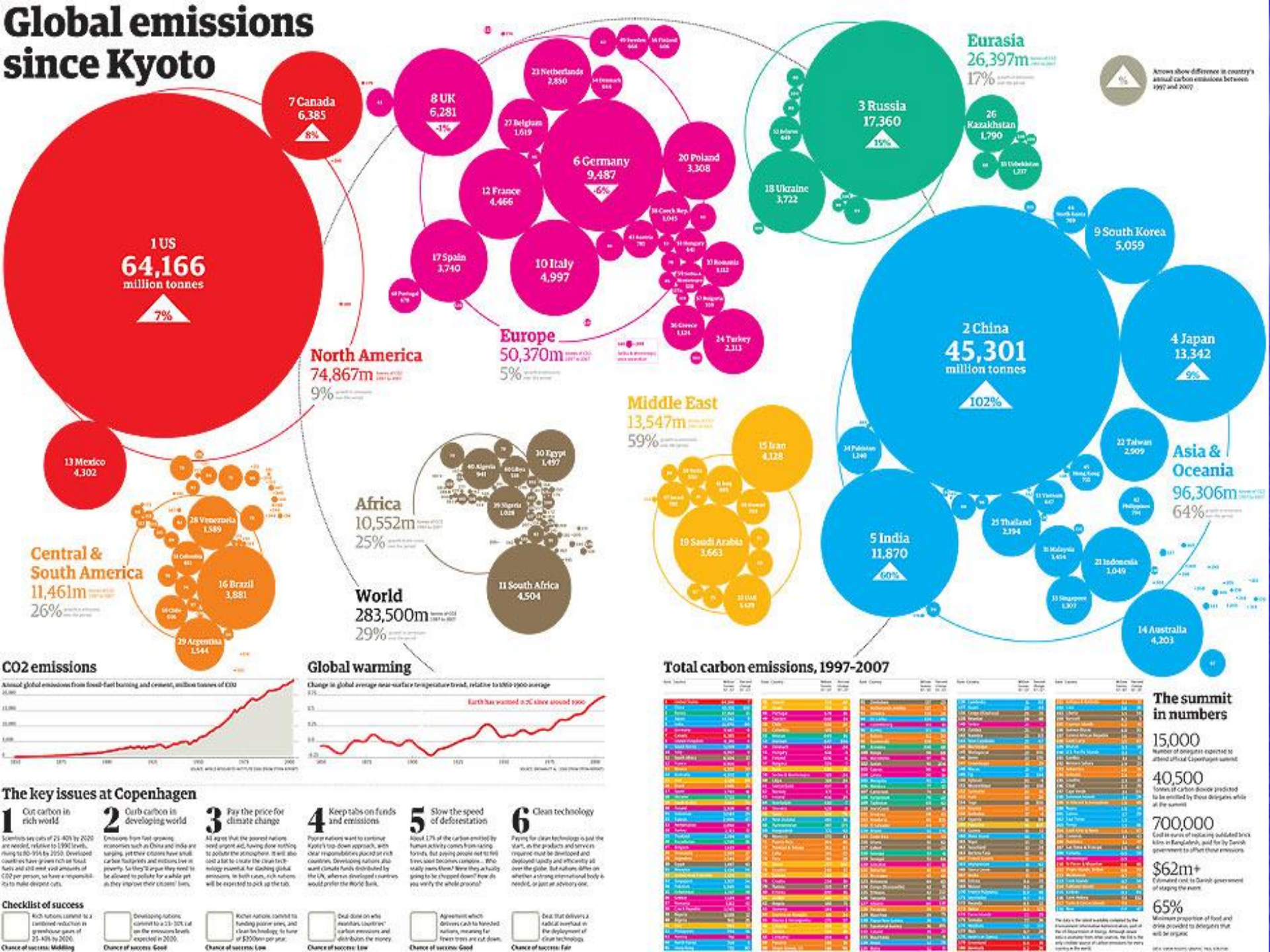
Kyoto and ICAO

"The Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation … working through the International Civil Aviation Organization…."

Kyoto Protocol to the United Nations Framework Convention on Climate Change Art. 2



Global emissions since Kyoto



CO2 emissions

Annual global emissions from fossil-fuel burning and cement, million tonnes of CO2

Global warming

Change in global average near-surface temperature trend, relative to 1850-1900 average

Total carbon emissions, 1997-2007

The key issues at Copenhagen

1 Cut carbon in rich world

Scientists say cuts of 25-40% by 2020 are needed, relative to 1990 levels, rising to 80-95% by 2050. Developed countries have grown rich on fossil fuels and still emit vast amounts of CO2 per person, so have a responsibility to make deepest cuts.

2 Curb carbon in developing world

Emissions from fast-growing economies such as China and India are surging, yet their citizens have small carbon footprints and millions live in poverty. So they'll argue they need to be allowed to pollute for a while yet as they improve their citizens' lives.

3 Pay the price for climate change

All agree that the poorest nations need urgent aid, having done nothing to pollute the atmosphere. It will also cost a lot to create the clean technology essential for slashing global emissions. In both cases, rich nations will be expected to pick up the tab.

4 Keep tabs on funds and emissions

Poorer nations want to continue Kyoto's top-down approach, with clear responsibilities placed on rich countries. Developing nations also want climate funds distributed by the UK, whereas developed countries would prefer the World Bank.

5 Slow the speed of deforestation

About 17% of the carbon emitted by human activity comes from razing forests. But paying people not to fell trees soon becomes complex ... Who really owns them? Were they actually going to be chopped down? How do you verify the whole process?

6 Clean technology

Paying for clean technology is just the start, as the products and services required must be developed and deployed rapidly and efficiently all over the globe. But nations differ on whether a strong international body is needed, or just an advisory one.

Checklist of success

- ☐ Rich nations commit to a combined reduction in greenhouse gases of 25-40% by 2020. — Chance of success: Middling
- ☐ Developing nations commit to a 15-30% cut on the emissions levels expected in 2020. — Chance of success: Good
- ☐ Richer nations commit to funding poorer ones, and clean technology, to tune of $300bn per year. — Chance of success: Low
- ☐ Deal done on who monitors countries' carbon emissions and distributes the money. — Chance of success: Low
- ☐ Agreement which delivers cash to forested nations, meaning far fewer trees are cut down. — Chance of success: Good
- ☐ Deal that delivers a radical overhaul in the deployment of clean technology. — Chance of success: Fair

The summit in numbers

15,000
Number of delegates expected to attend official Copenhagen summit

40,500
Tonnes of carbon dioxide predicted to be emitted by those delegates while at the summit

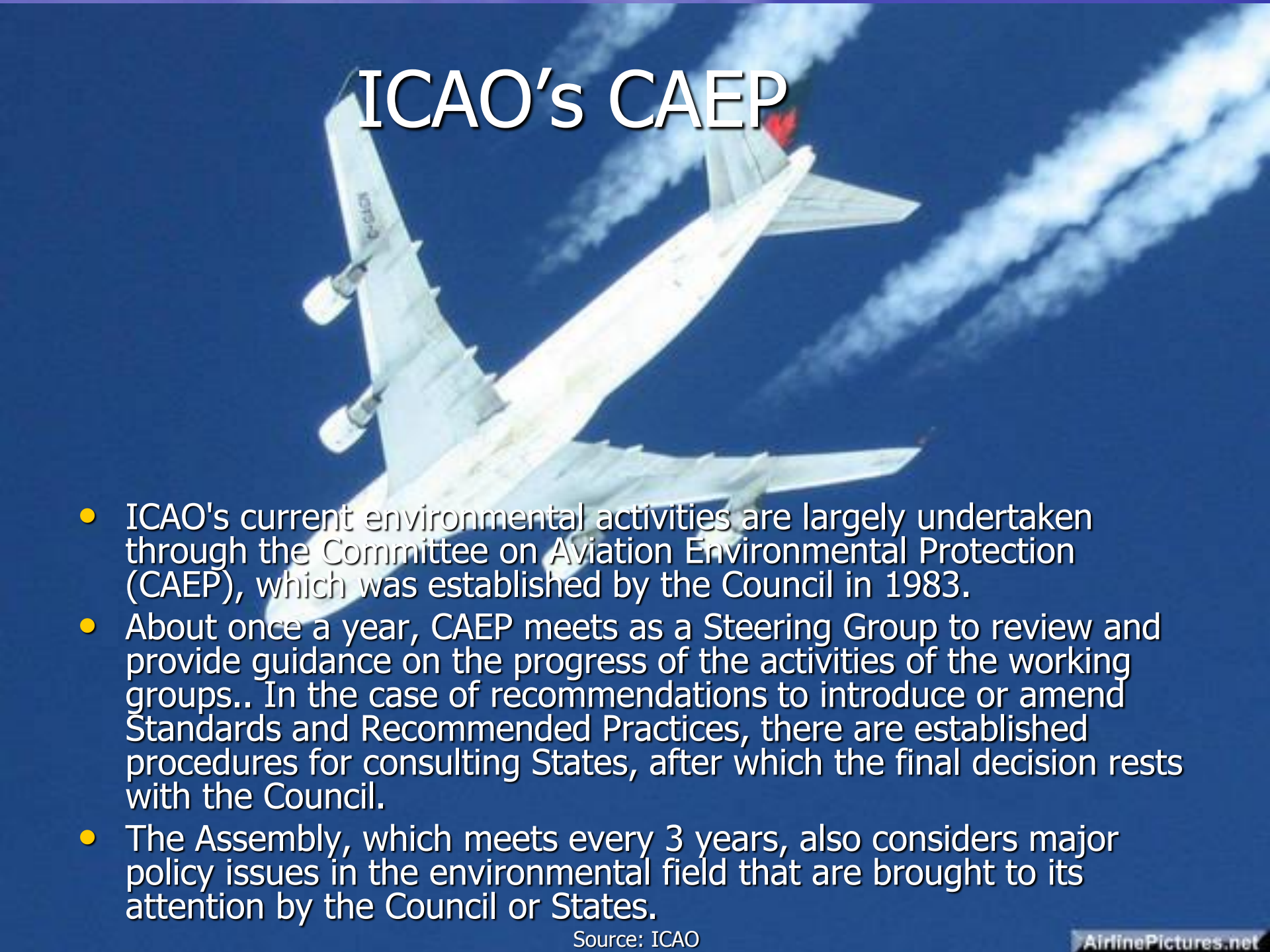
700,000
Cost in euros of replacing outdated brick kilns in Bangladesh, paid for by Danish government to offset those emissions

$62m+
Estimated cost to Danish government of staging the event

65%
Minimum proportion of food and drink provided to delegates that will be organic

- ICAO promulgated its first environmental standards in 1981;
- ICAO issued standards addressing CO2 emissions in 2001.

ICAO’s CAEP



- ICAO's current environmental activities are largely undertaken through the Committee on Aviation Environmental Protection (CAEP), which was established by the Council in 1983.
- About once a year, CAEP meets as a Steering Group to review and provide guidance on the progress of the activities of the working groups.. In the case of recommendations to introduce or amend Standards and Recommended Practices, there are established procedures for consulting States, after which the final decision rests with the Council.
- The Assembly, which meets every 3 years, also considers major policy issues in the environmental field that are brought to its attention by the Council or States.

Source: ICAO

The ICAO Assembly's Strategic Objectives

- The 35th Session of the ICAO Assembly established 6 Strategic Objectives to "achieve its vision of safe, secure and sustainable development of civil aviation through cooperation amongst its member States"
- Strategic Objective C, *Environmental Protection*
  - *Minimize the adverse effect of global civil aviation on the environment,* will be attained, in part, by developing, adopting, and promoting new or amended measures to:
    - limit or reduce the number of people affected by significant aircraft noise
    - limit or reduce the impact of aviation emissions on local air quality; and
    - limit or reduce the impact of aviation greenhouse gas emissions on the global climate

Source: US FAA

ICAO's Technical and Regulatory Standards

- ICAO first adopted NOx emission standards in 1981. These were strengthened in1993, 1998 and in 2004, when ICAO adopted new Standards to be applicable in 2008, 12% lower than the existing Standards.

ICAO's Four Pillar Approach:

- Investing in new technologies;
- Streamlining aircraft operations to conserve fuel;
- Updating the ANS systems to reduce flight times and delays; and
- Using market-based measures, including:
  - Emissions trading

Source: ICAO

1. New Technologies

- New aircraft and engine designs;
- New composite materials;
- Development of bio-fuels.

2. Operational Measures

- Improvements in air traffic management (ATM) and other operational procedures could reduce aviation fuel burn by between 8 and 18%
- Most important fuel saving opportunities come from ATM efficiencies –
  - more direct routings
  - use of more efficient conditions such as optimum altitude and speed

Source: ICAO

3. Improvements in Flight Operations

- Opportunities for fuel conservation
  - Landing weight
  - Fuel reserves
  - Airplane loading
  - Route selection
  - Altitude selection
  - Speed selection
  - Flap selection

Source: IC AO

4. Market-based Measures

- Voluntary Measures
  - government and other entity agree to take specified actions or meet specified goals
- Emissions Charges
  - a charge on the amount of emissions
  - revenues used to mitigate the environmental impact of engine emissions
- Emissions Trading
  - the total amount of emissions would be capped
  - allowances in the form of permits could be bought and sold to meet emission reduction objectives
  - open trading allows trading across sectors

Source: ICAO

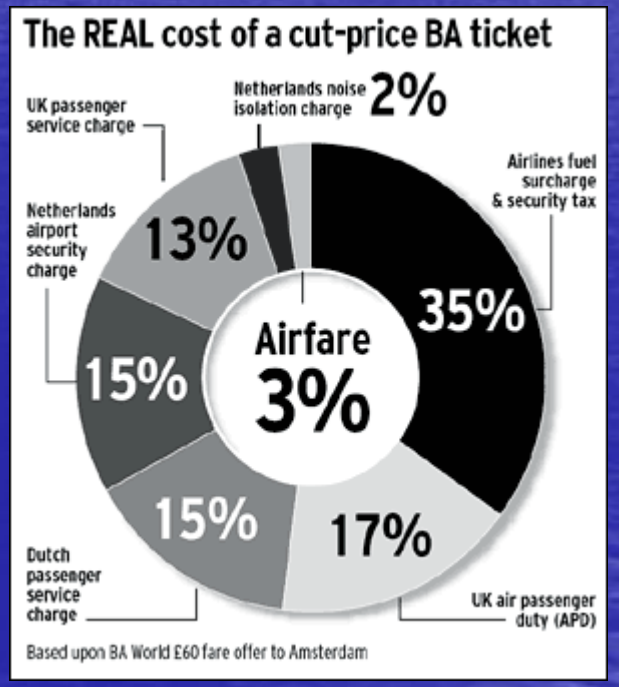
The Use of Market-based Measures

- The ICAO Assembly endorsed the development of an open **emissions-trading system**, a system whereby the total amount of emissions would be capped, and allowances in the form of permits to emit CO2 could be bought and sold to meet emission reduction objectives.

Source: ICAO

€mission Taxe$

- ICAO also has been considering **emission-related levies** - that is, charges or taxes.
- ICAO has developed separate policy guidance to States on taxation, which recommends the reciprocal exemption from all taxes levied on fuel purchased for international flights, a policy implemented in most bilateral air services agreements, and also calls on States to reduce or eliminate taxes related to the sale or use of international air transport.



Source: ICAO

Emissions Trading As An Alternative to Emissions Taxes

- Emissions trading imposes an overall limit of emissions while allowing the trading (market sale) of the right to pollute, thereby achieving emission reductions at least cost to society.
- If polluters emit more than their allotment, they must purchase an equivalent number of allowances from the carbon market.
- If they produce less, they may sell their allowances.
- Each entity can choose the least costly option to meet its quota. It can lower production, improve energy efficiency, *or* purchase allowances from other firms that emit less than their quota.

ADVANTAGES OF ETS

- ETS is more dynamically efficient than taxation.
- ETS self adjusts to economic growth.
- If designed properly – particularly if credits are auctioned and all industries are within the system - it can avoid competition distortion.
- ETS creates abatement incentives for industries with lower abatement costs.
- ETS is less expensive, and more effective, than taxation.

The European Union

- Between 1990-2003, international aviation emissions increased 73% (4% per year).
- Air traffic is expected to double by 2020, and triple by 2030.
- Aviation emissions will neutralize more than 25% of Kyoto's target by 2012.

EU Milestones

- **20 Dec. 2006:** Commission presented draft legislation aimed at including aviation in the Emissions Trading Scheme.
- **26 June 2008:** MEPs and the EU's Slovenian Presidency reached a deal on the details of plans to include aviation in the EU's Emissions Trading Scheme as of 2012.
- **8 July 2008:** European Parliament backed compromise deal, paving the way for entry into force of the legislation.
- **24 Oct. 2008:** EU justice ministers approved a compromise deal on including aviation activities in the EU ETS
- **13 Jan. 2009:** Directive 2008/101/EC to include aviation into the EU Emissions Trading Scheme (ETS) was published in the Official Journal.
- **1 Jan. 2012:** Target date for aviation sector to start trading CO2.
- **1 Jan. 2013:** Revised EU-ETS due to come into force, covering not only power-intensive industries, but also aviation.
- Source: http://www.euractiv.com/en/climate-change/aviation-emissions-trading/article-139728

EU ETS – What it is & who's affected

- What is it?
  - In Spring 2009, the European Union announced plans to expand the scope of its Emissions Trading Scheme (ETS) to include aviation. The plan has caused a lot of speculation throughout the aviation industry.
  - In simple terms, EU ETS is a mandatory regulation requiring all non-commercial operators and commercial large emitters who travel into, out of, and between EU Member States to monitor their CO2 emissions starting 1 January 2010.
- Who does it apply to?
  - The EU ETS applies to non-commercial operators and commercial large emitters who conduct flights to, from or within airports located in EU countries or EU country territories

EU Commission proposes bringing air transport into EU Emissions Trading Scheme

- The proposed directive will cover emissions from flights within the EU from 2011 and all flights to and from EU airports from 2012.
- Both EU and foreign aircraft operators would be covered.
- Like the industrial companies already covered by the EU ETS, airlines will be able to sell surplus allowances if they reduce their emissions and will need to buy additional allowances if their emissions grow.

Source: European Union

EU-ETS timeline

Phase I

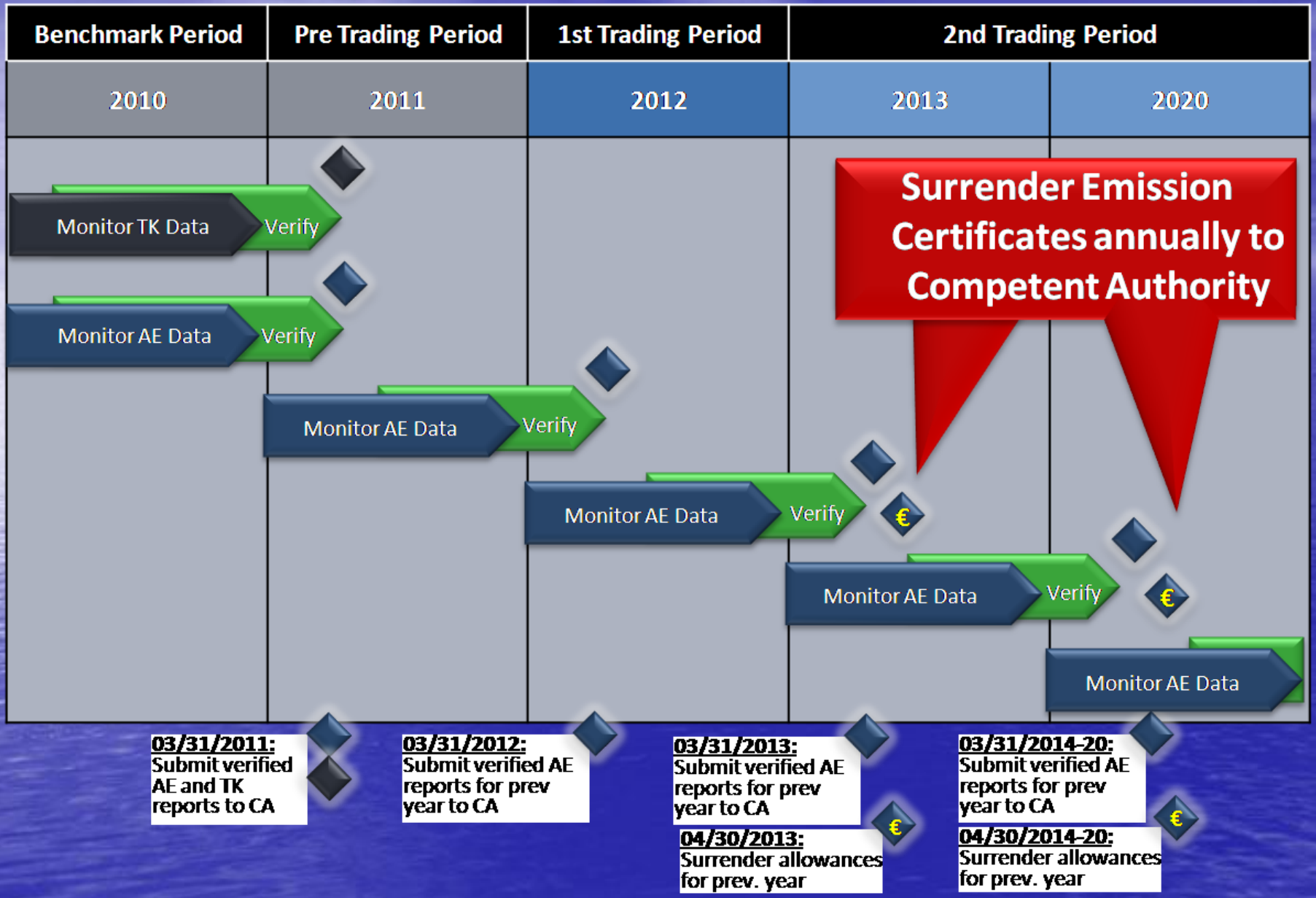
2005-2007:
Aviation sector not affected

Phase II

2008-2012:
Aircraft operators are required to monitor and report their CO_2 emissions beginning 1 January 2010

Phase III

1 January 2013:
Aircraft operators are required to surrender one allowance for each tonne of CO_2 emitted during the reporting year (the first surrender of allowances for the 2012 reporting period will need to be completed by 30 April 2013)


Benchmark Period
Pre Trading Period
1st Trading Period
2nd Trading Period
2010
2011
2012
2013
2020
Monitor TK Data
Verify
Monitor AE Data
Verify
Monitor AE Data
Verify
Monitor AE Data
Verify
€
Monitor AE Data
Verify
€
Monitor AE Data
Surrender Emission Certificates annually to Competent Authority
03/31/2011: Submit verified AE and TK reports to CA
03/31/2012: Submit verified AE reports for prev year to CA
03/31/2013: Submit verified AE reports for prev year to CA
04/30/2013: Surrender allowances for prev. year
€
03/31/2014-20: Submit verified AE reports for prev year to CA
04/30/2014-20: Surrender allowances for prev. year
€

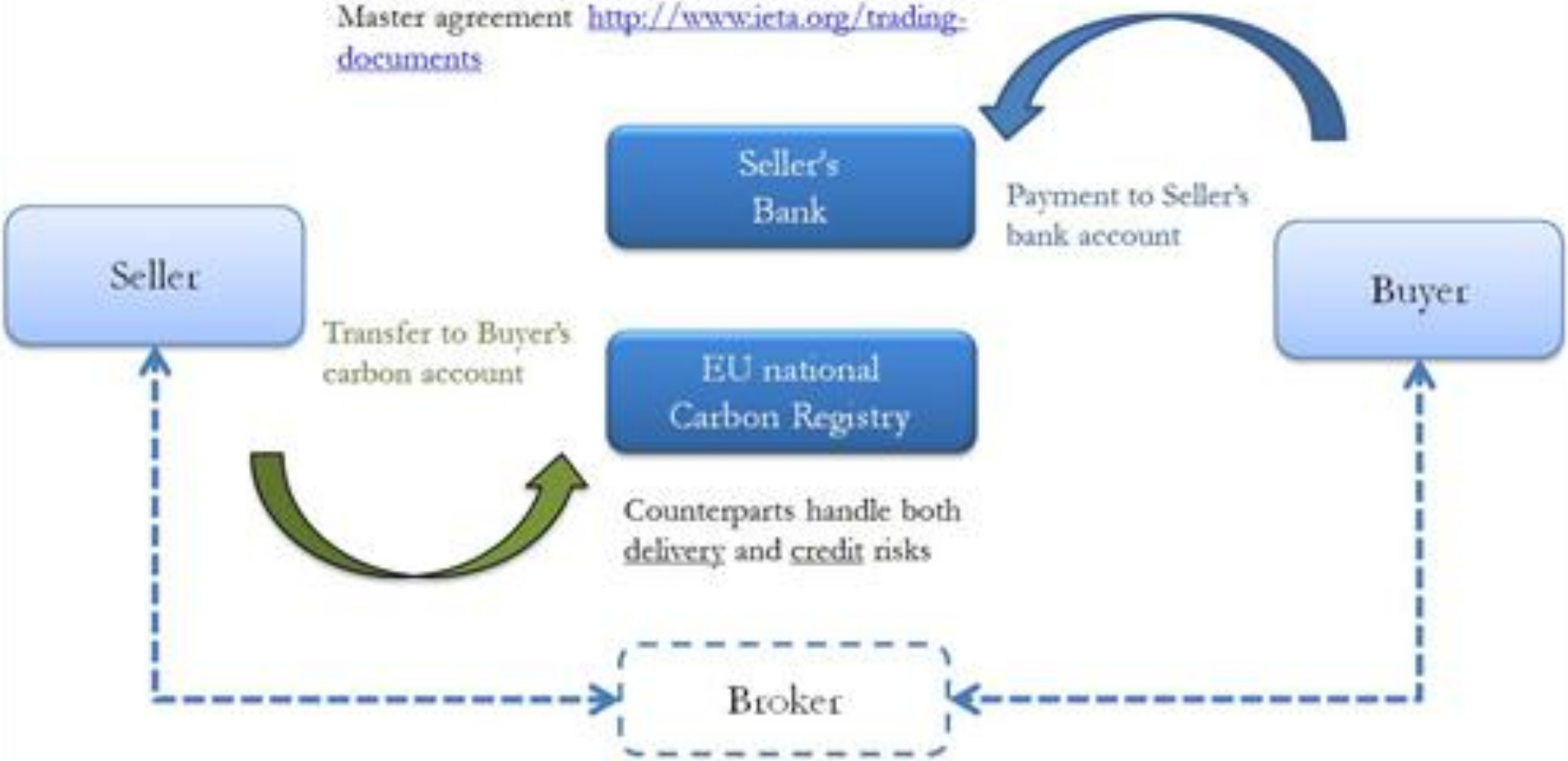
EU Communication On Emissions Trading Scheme (ETS)

* Provisions for international emissions trading for greenhouse gases were included in the 1997 Kyoto Protocol.
* Aviation will be added to the existing system which already includes energy and major industrial processes. It will thus be an 'open' system, as opposed to a 'closed' system which includes only aviation.
* The scheme will only cover carbon dioxide (CO2). Nitrogen oxides (NOx) and water vapor emitted by aircraft at altitude are also greenhouse gases. The EC has said that NOx will be addressed by a separate proposal. (No proposal for water vapor.)
* CO2 Permits will be needed by airlines for all arriving and departing flights in the EU, covering their entire flights, from origin to destination.
* The system started in 2011 when allocations was added to the pool for all the sectors. However, the allowance for aircraft was based on their emissions around 2005. Because of the growth in aviation's emissions from 2005 to 2011, the airlines will have to buy a proportion of permits they need, estimated at 30 to 40%.
* The allocated permits will be given free to airlines, except for a small proportion which will be auctioned. The net effect is that airlines will have to pay for about 40% of the permits they need (allocated but auctioned plus ones not allocated). As aircraft emissions continue to grow after 2011, the proportion that have to purchased will grow.

Source: Aviation Environment Federation

Over-The-Counter spot transaction

Use semi-standardised agreements like e.g. IETA Master agreement http://www.ieta.org/trading-documents

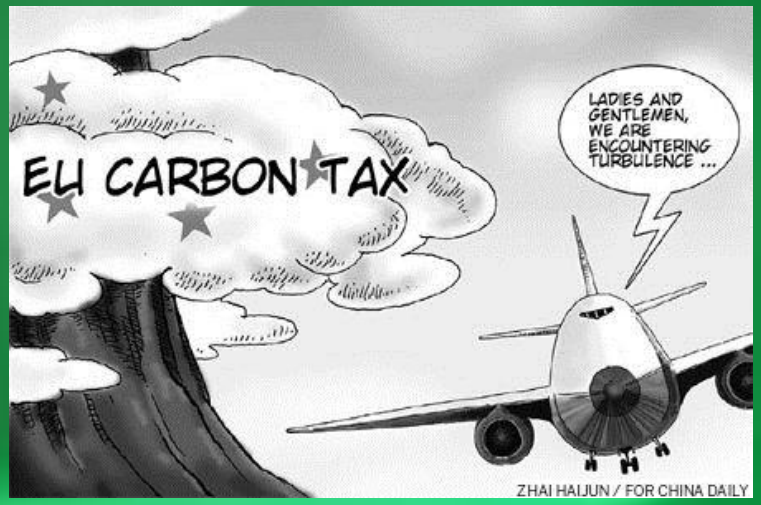


Moneys Collected Go Where?

- EU Member States are *encouraged* to commit half the funds they receive to environmental matters. But they are not required spend funds collected addressing aviation GHGs.

ETS to cost airline sector over €1bn annually: Study

By Graham Dunn



- Airlines could face a collective annual cost of over €1 billion ($1.4 billion) from 2012 under the sector's inclusion in the European Union's Emissions Trading Scheme (ETS), according to new independent research.
- A report estimates the aviation sector could face a shortfall of 77 million tonnes of CO2 when it enters the ETS in 2012. This equates to €1.1 billion at today's spot price of €14.40 per tonnes of CO2.
- "The cost is just an indication," explains the report's co-author, and senior analyst at Point Carbon, Andreas Arvanitakis. "The actual cost will be whatever the carbon price will be in 2012." But he describes the €1.1 billion annual cost figure as "conservative" given current forecasts of the spot price for carbon in 2012 of nearer €20 per tonne.
- Other sources predict it Europe's ETS will cost €4 billion by 2020.

Estimated compliance costs under EU ETS Aviation scheme

Country/Airline	Expected Cost
China	$123.6 million per year
United States	$3.1 billion by 2020
India	$40 million per year
Emirates	$0.5-1 billion by 2020
Etihad Airways	$719 million by 2020
Virgin Atlantic	€3.1 billion by 2020

Airline Industry Response

- IATA supports ETS in principle, but notes that any carbon trading plan must be rolled out in tandem with changes to air traffic management. The Single European Sky process will reduce aviation emissions by 12%. Also, an ETS should be developed by ICAO, so the industry can have a "global approach for a global problem."
- U.S. Air Transport Association said the EU should work through ICAO to develop an emissions trading plan, as the EU doesn't have the authority to impose ETS without the necessary bilateral agreements. Instead, the EU should work to improve air traffic management, which will yield a more significant and immediate reduction in carbon emissions. Unilaterally imposing ETS could snarl the EU in years of legal challenges.
- EasyJet "Contrary to the assertion of many, aviation is not the environment's biggest enemy – not today and not tomorrow."

Some carriers are trying to appear environmentally friendly

10 October 2009

The International Air Transport Association (IATA) welcomed progress made at the International Civil Aviation Organization (ICAO) High Level Meeting on International Aviation and Climate Change (HLM-ENV). IATA urged governments to move forward quickly to implement what was agreed and develop an even more ambitious agenda.

"We took a step in the right direction, toward a global sectoral approach, but there is still a lot of ground to cover. As a united industry, we remain committed to the ambitious environmental targets that we brought to this meeting. Governments took note of our targets and recognized the need to work with industry to secure a sustainable future for aviation. This is significant progress," said Giovanni Bisignani, IATA's Director General and CEO.

In a joint working paper by IATA with Airports Council International, Civil Air Navigation Services Organisation and International Coordinating Council of Aerospace Industries Associations, a united industry committed to three sequential targets:

- Improving fuel efficiency by an average of 1.5% annually to 2020
- Stabilizing emissions from 2020 with carbon-neutral growth
- A 50% net reduction in carbon emissions by 2050 compared to 2005

10 October 2009

The ICAO HLM-ENV Declaration confirmed the desire of governments to deal with aviation and climate change through ICAO and in coordination with the United Nations Framework Convention on Climate Change (UNFCCC). The Declaration also contained the following commitments for:

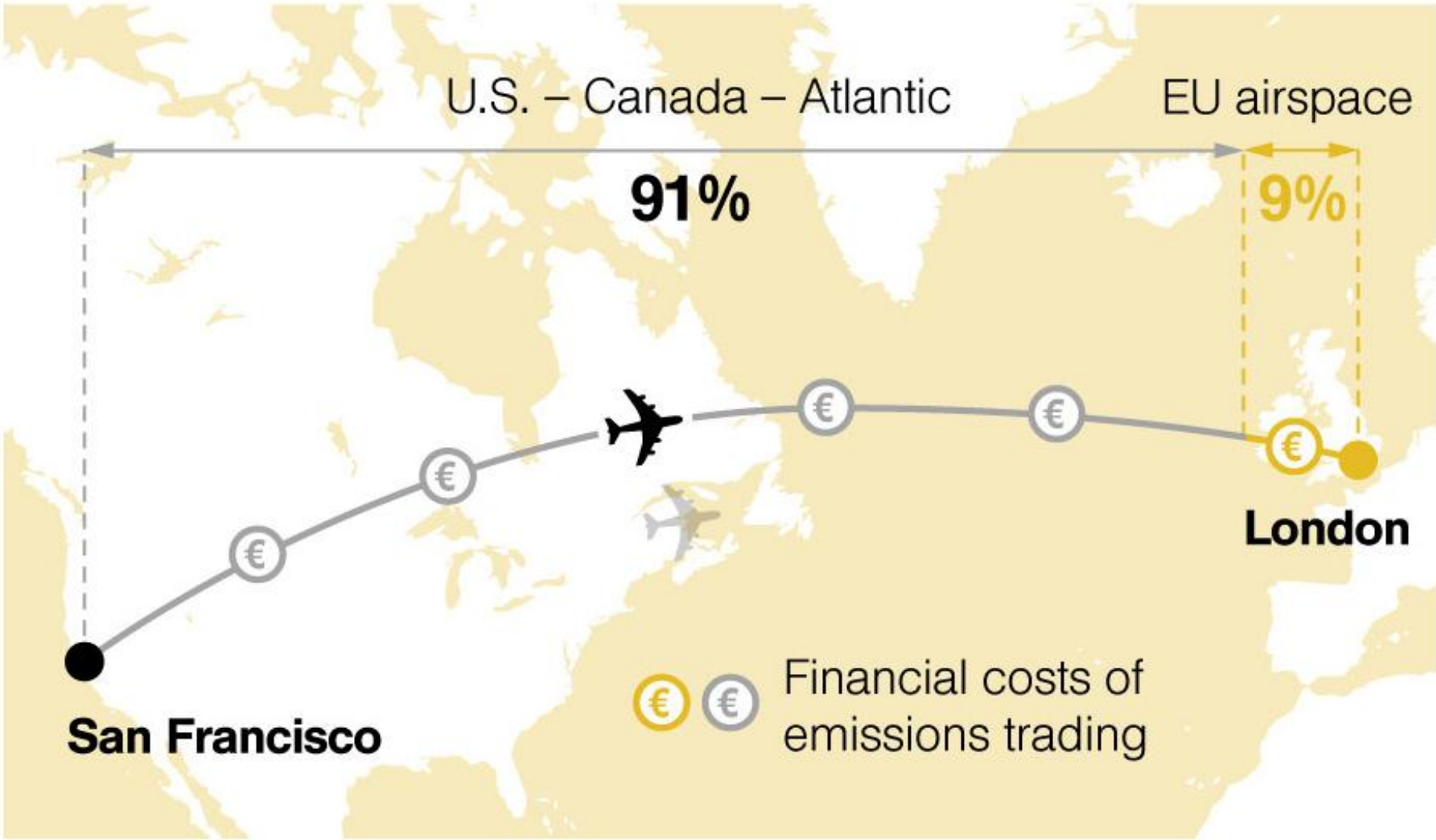
- States to work together to achieve a global annual average fuel efficiency improvement of 2% to 2020, followed by an aspirational goal of a further average annual 2% improvement from 2021 to 2050
- ICAO and its contracting States to evaluate the possibility of more ambitious goals by the next ICAO Assembly (2010), taking into consideration industry's collective commitments and the special needs of developing nations
- ICAO to establish the process to develop a framework for economic measures
- ICAO and its contracting States to encourage the development and use of sustainable biofuels.

Source: ICAO

The Chicago Convention

- Article 1: “every State has complete and exclusive sovereignty in the airspace above its territory.”
- Article 11: the laws of a State shall be applied to all aircraft entering its airspace.
- Article 12: over the High Seas, the rules in force shall be those established by ICAO

CO_2 Emissions for a typical flight from San Francisco to London


U.S. – Canada – Atlantic
EU airspace
91%
9%
London
San Francisco
Financial costs of emissions trading

The Chicago Convention

- Article 15: No fees or other charges shall be imposed by any State solely for the "right of transit over or entry into or exit from its territory of any aircraft of a contracting State . . . ."
- Article 24: fuel "shall be exempt from customs duty, inspection fees or similar national or local duties and charges."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ايكاو

EU Court of Justice in ATA v. Sec. of State for Energy and Climate Change (2012)

Held:

- The EU is not a party to the Chicago Convention, nor is bound by it.
- The Kyoto Protocol lacks "direct effect."
- It distinguished between the exercise of jurisdiction over the territory of another State, and exercising "unlimited jurisdiction" of a foreign entity present in its own territory.
- Airlines that choose to serve Community airports subject themselves to the conditions of entry and exit of a member State.
- ETS is not a tax on fuel.

Threatened Retaliation

- Retaliatory threats soon ensued from the international community. Trade wars began to loom on the horizon, the pinnacle being the "Moscow Joint Declaration" which entertained the possibility of coordinated retaliatory action against European carriers. Russia, China, Saudi Arabia and the United States united to deplore Europe's unilateralism. Legislation was passed in certain States prohibiting their carriers from complying with ETS. China delayed delivery of Airbus 380 aircraft worth $4 billion. Russia's Deputy Minister for Transport threatened that the Russian Federation might stop issuing permits for European airlines to fly over Siberia. The New Delhi Declaration, joined by both the Russian Federation and the United States, urged the EU to abandon unilateralism and collaborate with the international community in the effort to reduce aviation emissions.

The EU Postpones ETS Implementation

- Appreciative of the progress made by the ICAO Council in developing proposals for the application of an global MBMs scheme, and in order "to create space for political negotiations", the EU Commission announced in November 2012 that it would "stop the clock" for a year and refrain from applying the ETS to flights to and from the European Union.
- That was without prejudice to the application of the scheme for intra-European traffic, and was conditioned on the ICAO 38th Assembly's taking "meaningful international action" towards the realization of a global scheme for the limitation of aviation carbon emissions.

ICAO General Assembly Resolution A38-18 (Oct. 2013)

- The Resolution reiterated the primacy of ICAO and the ICAO Council as the leading bodies for the adoption of measures concerning environmental issues.
- Specific consideration was accorded to the needs of developing States and to the avoidance of measures that could negatively impact the growth of aviation in developing economies.
- The containment of aviation carbon emissions was deferred until 2020. It was accepted that carbon levels will continue to rise in the interim, and the aspirational "medium term" goal calls for neutral carbon growth only after 2020.
- Development of a global Market Based Measures scheme for international aviation, though it would not be implemented prior to 2020, and would only comprise part of a broader basket of measures, including technologies, operational improvements and sustainable alternative fuels.
- With respect to existing schemes, their continued implementation was conditioned on the agreement of all States involved, which *prima facie* precludes unilateral initiatives.

EU Reservation & Threat

- The aspirational goal communicated in Resolution A38-18 was deemed "insufficiently ambitious", and a "10% reduction [of greenhouse gas emissions] compared to 2005 levels" was proposed instead.
- The requirement of mutual State consent as a condition for the continuation of existing trading schemes was rejected.
- The *de minimis* principle expressed in the Resolution was also rejected.
- The Reservation also rejected the principle of "common but differentiated responsibilities", as it would result in the non-uniform application of the global MBM scheme.

The EU Post-Assembly Response

- Intra-European flights remain under the ETS.
- Effective 2014, flights to and from third States are covered for the distance traveled in European airspace.
- Overflights are exempted.

Environmental Law and Sustainability in International Aviation

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Director, Institute of Air & Space Law
McGill University

http://www.mcgill.ca/iasl/