

Table 3 Major Impacts of Climate Change on the Earth System

Temp- erature rise above prein- dustrial	[CO ₂] ppm	Year in which impact occurs	Impacts to the earth system	Region affected	Source
OBSERVED CHANGE					
0.6	378	2004	Annual average temperature has risen by 0.6C	Globe	IPCC TAR
0.6		2004	Temperature has risen by 1.8C; could rise by 10C by 2100	Arctic	ACIA 2004
0.6		2004	Sea surface temperature increased by 0.6C +/-0.1C	Globe e.g. N Sea where 0.5C rise in 15 years	IPCC 2001; EEA 2004
0.6		2004	90% globe's glaciers retreating since 1850 (not attributed)	Globe e.g. Alps where 70-90% mass loss (30-40% since 1980)	EEA 2004, Street & Melnikov 1990
0.6		2004	Increased freshwater flux from Arctic rivers appears to be already 20% of what would cause shutdown of THC	Northern and Western Europe	ECF 2004
0.6		2004	Arctic sea ice extent decreased by 0.30 +/- 0.03 x 10 ⁶ km ² /10 yr from 1972 through 2002, but by 0.36 +/- 0.05 x 10 ⁶ km ² /10yr from 1979 through 2002, indicating an acceleration of 20% in the rate of decrease.	Arctic	Cavalieri et al 2003
0.6		2004	3.7+/- 1.6C warming/century observed	Antarctic Peninsula	Vaughan et al 2003
0.6		2004	N hemisphere snow cover decreased by 10% since 1966	N hemisphere	EEA 2004
0.6		2004	Measured spring snowpack decreased in Alps	Switzerland	Scherer et al 2004
0.6		2004	Measured spring snowpack declined, (not attributed) correlated with rising temperature/declined precipitation	Cascades & N California, USA	Mote 2005
0.6		2004	Arctic sea ice reduced by 15 - 20%	Arctic	ACIA 2004

0.6	2004	Bottom melt rates of Antarctic glaciers increase by 1m/year for each 0.1C rise in ocean temperature	Antarctic	Rignot & Jacobs 2002
0.6	2004	Some evidence that savannaisation of parts of Amazon triggered by land use change interacting with warming	Amazon	ECF 2004
0.6	2004	Greenland ice sheet losing mass (not attributed)	Greenland	Rignot & Jacobs 2002
0.6	2004	West Antarctic Ice Sheet losing mass overall;	Antarctic	Rignot & Jacobs 2002
0.6	2004	Larsen B ice shelf collapse; subsequent ice discharge from land (not attributed)	Antarctic	Rignot et al 2004
0.6	2004	Increase in global sea level of 1.8 mm/year : about 50% of this caused by melting of terrestrial ice (remainder from thermal expansion of water), of which 0.4 mm/yr from non-polar glaciers, 0.4 mm/yr from Greenland, estimated 0.2 mm/yr from West Antarctic Ice Sheet	Globe	Thomas et al 2004
0.6	2004	Green biomass increased by 12% (not attributed)	Europe	EEA 2004
PREDICTED CHANGE				
1.5	7m sea level rise over between x and y years	Onset of complete melting of Greenland ice: when complete 7 m of additional sea level rise	All coastal regions; many world cities inundated	Gregory 2004
2 – 3??	CO ₂ doubling +/- ?q	Collapse of Amazon rainforest replacing forest by savannah: enormous consequences for biodiversity and human livelihoods	S America, also globe	Cox et al 2004, Betts 2005
2 to 3?	550 +/- ?? but inevitable at some point	Conversion of terrestrial carbon sink to carbon source, due to temperature-enhanced soil and plant respiration overcoming CO ₂ -enhanced photosynthesis. Resulting in desertification of many world	Global	Cox et al 2000, Cox 2005, ECF 2004

			regions as there is widespread loss of forests and grasslands, and accelerating warming through a feedback effect	
Any			Release of C to atmosphere due to deterioration of ecosystems at rapid rates of temperature change	Global Neilsen 1993
	Double		Net primary production increases by 10%	Globe Betts 2005
	Double		Runoff increases by 12%	Globe Betts 2005
2.3	2100		Collapse of thermohaline circulation: Maximum likelihood of shutdown of 4 in 10 for climate sensitivity of 3C (and climate sensitivity could lie between 1.5 and 11C)	Globe; cooling NW Europe, warming Alaska and Antarctic, decreasing rainfall in S America Schlesinger 2005
1.5			Probability of collapse exceeds 50%	Yohe, Schlesinger and Andronova in press.
1 – 3			Collapse of thermohaline circulation affecting fisheries, ecosystems, agriculture: expert opinion probability “a few percent”	Northern and Western Europe Rahmsdorf in ECF 2004
3	2100	700	THC collapse	O’Neill & Oppenheimer 2002; Keller et al 2004
2 – 4.5			Potential to trigger melting of the West Antarctic Ice Sheet raising sea levels by a further 5 to 6 m ie 60 to 120 cm/century	Globe ECF 2004
4 – 5			Expert opinion: probability of thermohaline shutdown up to or above 50%	Northern and Western Europe Rahmsdorf in ECF 2004
Comment:			THC collapse, Greenland Ice Sheet melt and West Antarctic Ice Sheets may interact in ways that we have not begun to understand	Discussed at conference
			Potential release of methane	Globe: IPCC 2001

	from melting tundra and clathrates from shallow seas; <i>add recent publication mentioned at conference that we may be nearing this point</i>	feedback accelerating warming	
2100	Acidification of the oceans falls by 0.4: may disrupt marine ecosystem functioning, in turn reducing buffering capacity of oceans (positive feedback)	World oceans	IPCC 2001; Blackford 2005 ; Archer 1995
2250	Acidification falls by 0.77	World oceans	IPCC 2001; Blackford 2005
	Increased variability in summer monsoons exacerbating flood/drought damage	Asia, Australia	IPCC 2001, Steffen 2005, Lal 2003
16 xCO2	Permanent El Nino	Globe	Navarra 2005

*Note: at 0.6C some observed changes are marked as “not attributed”. In these cases calculations of the cause of these changes has not yet been made. They are listed because they are changes which are consistent with the patterns of change predicted to result from anthropogenic climate change.