

# Environment changes, climate change?

There are many factors that could affect the Earth's climate by changing the amount of energy that flows into and out of the system. Think about the ones listed and try and decided which ones affect the amount of energy coming in from the Sun, which affect the amount of energy that the Earth radiates away and which affect both.

Factor	If this factor was increased, what would be the effect on...	
	the amount of radiation from the Sun being absorbed by the Earth and why?	the amount of radiation being emitted from the Earth ( <b>NOT</b> the Earth + atmosphere) and why?
Cloud cover (i.e. H <sub>2</sub> O in the atmosphere as water vapour)	Clouds look white to us, meaning that they reflect light, the main component of the Sun's radiation. So clouds reduce the radiation being absorbed.	The Earth's radiation is mainly infrared, which is absorbed and reemitted by water vapour, as it is a major greenhouse gas. This means that the clouds act as an insulating blanket.
Ice/ snow cover	Ice/ snow look white to us, meaning that they reflect light, the main component of the Sun's radiation. So ice and snow reduce the radiation being absorbed.	No effect.
Amount of CO <sub>2</sub> in the oceans	No effect.	The critical factor is how much carbon is in the atmosphere rather than any of the other carbon reservoirs (ocean, rocks etc.) If more CO <sub>2</sub> in the ocean means less in the atmosphere, then the Earth will emit less radiation because it will be cooler.
Dust/ pollutants in the atmosphere	Some dust may be reflective and reflect incoming solar radiation.	Some pollutants (e.g. soot) can reflect/ absorb outgoing terrestrial radiation. This has the same effect as Greenhouse Gases and the Earth will heat up and give off more radiation.

Amount of CO <sub>2</sub> in the atmosphere from burning carbon	No effect.	Increases the amount of radiation emitted by the Earth, as it heats up due to the insulating 'greenhouse effect' of CO <sub>2</sub> .
Life producing CO <sub>2</sub> (respiration)	No effect.	Depends on the balance between plants and animals – is more CO <sub>2</sub> being fixed by plants than is being respired by plants and animals?
Life absorbing CO <sub>2</sub> (photosynthesis) – amount of plant cover	The amount of plant cover can have an effect on how much solar radiation the Earth reflects (green plants reflect less than bare rock) and on how much dust there is in the atmosphere.	Depends on the balance between plants and animals – is more CO <sub>2</sub> being fixed by plants than is being respired by plants and animals?

If the amount of energy coming into the system is greater than the amount leaving then the Earth will warm up and vice versa.

1. Which of the factors will be affected by a change in the Earth's temperature?

All of them!

Cloud cover – more water is evaporated if the Earth is warmer, ultimately intensifying the whole water cycle.

Ice/ snow cover – will reduce in most places, if they get warmer, but may increase in some places if they the amount of precipitation increases.

Amount of CO<sub>2</sub> in the oceans – the warmer the ocean, the less CO<sub>2</sub> it can hold

Dust/ pollutants in the atmosphere – less vegetation, more dust e.g. if deserts expand.

Amount of CO<sub>2</sub> in the atmosphere – the million dollar question! All depends on how plants, animals (e.g. carbon secreting copepods in the oceans) etc react to increasing temperatures.

from burning carbon – less heating costs, more air conditioning

life producing co<sub>2</sub> – less obvious how this will be affected, but it probably will .. less land so less life?

Life absorbing CO<sub>2</sub> – some plants will react to warmer temperatures/ more CO<sub>2</sub> by being more productive and fixing more CO<sub>2</sub>. Others will react by being less productive. Some plants will not be able to cope at all and die out in their present locations so e.g. more widespread desertification could be expected.

2. Which will change to make this effect even bigger (positive feedback) and which will change to negate the temperature change?

positive feedback factors

CO<sub>2</sub> in the oceans

Ice/ snow cover (probably positive feedback will outweigh negative feedback)

negative feedback factors

none

we don't know!

Cloud cover

Dust/ pollutants in the atmosphere

Amount of CO<sub>2</sub> being emitted/ absorbed

3. Which of the factors are directly influenced by humans?

All of them are influenced by humans, however some (e.g. ice and snow cover) are not directly influenced.