→ EVOLUTION OF THE ATMOSPHERE

Atmospheric processes are central to our climate as they regulate how much energy we receive from the sun, and crucially, how much is emitted back into space, known as the 'radiation budget'. Greenhouses gases help prevent energy escaping back in to space, thereby heating up the Earth. Two of the key greenhouse gases, carbon dioxide (CO_2) and methane (CH_4) that are responsible for climate change are measured by satellites.

The CCI is combining satellite data from different missions to produce maps of variations in these two greenhouses gases across the globe. By analysing these subtle variations, it is possible to investigate the location and strengths of where these greenhouse gases are being released and where they are being taken up, to validate our knowledge of surface fluxes, and to improve our understanding of Earth's carbon cycle.

Clouds also influence Earth's radiation budget as they reflect sunlight, keeping Earth cooler, but also limit the amount of energy radiating from Earth's surface that gets back to space, keeping Earth warmer.

The CCI Clouds project is integrating 17 years of ESA satellite data on clouds with the long time series of data acquired since the late 1970s by US satellites. This provides the most consistent long time series produced to date for research into changes in cloud properties, over the last 30+ years. This gives us insights in to the energy budget of the Earth as well as the water cycle, as clouds determine precipitation patterns and water transport.

Another key part of our atmosphere to measure for climate is the amount and type of aerosols. These are microscopic particles that can be a solid, liquid or gas, such as sea salt, dust and exhaust fumes. Like clouds, aerosols can both increase and decrease the amount of energy the Earth receives depending on their type and interactions, making them an important topic to study to know which effect will be dominant in the future.

The CCI programme has achieved a major advance in the accuracy of aerosol information retrieved from ESA's satellites and has generated a high quality 17-year aerosol data set. Advances have also been made in the accuracy of mapping the distribution of aerosols from volcanic eruptions, and in promising new techniques to distinguish different types of aerosol, such as dust and soot.

Satellites are also able to measure the amount of ozone in our atmosphere. It's important to measure ozone as depending where it resides in the atmosphere it can either be a pollutant (if it's lower, in the troposphere) or protects us from harmful UV rays (if it's higher, in the stratosphere). The CCI provides the most complete and consistent European measurements to date of the global distribution of ozone. This information is able to update us on the state of the ozone hole in Antarctica, as well as how the chemistry of our atmosphere is changing over time, and how it links to the climate.