INTERNATIONAL COMMISSION ON CLOUDS AND PRECIPITATION (ICCP)

STATEMENT ON THE ROLE OF CLOUDS AND PRECIPITATION ON CLIMATE CHANGE

(approved by the ICCP commission on 19th of November 2021)

Human-induced global climate change is one of the most pressing issues of our time. In 2015, the Paris Agreement, a legally binding international treaty on climate change, was adopted by 196 Countries at COP 21 (the 21st Conference of the Parties) and entered into force in 2016. Its key aspect is to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit this temperature increase even further to 1.5°C. Limiting maximum temperature increase aims to prevent potentially catastrophic climate change, for which the likelihood increases strongly once these limits are passed.

The recently published 6th assessment report of the International Panel on Climate Change (IPCC) makes it very clear that human-induced climate change is already affecting weather and climate extremes in every region across the globe. This includes changes in heatwaves, droughts, heavy precipitation events, flash floods, and tropical cyclones. It is clearly stated in the 6th IPCC report that global warming of 1.5° C and even of 2° C will be exceeded during the 21st century unless deep reductions in carbon dioxide (CO₂) and other greenhouse gas emissions occur in the coming decades. Continued global warming is projected to further intensify the global water cycle, including its variability, global monsoon precipitation, and the severity of wet and dry events. The report also states that gaps in the understanding of clouds remain the largest contribution to the overall uncertainty in climate feedbacks.

It is well known that the present distribution of clouds leads to an overall cooling of the Earth compared to if no clouds were present. However, we do not have a good understanding yet of how the geographic distribution of clouds, their heights and lifetimes, and their microphysical properties will change in response to increases in greenhouse gases (GHGs), anthropogenic aerosols, and land use and land cover change (LULC). Consequently, it is poorly known whether such changes in clouds will amplify or partially mitigate the warming associated with increases in greenhouse gases; the impacts of these changes on precipitation distributions and the occurrence of extreme weather are also poorly known. The large uncertainties in cloud responses to those changes caused by human activities propagate significantly to the overall uncertainty in climate projections, with ice containing clouds being the least understood. An improved understanding of how clouds will be affected by GHGs, aerosols, and LULC will thus lead to better climate projections.

The International Commission of Clouds and Precipitation (ICCP) is a commission of the International Association of Meteorology and Atmospheric Sciences (IAMAS) that stimulates the worldwide scientific study of clouds and precipitation, encourages the transfer of scientific ideas among scientists and promotes education and public awareness of scientific issues related to clouds and precipitation. ICCP acknowledges the threats posed by climate change. As specialists in fields concerned with clouds and precipitation, scientists in ICCP understand the complexity of cloud and precipitation processes and their representation in climate models. More atmospheric measurements, laboratory experiments, and modelling studies and the integration of methods across observations and models are needed to increase our knowledge of how cloud processes and feedbacks affect climate projections. This might seemingly contrast with the urge to act to counter global climate change. Therefore, the ICCP makes the following statements:

1) There is clear evidence that human-induced changes are occurring in Earth's climate, including the increase in frequency of extreme weather, but more research is critically needed to better understand how the representation of cloud processes in models impacts future projections of climate.

2) Despite gaps in science areas such as clouds and precipitation, it is clear that significant emission reductions are urgently required to reduce the impacts of human-induced climate change.

3) Knowledge gaps in the field of clouds, aerosols and precipitation interactions mean that the ICCP does not support the implementation of climate engineering through artificial cloud modification to solve the global warming problem, as elaborated on in an earlier statement (to be found at https://tinyurl.com/bkhd3z98).

4) Overall, research of the role of clouds under the changing climate needs to be conducted in an open manner with results of such research effectively communicated to the public in order to increase confidence in the findings of such research.

It is our concern to make the threat of climate change to humanity understandable to everyone, so that solutions can be found together. To meet our responsibility as scientists who are familiar with the topic of climate change, this statement is therefore intended to point to the worldwide endangerment and with this to inform people and help to increase our progress in finding solutions.