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A vast majority of climate scientists worldwide agree on the existence and causes of climate change. They also approximate its magnitude and human contribution to these changes at similar level. However, by no means do climate scientists claim that every aspect of this global phenomenon is completely resolved. Among these aspects, clouds remain at the top of climate research priorities. Not only does the role of clouds remain unknown in altering climate but also their prediction in weather forecast is challenging.

Due to complex interactions with radiation, air humidity and aerosols, clouds control the radiation budget and govern the water cycle on Earth. Clouds cool the earth by reflecting a significant fraction of the incoming shortwave solar radiation. A decrease of cloud fraction by 1% would have a similar effect as the doubling of carbon dioxide concentration in the atmosphere. Concurrently, clouds warm the atmosphere by intercepting and radiating back the longwave (thermal) radiation emitted by the Earth’s surface. Those two effects vary with cloud type, its physical properties such as thickness, height and phase (liquid or ice).Consequently, the net radiative effect of clouds and its evolution with climate change remain not fully understood.

Satellites are the only way to observe changes in cloud cover on a global scale. Data of polar orbiting satellites now span a 30-year period which is agreed to be a minimum to study climatological changes. Nevertheless, this 30-year period can only be achieved by merging observations acquired by several instruments such as Advanced Very High Resolution Radiometer mounted onboard NOAA satellites. Data fusion from several sources can cause spurious cloud cover trends originating from technical problems such as instrument malfunction or de-calibration, or satellite platform instability. Moreover, gradual orbital drift of a satellite caused by Earth's gravitation results in a shift in local time of image acquisitions. As a result, diurnal cloudiness cycle is sampled at different moments, which in turn leads to unwanted trends detected during climatological analyses.

The aim of our project is to correct for the orbital drift and varying number of image acquisition per day to derive satellite cloud cover dataset suitable for climate analysis. To achieve this we will develop a statistical method for reconstruction of diurnal cloud cycle that will take into account geographical location, atmospheric circulation and cloud type information derived from satellite data.

The ultimate objective of this project is to quantify global changes in cloud cover distribution and in diurnal cycle of cloud formation over the last 30 years. This project will contribute to important yet missing understanding on how diurnal cloud formation has been changing with global climate change. The unprecedented analysis of long-term changes in diurnal cycle of cloud fraction at the global scale will facilitate better understanding of cloud-climate interactions and cloud feedbacks and in turn will lead to reduction of uncertainty in future climate projections. These are essential to allow policymakers and society to take informed decisions on mitigation and adaptation for climate change.