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THE ROLE OF SPACE OBSERVATION TECHNOLOGY IN UNDERSTANDING PLANETARY BOUNDARIES, AND CLIMATE CHANGE IMPACTS AND CHALLENGES

Abstract

As humanity faces the serious consequences of climate change, space technologies are essential in understanding both current and future climate change impacts and challenges, as well as how climate change can be mitigated. To better understand the impacts and challenges of climate change, the Planetary Boundaries framework can be used. This paper assesses how space based observations can help us understand climate change impacts and challenges in the context of the Planetary Boundaries framework, and the causal connections that exist between the Planetary Boundaries and wider society and industry.

The Planetary Boundaries framework identifies a safe operating space for humanity across the earth systems of biodiversity, climate change, novel entities, land-system change, stratospheric ozone depletion, freshwater use, atmospheric aerosol loading, biogeochemical flows, and ocean acidification. This safe operating space is defined by different zones of uncertainty for the given earth systems and humanity's place within them, whereby in high-risk zones, environmental tipping points and non-linear change may occur. This paper starts by conducting a literature review into the Planetary Boundaries framework, where humanity is within each of the boundaries, and existing space-based observation capabilities. Following this the paper will use a systems approach to identify how the Planetary Boundaries relate to the areas of human health, habitability, economics, disasters, infrastructure, sea level rise as well as other domains.

Using this assessment and the literature review, the paper will then assess how space-based observation can help to further understand where humanity is within each of the Planetary Boundaries, what space observation technology exists and how it can be used, what technology needs to be developed, and how existing technology could be used differently. From this analysis a framework and roadmap is created for the use and development of space observation technology to understand where humanity is within each of the Planetary Boundaries, how the impacts of the Planetary Boundaries to other domains can be better understood using space observation technology, and hence how humanity can avoid the most serious effects of climate change.