Habitable zone for a planet with a small amount of water on its surface

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Some of the detected exoplanets are expected to be Earth-sized rocky planets. Habitable exoplanets seem to be significant targets for observation of exo-terrestrial planet and exo-life. Liquid water evaporates entirely when planets receive the insolation above a certain critical value, which is called the runaway greenhouse threshold. If planets receive very weak insolation, on the other hand, such planets lapse into the snowball state where the insolation is called the complete freezing threshold. Most of studies for habitable exo-terrstrial planet have been discussed introducing the habitable zone, in which planets can maintain liquid water on their surface for a long term.

We call a planet with a small amount of water on its surface, a land planet. Land planets have less water amount in its atmosphere and can radiate stronger planetary radiation than that for aqua planets, which have a large amount of water on its surface. Thus, a planet with a small amount of water on its surface has a wider habitable zone than that for a planet with a large amount of water on its surface [Abe et al., 2011; Kodama et al., 2018; 2019]. Here, we investigate the relationship between the width of the habitable zone and the surface water distribution using 3D GCM(General Circulation Model). We confirm that the habitable zone strongly depends on the surface environment. In this presentation, we summarize the climates and habitability for exo-land planets.

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