Stability of Martian Surface system

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Valley networks on Martian surface imply a warm and wet climate in the past. In this study, we introduce a one-dimensional energy balance climate model with CO2-dependent outgoing radiation to discuss stability and evolution of an atmosphere-regolith-polar ice cap system. Under the present bundary condition, there are two stable steady states of the system. The Martian climate system has three additional feedbacks which do not exist in the terrestrial climate system. When we consider CO2 as a greenhouse gas for a warm and wet climate in the past, the total amount of CO2 in the whole system (atmosphere, ice cap, regolith) should have been larger than that at present, and ice sheet may have been larger in the past than the present one.