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Abstract

Young stars emit strong flares of X-ray radiation that penetrate the surface layers of their associated protoplanetary disks. It is still an open question as to whether flares create significant disk chemical composition changes. We present models of the time-evolving chemistry of *gaseous* H_20 during X-ray flaring events. The chemistry is modeled at point locations in the disk between 1 and 20 AU at various vertical heights from the mid-plane to the surface. We find the gas-phase H_20 abundance can be enhanced in the surface ($Z/R \geq 0.3$) by more than a factor of ~ 3 - 5 by strong flares, i.e., those that increase the ionization rate by a factor of 100. Dissociative recombination of H_30 +, H_20 adsorption onto grain, and photolysis of H_20 are found to be the three dominant processes leading to a change in H_20 abundance. We find X-ray flares have predominantly short-term (days) effects on *gaseous* H20 abundance, but some regions show a long-term (for the duration of the test ~ 15 days) decrease in *gaseous* H_20 due to adsorption onto grains as ice, though only in regions with otherwise low water ice abundances. Even though we do not see a substantial increase in long term water (gas+ice) production, the flares large effects should be detectable as time varying inner disk water "bursts" with future observations from facilities like JWST.

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