Safe long-term storage of carbon dioxide (CO₂) will reduce CO₂-emissions to the atmosphere. This can be achieved by injecting captured CO₂ in geological formations. CO₂ injection in reservoirs is also a well-known method used in enhanced oil-recovery (EOR). Lastly, injection of carbon dioxide in methane hydrate is a promising method, both due to energy aspects as well as climate aspects. The above mentioned reasons have several challenging common problems, there among, how the microscopic interactions between reservoirs species governs the behavior of injected CO₂. To study the behavior of super-critical CO₂ at the nanoscale, we have performed Molecular Dynamics (MD) simulations of a water, CO₂ and clay system. The mineral used in our simulations is kaolinite, a common clay found in the earth's crust. We have initially focused on a slab of kaolinite with the hydrophilic gibbsite layer exposed to a water phase that is in contact with a super-critical CO₂ phase. The interactions of the CO₂ phase with the water phase have been analyzed. As well as the impact of varying temperature on CO₂ dissolution from the super-critical phase into the kaolinite adsorbed water. Results shows that water adsorbs strongly on the gibbsite surface of kaolinite, but this strongly adsorbed water also creates following exclusion zones where adsorption of CO₂ can be facilitated.