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Deciphering Mars' water cycle with missions and models

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My presentation will cover the present and recent configurations of Mars' water cycle. The Martian water is only visible in two forms: gas and ice. The existence of a water cycle on Mars was deduced from the first seasonal monitoring of water vapor performed by the Viking mission in 1982. It revealed that the same seasonal and spatial pattern repeated itself for nearly two consecutive Martian years. After Viking, other missions have confirmed this initial conclusion: seasonal water vapor variations appear to be controlled by exchanges between various reservoirs, achieving an annual stationary state with some inter-annual differences. These variations are primarily influenced by the seasonal evolution of the climate in the north polar region, as the latter hosts the most massive reservoir of water, consisting of an ice cap of more than 2 million km³. When exposed to sunlight in spring and summer, this cap releases a massive amount of water vapor that then spreads across the Martian globe, only to return to the North Pole the following winter in the form of frost. Decades of theoretical and observational exploration have delivered a nearly comprehensive view of Mars' water cycle. From the water molecules that leave the cap in summer to the hydrogen atoms that escape Martian gravity and get lost in space; I will show how the Mars missions and the 3D models used to simulate Mars' climate have laid the foundations for our understanding of the main processes that govern the evolution of water on Mars.