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Solar forcing, implications for the Terrestrial planets - Earth, Venus and Mars

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Solar forcing by x-ray, FUV, EUV and the solar wind, have major implications for planets orbiting near the Sun. After solar system formation to present times, the accumulated radiation and solar wind has substantially modified the volatile inventory of the Terrestrial planets. The effect is most pronounced for Mercury and Venus, but significant also for Mars. Earth is an exception. Why so, is a pending question with no obvious answer, and does this have a bearing on today's climate change?

Solar forcing is known to lead to mass loss of atmospheric constituents, such as hydrogen and oxygen. From satellite instruments orbiting Earth, Mars and Venus we have gained substantial knowledge of such mass losses. The mass loss from the Earth primarily originates from water. More recent results suggest that the same applies for Mars and Venus, despite water being a minor constituent in the atmosphere of these planets. Water therefore appears to be an important marker, bearing the signature of the past planetary evolution. Conversely, carbon dioxide, the major molecule in the atmosphere of Mars and Venus, seems more resistant to solar forcing.

Since carbon dioxide plays a major role in today's discussion on Earth's climate change, the atmospheric evolution of Mars and Venus must be considered an interesting reference to climate change. This is particularly relevant considering the complexity of solar forcing of the Terrestrial planets.

In this talk aspects of how solar forcing affects Earth, Venus and Mars will be discussed. Particular emphasis is put on the impact of solar variability on the mass loss and the electromagnetic coupling between the Sun and the planets.