The evolution in our understanding of the greenhouse effect

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Always based on new observations, also by others, famous scientists like Fourier (1824), Tyndall (1863), Arrhenius (1896) laid the foundation of the understanding of the greenhouse effect of the Earth’s atmosphere. The first full theory of the anthropogenic greenhouse effect was presented (in vain) by Guy Stewart Callendar already in 1938. We had to wait until the 1950s to see radiative transfer calculations emerging that gave numbers for the equilibrium response to doubled carbon dioxide concentration with and without certain feedbacks of radiatively active gases and clouds. A WMO commissioned report in 1983 “officially” added many new strong greenhouse gases emitted mainly by industrialized countries. Still today the reaction of clouds to an enhanced greenhouse effect is fraught with large uncertainties as are estimates of the equilibrium response. However, the radiative forcing by the changed composition of the atmosphere is one of the best understood parts in the global climate change debate. The talk will end with key scientific questions concerning the Earth system response to an enhanced greenhouse effect.