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Dynamics of Sudden Stratospheric Warmings

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Abrupt breakdowns of the polar winter stratospheric circulation such as sudden stratospheric warmings (SSWs) are a manifestation of strong two-way interactions between upward propagating planetary waves and the mean flow. While tropospheric precursors to SSWs have often been noted, SSWs have also been shown to spontaneously arise due to fortuitous coupling of a fixed wave field provided by the troposphere and the concurrently evolving state of the stratosphere. Here we present further evidence based on climate model simulations and reanalyses that the explosive dynamics associated with SSWs primarily take place within the stratosphere. The crucial dynamics for forcing SSWs appear to take place in the “communication layer” just above the tropopause. We also isolate a sub-class of SSWs that are associated with anomalous wave fluxes from the troposphere and provide details on their distinct evolution. Lastly, the downward coupling following the different categories of SSWs will be discussed.

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Session Classification: Session 5 : Model development, impact of model biases