Haynes, P., P. Hitchcock, M. Hitchman, S. Yoden, H. Hendon, G. Kiladis, K. Kodera, and I. Simpson, 2021: The influence of the stratosphere on the tropical troposphere. *J. Meteor. Soc. Japan*, **99**, https://doi.org/10.2151/jmsj.2021-040.

Plain Language Summary: Observational and model studies suggest that the stratosphere exerts a significant influence on the tropical troposphere. Such influence requires both communication of dynamical effects from stratosphere to troposphere and feedbacks within the troposphere which enhance the tropospheric response. This review summarises the current observational and modelling evidence for stratospheric influence on the tropical troposphere, on timescales ranging from diurnal to centennial, identifies outstanding scientific questions and discusses implications for weather and climate prediction.

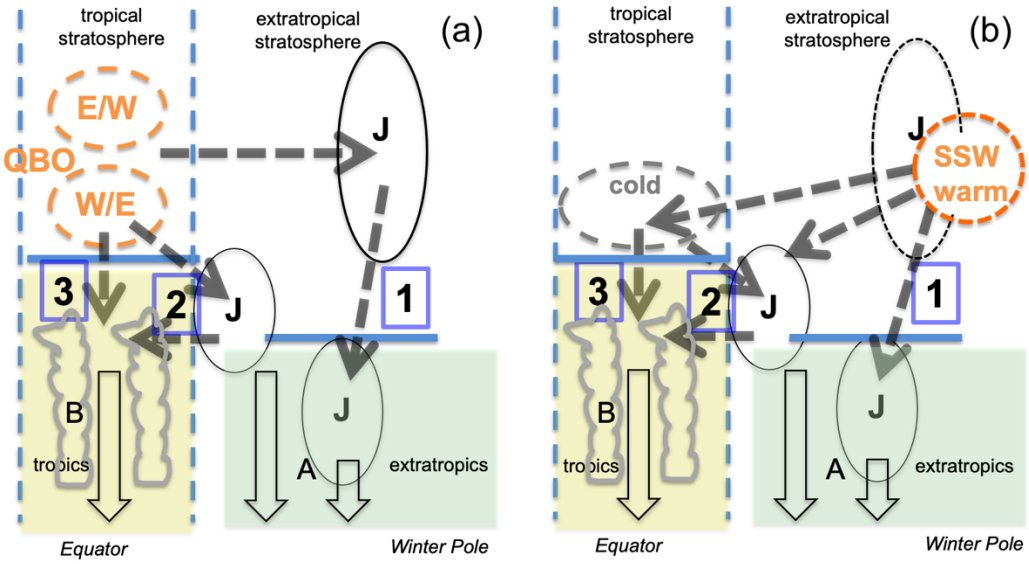

Figure 1. Schematic of possible pathways for coupling to troposphere for processes of (a) QBO-type (from tropical stratosphere) and (b) SSW-type (from extratropical stratosphere). Communication pathways: (1) extratropical stratosphere to midlatitude tropospheric jet; (2) tropical lower stratosphere to subtropical jet; (3) tropical lower stratosphere directly to tropical upper troposphere. Tropospheric feedback pathways: (A) via extratropical dynamics; (B) via tropical dynamics.

- Potentially important pathways and feedbacks are identified.
- The recently identified connection between the Quasi-Biennial Oscillation (QBO) and the Madden-Julian Oscillation is highlighted as an opportunity to test many different aspects of scientific understanding of the tropical atmosphere.
- The use of different models, including free-running climate models, seasonal forecast models and convection resolving models, is discussed and examples are described from model investigations of the influence of stratospheric sudden warmings (SSW), the stratospheric QBO, stratospheric geoengineering and ozone-climate interactions.
- The connection to ongoing discussions in the tropospheric climate community on future changes in tropical convection and precipitation is emphasised.