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Stationary Wave Biases and Their Effect on Upward Troposphere - Stratosphere Coupling in Sub-seasonal Prediction Models

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The simulated Northern Hemisphere stationary wave (SW) field is investigated in 11 subseasonal-to-seasonal (S2S) models. It is shown that while most models considered can well-simulate the stationary wavenumbers 1 and 2 during the first two weeks of integration, they diverge from observations following week 3. Those models with a poor resolution in the stratosphere struggle to simulate the waves, both in the troposphere and the stratosphere, even during the first two weeks, and biases extend from the troposphere all the way up to the stratosphere. Focusing on the tropospheric regions where SWs peak in amplitude reveals that the models generally do a better job in simulating the Northwest Pacific stationary trough, while certain models struggle to simulate the stationary ridges both in Western North America and the North Atlantic. In addition, a strong relationship is found between regional biases in the stationary height field and model errors in simulated upward propagation of planetary waves into the stratosphere. In the stratosphere, biases mostly are in wave-2 in those models with high stratospheric resolution, whereas in those models with low resolution in the stratosphere, a wave-1 bias is evident, which leads to a strong bias in the stratospheric mean zonal circulation due to the predominance of wave-1 there. Finally, biases in both amplitude and location of mean tropical convection and the subsequent subtropical downwelling, are identified as possible contributors to biases in the regional SW field in the troposphere.