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Multiple Timescales of the Southern Annular Mode

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Using the ensemble empirical mode decomposition (EEMD) method, this study systematically investigates the multiple timescales of the Southern Annular Mode (SAM) and identifies their relative contributions to the low-frequency persistence of SAM. Analyses show that the subseasonal sustaining of SAM mainly depends on the contribution of longer-timescale variabilities, especially the cross-seasonal variability. When subtracting the cross-seasonal variability from the SAM, the positive covariance between the eddy and zonal flow, which is suggested the positive eddy feedback in SAM, disappears. Composite analysis shows that only with strong cross-seasonal variability, the meridional shift of zonal wind, eddy momentum forcing and baroclinicity anomalies can be maintained for more than 20 days, mainly resulting from the longer-timescale (especially the cross-seasonal timescale) eddy-zonal flow interactions. This study further suggests that the dipolar sea surface temperature (SST) anomalies in the mid latitude of Southern Hemisphere (SH) is a possible cause for the cross-seasonal variability. Analysis shows that about half of the strong cross-seasonal timescale events are accompanied by evident dipolar SST anomalies, which mostly occur in austral summer. The cross-seasonal dependence of the eddy-zonal flow interactions suggests the longer-timescale (especially the cross-seasonal timescale) contribution cannot be neglected in subseasonal prediction of SAM.