Is West Antarctica running a tropical fever?

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Despite sparse in-situ data and uncertain satellite measurements, evidence is mounting that West Antarctic surface climate has warmed significantly in recent decades. Previously, the spatial patterns of temperature trends in Antarctica have been interpreted as the signature of a persistent positive trend in the Southern Annular Mode (SAM), which can be forced by stratospheric ozone depletion. However, we show that there is much more going on in Antarctica. We analyze multiple datasets (including in-situ, satellite, and statistical reconstructions) of Antarctic surface temperatures and related physical variables such as sea ice and atmospheric circulation. We find that along with an annual-mean trend during the past 50 years of about 0.1°C/decade averaged over Antarctica, there is a distinct seasonality to the trends, with insignificant change (and even some cooling) in austral summer and autumn in East Antarctica, contrasting with warming in austral winter and spring concentrate din the Peninsula and West Antarctica. Second, using a variety of polar and tropical observational datasets, we examine the seasonally dependent spatial patterns of tropical climate signals over Antarctica. It is observed that the strongest teleconnection of tropical and Antarctic climate occurs in the austral spring via the Pacific South American pattern (PSA), a wave train with a center of action in the South Pacific. A secondary tropical teleconnection operates in the austral summer and projects onto the SAM. Next, we use a statistical congruency analysis, together with modeling, to illustrate the contribution of tropical sea surface temperature (SST) trends to a trend in the PSA and the warming of West Antarctica in the austral spring. Similarly, trends in the SAM more than account for East Antarctic cooling trends in austral summer and autumn, though separating the roles of SST and ozone forcing remains a challenge. This has implications for our ability to predict 21st Century Antarctic climate change, as we cannot rely on estimates of a single forcing (e.g. stratospheric ozone) to accurately predict future changes. Further modeling studies by Steig et al. (this meeting and submitted manuscript) directly link tropical SST trends with wind changes in the South Pacific that have brought warm, circumpolar deepwater in contact with several outlet glaciers of the WAIS.