The Cryosphere Discuss.,
https://doi.org/10.5194/tc-2017-102-SC1, 2017
© Author(s) 2017. This work is distributed under
the Creative Commons Attribution 3.0 License.

The Cryosphere Discussions

Interactive comment on "Countervailing regional snowfall patterns dampen Antarctic surface mass variability" *by* Jeremy Fyke et al.

C. Genthon

christophe.genthon@univ-grenoble-alpes.fr

Received and published: 30 June 2017

This paper presents a nice piece of analysis of spatial patterns of coherent interannual variability of precipitation over the antarctic ice sheet and shelfs from a very long climate model preindustrial simulation. It demonstrates significant correlations and anticorrelations at inter drainage basin scales. This is of interest in its own right. However, it is not a new information that regional precipitation variations can be anticorrelated within continental scales. This occurs because the regional interannual variability of precipitation is generally associated to shifting or variable strength of major influencing synoptic systems, like the Icelandic or Azore hights affecting precipitation in Europe (north vs southern Europe). This is not new in general and not new in Antarctica. Spatially coherent (correlated or anticorrelated) patterns of variability of precipitation have previously

been exhibited by principal component analysis [e.g. Genthon et al., 2003, Interannual Antarctic tropospheric circulation and precipitation variability, Climate Dyn. 21, 298-307. DOI 10.1007/s00382-003-0329-1, and references therein] and interpreted in terms of the variability of the atmospheric circulation (500hPa geopotential, paper cited above), major driving antarctic synoptic systems and thus patterns of moisture advection towards or from Antarctica [e.g. Genthon andCosme, 2003. Intermittent signature of ENSO in west-Antarctic precipitation, Geophys. Res. Lett. 30, NO. 21, 2081, doi:10.1029/2003GL018280]. Corroboration by ice core records of such patterns have also been highlighted (e.g. Genthon et al., 2005. Interannual variability of the surface mass balance of West Antarctica from ITASE cores and ERA40 reanalyses, Climate Dyn. 24, 759-770, DOI:Âă10.1007/s00382-005-0019-2). I don't think that "a clear analysis of spatial heterogeneity in Antarctic snowfall variability" is really fully lacking, even though not yet necessarily in a drainage basin mode as performed here.

Further, I find it hard to buy this idea of "dampening" of continental scale precipitation variability by (anti)correlated regional variability. This sounds pretty much like, the long term global temperature trend is dampened by interannual variability which is to some extend (anti)correlated, e.g. El Nino (warm) – La Nina (cold) sequences. There is no dampening, just averaging out both uncorrelated and correlated variability.

On page 3: To confuse snow fall, precipitation and accumulation is misleading. Accumulation may be evaluated from ice cores, not precipitation. It may be a problem when tentatively comparing with ice cores. At least one of the authors is very aware that blowing snow can significantly affect the surface mass balance. Accumulation is generically used in much of the rest of the paper even including in section 3.3 where ice cores are discussed, although P-E is finally used in section 4.4.. I rather suggest to stick to precipitation when it is precipitation, surface mass balance when it is surface mass balance, P-E when it is precip – evap.

Section 3.5 on 'links to broader patterns of atmospheric variability" falls a bit short. A contribution of the wave-3 pattern and SAM are mentioned but not really demonstrated,

e.g. by calculating the time correlation between indices of these modes in the model and precipitation anomalies. The Amundsen – Belinghausen low is definitely a major center of natural variability in the region, directly affecting moisture advection to and from the Antarctica, but the fact that this is related to both the SAM and the ENSO, broader patterns of variability, could also probably be reported (Genthon et al., 2003, see above).

Interactive comment on The Cryosphere Discuss., https://doi.org/10.5194/tc-2017-102, 2017.