Antarctic climate variability over the past 1,000 years: is there a similarity with recent changes in Antarctica?

Our knowledge of SH circulation changes during the last millennium is very limited in comparison to the NH due to the low density of proxy records in the SH. In the last 1000 years orbital forcing only changed slightly and thus internal variability, solar and volcanic forcing played a large role before the influence of humans became noticeable. Thus, this period provides a good opportunity for placing the recent and 20th century SH circulation change into a longer term context and examining the impacts of both the anthropogenic and natural external forcing on the SH circulation.

The instrumental data in the SH can only provide at most 100 years climate information back to early 20th century. Thus, we have to rely on various paleoclimate proxy data to evaluate the models' millennial simulation. Several scientific works have pointed out the existence of climate changes in Australia/New Zealand and South America and their relationship to the Medieval Warm Period (MWP) and Little Ice Age (LIA) periods. In West Antarctica, the water stable isotope records from ice core also show shifts of the climate state between the WMP and LIA and significant warming in the past 100 years. As we know, the δ18O of precipitation in ice core is not only governed by local temperature but also by large scale circulation in the polar region. Thus, there

is an advantage to directly compare model generated δ18O and observed δ18O in ice core. However, the models used to produce the millennial simulations in the AR5 and most of model comparison projects do not have ability to produce water isotopes. So, a direct comparison between ice core data and the millennial simulations is impossible. To fill this gap, I propose a new approach to understand an Antarctica wide δ18O field associated with existing millennial runs. Finally, I will suggest a way forward so that we can better understand the cause of Antarctic climate variability in the past 1000 years and improve projections of future global climate change in the SH.