

Weather Clim. Dynam. Discuss., author comment AC2
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Reply on RC2

Nele Tim et al.

Author comment on "The impact of the Agulhas Current system on precipitation in southern Africa in regional climate simulations covering the recent past and future" by Nele Tim et al., Weather Clim. Dynam. Discuss.,
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We thank the reviewer for their constructive comment. In the following, we list their comments (in italics) and our responses (in normal font).

Discussion:

L133: generally, in regional climate models, precipitation is overestimated over the Drakensberg region. E.g: the weather research forecast model (WRF, see Koseki et al. 2018). How about the CCLM? Why does your model have more inland precipitation?

CCLM also overestimates precipitation over the Drakensberg region and the large lakes in the northeast of our domain (Fig. 2c). In the rest of the domain, precipitation is underestimated.

L320: you state that "trends over the past are spatially heterogeneous and strongly depend on the analysed time period as well as on the used data set." How does your chosen period and your data influence your analysis?

The heterogeneity of precipitation trends over the past in different data sets may impact our analysis. We will include more observational and reanalysis data sets to compare to CCLM. Nevertheless, most data sets agree upon a wetting over most parts of the SRZ. Precipitation trends in the future are more robust, with projected drying of the whole region.

For the section on the impact of the Agulhas Current System on precipitation, results are robust as they show a stationary relation between both variables. The strengthening of the Agulhas leakage leads to drying in the WRZ and the weakening of the Agulhas Current leads to a drying over the south and southeast coast of South Africa. The stronger trends of both, the Agulhas Current and the Agulhas leakage, in the future compared to the past, may contribute to a homogeneous drying of the region in the future. We will add a figure of the trend of Agulhas Current and leakage in a revised version.

There is a whole system for the formation of winter and summer precipitation (see the introduction of Imbol Nkwinkwa et al. 2021). What is the percentage of the contribution of the Agulhas leakage to winter precipitation?

Our analysis of the contribution of the Agulhas Current System on precipitation is not done for each season separately. Nevertheless, precipitation in the WRZ is typically strongest in

winter. Therefore, we assume that the contribution of the Agulhas leakage is of the same range for winter precipitation only as for the annual precipitation, namely 1/10. We will analyze the contribution for the winter season separately and will include it if it differs remarkably from the contribution of the whole system.

The south coast of South Africa receives precipitation all year long (Engelbrecht et al. 2015; Engelbrecht and Landman, 2016). Could you tell from your analysis whether this phenomenon is due to the Agulhas Current or the Agulhas leakage?

Unfortunately, we cannot state this explicitly from our analysis. Nevertheless, regarding future precipitation, in figure 10d, it looks like that rainfall trends in the YRZ are impacted by the Agulhas Current and not that much by the Agulhas leakage (Fig. 10b).

Minor corrections:

Line 90: define CCLM because it is the first use.

We will change it in a revised version.

Line 97: define FOCI.

We will change it in a revised version.

Line 107: explain or give a reference for the method f-test.

We will change it in a revised version.

Figure 2 is the annual mean or the climatology?

It is the climatology. It is the mean over the whole overlapping period 1997-2018. We will change this plot in a revised version and include more observational and reanalysis data sets.

Caption figure 3, replace reanaylsis by reanalysis

We will change it in a revised version.

L157 replace a extenuated by an extenuated

We will change it in a revised version.

L180 replace "decreasing slightly close the the South African coast" by "decreasing slightly close to the South African coast"

We will change it in a revised version.

L197-L203: precise the figures you are referring to

We will add a figure of the trends of the Agulhas Current and Agulhas leakage strength.

L227: "to" is missing

We will change it in a revised version.