

Interactive comment on “Sea Ice dynamics at the Western Antarctic Peninsula during the industrial era: a multi-proxy intercomparison study” by Maria-Elena Vorrath et al.

Anonymous Referee #2

Received and published: 10 September 2020

SUMMARY COMMENTS

In this paper, Vorrath et al. present 3 new sea ice and temperature records of the past ~200 years from a region of Antarctica that is known to have undergone rapid warming over recent decades. The manuscript presents new data, relevant discussion and is likely to attract a broad readership. However, the manuscript would be greatly improved if the authors used the post-1980 intervals of their cores to test/establish which aspects of the sea ice environment and/or ocean conditions are most likely driving the variations in their biomarker proxies before considering the pre-1980 record. The authors acknowledge the complexity of the sea ice environment but should do a more thorough

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comparison of their youngest sediments with observations (and/or reanalysis data) to improve understanding of these dynamic settings and establish how best to interpret these proxy records for these specific locations before evaluating the pre-1980 records. The fact that the sediment cores have similar sedimentation rates, are close enough together to share large scale climatic/oceanographic regimes but distal enough to have site specific sea-ice conditions and water mass properties, makes these data ideal to investigate the more nuanced controls on production of the HBI and GDGT proxies.

MAJOR POINTS

> Model Results: Generally, Antarctic sea ice is poorly resolved in climate models so it is understandable that your model doesn't match with observations either. This mismatch between observations and model outputs throws serious doubt over the use of model results, especially for the pre-satellite era. Consider whether other lines of evidence are available (eg diatom concentrations or assemblage changes) that could support your interpretations. The general deficiency of models with regards Antarctic sea ice should be more broadly discussed in your manuscript, especially if you retain the model sea ice thickness results or any model results in your pre-satellite era records (eg. sea ice edge).

> Units: Not clear what the units are based on. If the 'units' reflect the numerical results then lines 422-423 should be moved to the end of the results section. Why have you not done any statistical analyses to determine the units, assess variability and/or significance of signals? If there is a reason, you should include it with lines 422-423. If the units are supposed to highlight the environmental interpretation then consider defining units for each site independently and then comparing the sequence/timing of units between sites. The environmental summaries of the units are ambiguous and not very easy to follow with some of the descriptions seeming confused or even contradictory. eg. In unit B, 'moderate' spring sea ice is equated to 'long persisting' spring sea ice cover. Unit A described as - 'decreasing winter sea ice and moderate spring sea ice with low variability in seasonal sea ice changes.' So not clear how decreasing winter

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sea ice can be reconciled persistent spring sea ice cover.

> Climate Links: I would encourage the authors to broaden their consideration of climate forcings/impacts to include eg. GHGs, the ozone hole, glacial meltwater/ice shelf collapse. They should also keep in mind that many of the climate modes/features are highly seasonal such that annual records may dilute the amplitude of a signal and produce weaker correlations.

MINOR POINTS

> Not always evident which results are used to inform interpretations. Connections between data and specific environmental conditions are clearly stated in some places but only sparsely, this should be improved throughout the manuscript but especially in the first section of the discussion.

> Where possible, replace neutral terms 'impact, influence, change' – with 'augment, elevate, increase, contribute to . . . etc.' or 'decrease, reduce, alleviate, mitigate . . .etc.' so the nature of feedbacks/responses are clear. Similarly, be sure that the nature of relationships/feedbacks are evident when 'impacts' are described as positive or negative.

> Replace 'at the WAP' with "in, on, along or through' the WAP' in your introduction. In your discussion, because your sites are only in one area of the WAP, you should replace WAP with Bransfield region or similar.

> Some of the refs could be updated with more recent literature eg. consider Montes-Hugo et al. (2009); Holland et al. (2012); Abernathey et al. (2016) & Frew et al. (2019).

Please also note the supplement to this comment:

<https://cp.copernicus.org/preprints/cp-2020-63/cp-2020-63-RC2-supplement.pdf>

Interactive comment on Clim. Past Discuss., <https://doi.org/10.5194/cp-2020-63>, 2020.