Atmos. Chem. Phys. Discuss., 13, C11834–C11839, 2014
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Atmospheric Chemistry and Physics Discussions

Interactive comment on "On the variability of atmospheric ^{222}Rn activity concentrations measured at Neumayer, coastal Antarctica" *by* R. Weller et al.

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Received and published: 4 February 2014

General comments

This paper presents daily radon concentrations measured at Neumayer antarctic station between 1995 and 2011 and tries to interprete seasonal variations and radonic storms. The backward trajectory analysis is applied to answer the question to what extent marine, in contrast to continental 222Rn emissions, were responsible for the observed variability. Part of the interpretations relies on the mean concentrations at Dumont d'Uraville.

The authors found that high concentration events are observed at the time of the transport from Antarctic plateau. They suggest that the continental flux from South America is less chance to contribute the seasonal variation as well as radonic storm compared to the emissions from the ocean. The seasonal variation observed at Neumayer station are suggested to be caused by the wax and wane of sea-ice that caps oceanic emissions. Ice free area, nunatak, in the interior or coastal area of the Antarctic continent is considered to be insignificant. This speculation is based on the fact that mean concentrations at Neumayer and d'Uraville are comparable.

Specific comments. Thanks to the dataset provided in the supplementary material, I was able to make a set of simulations using a global atmospheric transport model (STAG), and found many deficiencies in my model. This fact demonstrates the value of this paper and supports the publication in ACP as it is. My model simulation is consistent with the main conclusion of this manuscript such that the cause of seasonal cycle at Neumayer station is the effect of sea ice coverage. I would be grateful if you could answer the following questions because they could help us to evaluate any transport model in the future.

1. p32821, line24 A continuously monitored flow of ambient air was pumped through the quarts filter,..

Does the measurement have temporally suspension during harsh weather ? In Wellar et al. (2008), there is a description on the stopping of the pump when the wind exceed 20m/sec. (Section 2.1 Measurement site and meteorological conditions). Does this affect the Rn measurement ?

2. p32822, line17 apart from an only local impact of Antarctic 222Rn activity concentrations,..

How did you evaluate 'local impact' such as the effect of emissions of nunataks around Neumayer? The stations below where photos of them are available on Web may be located on or near nunataks. (1) Sanae/South Africa, 71deg40min25sec

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S, 2deg49min44sec W, (2) Troll/Norway, 72deg00min07sec S, 2deg32min02sec E, (3) Maitri/India, 70deg45min57sec S, 11deg44min09sec E, (4) Svea/Sweeden, 74deg35sec S, 11deg13min W.

3.p32826, line26 Surprisingly, the results presented in Fig.4 did not show any "radon storm trajectory" originating from South America...

In my simulation, significant contributions from South American continent are predicted at some time. Top five examples are (1) 1995.APR.19 431 mBq/SCM (21.75) (2) 1999.AUG.22 215 mBq/SCM (15.00) (3) 2004.JUN.03 154 mBq/SCM (19.72) (4) 2000.FEB.08 140 mBq/SCM (23.89) (5) 2003.SEP.29 126 mBq/SCM (14.04) Observed concentrations at these days are listed in parenthesis. Did you have any special operation on these days ?

4. p32827, line22 fact that 222Rn levels at NM were comparable to the rocky site DDU cast into doubt a significant contributions from ice free regions.

Could you suggest any specific reason for your doubt ?

I am saying it because I have compared model concentrations at Neumayer and Dumont d'Urville using the following sources. (1) South Africa (2) Oceania (3) South America (4) Oceanic sources using 3.5 power law masked with sea-ice mask, and without mask (5) emission from Nunatak as a results of inverse calculation as described in Taguchi et al. (2013). Figure 1 and 2 show time series in 1995 as an example. (1) Neumayer (2) Dumont d'Urville. I compared two types of oceanic flux, one with sea-ice mask (solid) and without it (dashed). In the bottom panel, thick line corresponds to observed data set of Alfred Wegener Institute. The same curve is drawn at Dumont d'Urville site in dotted curve just for reference. Thin line is model result there. Please note that scaled out values are terminated and the corresponding value is written nearby. The comparison indicates that the model concentrations are comparable in these sites as observed but the relative contributions are different. At Neumayer (1), concentrations from oceanic sources and those from nunatak are comparable. At

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Dumont d'Urville (2), oceanic sources and emissions from Australia have much contributions as compared to nunatak. Because I did not use data at Dumont d'Urville for inverse method, the comparison here is not conclusive. As shown in Figure 1, sea-ice mask has significant effect on winter time concentrations at Neumayer. It also shows my model overestimates the contribution from South American continent. I tried to solve this problem but could not finish it during the time allowed for the review. Thank you for your publication and the data set.

END

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 32817, 2013.

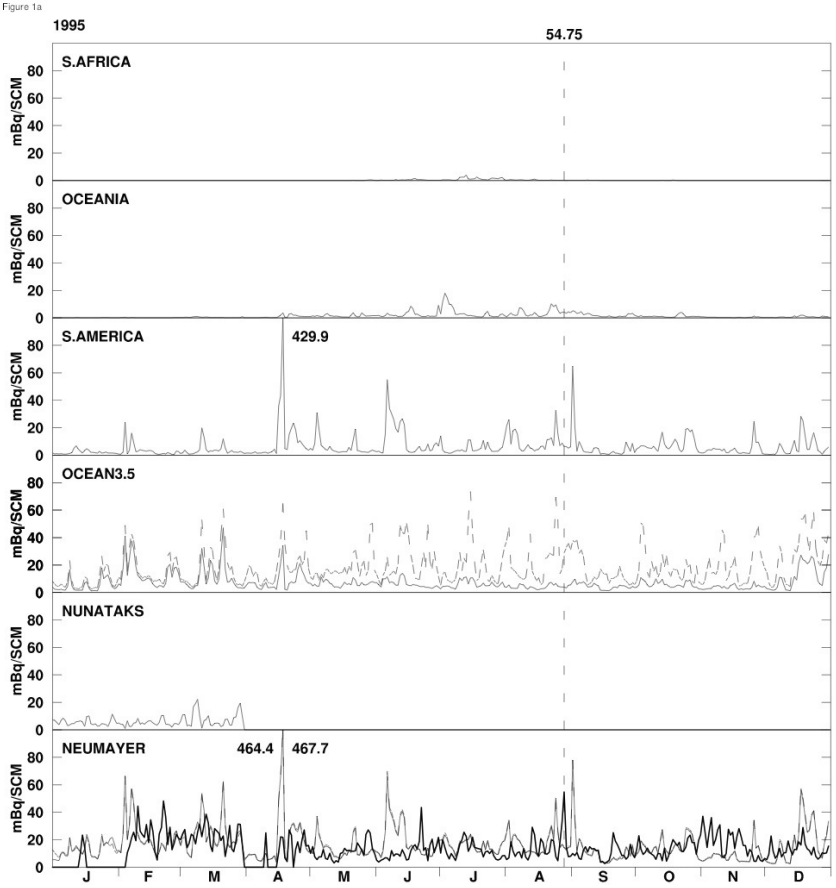

Fig. 1. STAG and AWI concentrations at Neumayer 1995

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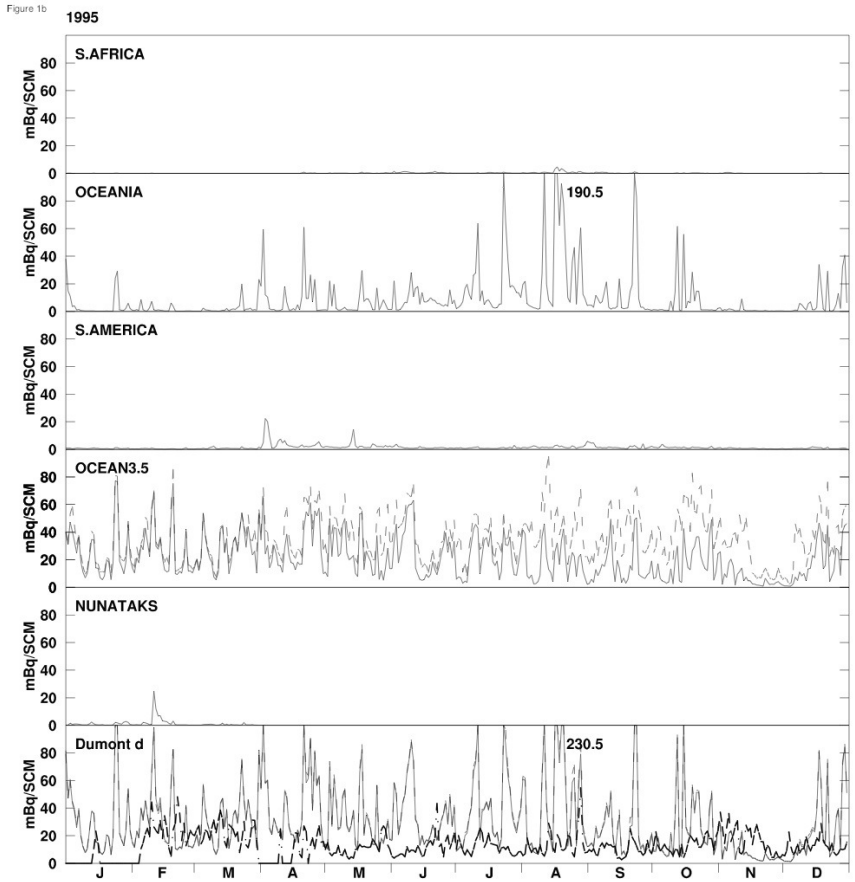

Fig. 2. STAG concentrations at Dumont d'Urville 1995

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