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Atmospheric Measurement Techniques Discussions

Interactive comment on "Continuous measurements of greenhouse gases and atmospheric oxygen at the Namib Desert Atmospheric Observatory" *by* E. J. Morgan et al.

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We thank Dr. Lowry for his helpful suggestions and comments. Each comment has been responded to individually.

COMMENT: I have just two general points. The manuscript is fine for technically-minded laboratory scientists, but it needs to entice a wider audience into the usefulness of the data from this site. It mentions that the site is representative of ocean and terrestrial background, but I would include a site footprint (possibly seasonal) / location map to give this more impact, and perhaps some context by marking other

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stations in the region such as Cape Point or Ascension Island. RESPONSE: It is a good suggestion, and we have included a figure showing the footprint of NDAO on a seasonal basis for different integration times (included at the end of the document). Caption reads: "Average integrated footprints for NDAO during 2012–2013, using the Stochastic Time-Inverted Lagrangian Transport (STILT) model (Lin et al., 2013), driven by European Centre for Medium-Range Numerical Weather Prediction (ECMWF) meteorological fields on a 0.25° x 0.25° grid. The domain chosen to run the model was 5°N to -45°S; -30°W to 40°E. Average austral summer (November–February) footprints are shown in the top row and average austral winter (June–September) footprints are shown in the bottom row, integrated over 1, 3, and 5 days. The pixel size increases in distance from NDAO due to the dynamic grid resolution of the model."

COMMENT: The second is that there is too much general text on the instruments that seems to be derived straight from the manual. I would cut this down and refer directly to the source reference. There is a large amount of detail on data correction for O2/N2, but not for the other instruments. I would try to balance this a little better. RESPONSE: We have trimmed some of the background information on the CRDS, DFCA, and OA-ICOS, while retaining enough discussion to present a coherent, basic description of the instrumentation. The DFCA discussion is necessarily longer, since it requires a more involved data treatment procedure to go from analyzer output to final O2/N2 ratio than the CRDS and OA-ICOS do to obtain final mole fractions from the analyzer output. We added the following clarification for the CRDS: “Since the CRDS software calculates the mole fractions of CO2, CH4, and H2O, this output can be used directly, after the application of an instrument-specific water correction and a calibration (see Sections 2.7 and 2.8, respectively).” For the OA-ICOS, “Like the CRDS, the OA-ICOS software calculates the mole fractions of N2O, CO, and H2O; this output is used directly after the application of an instrument-specific water correction, calibrations, and a drift correction (see Sections 2.7, 2.8, and 2.9, respectively).”

COMMENT: Line 94 – ’The the’ RESPONSE: Done

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COMMENT: Lines 135-140 – Not all necessary (see general comments) RESPONSE: See response to general comment #2.

COMMENT: Line 231 – The 'it' is not correct RESPONSE: Done.

COMMENT: Line 243 – Please clarify the analysis method for isotopes. Presume IRMS but not mentioned REPONSE: Text now reads: "Isotopic ratios are determined with isotope ratio mass spectrometry (IRMS)."

COMMENT: Line 246 – 'water droplet method' – please include a reference for this technique RESPONSE: Reference added, text now reads: "A version of the 'water droplet' method was used to humidify the air stream of a target gas cylinder, using a slight variant of one of the methods in Rella et al, (2013) (Method 2, "Empa variation")."

COMMENT: Line 298 – I would indicate here that the water vapour correction is discussed later, because it comes across as though it should be at this point RESPONSE: Done.

COMMENT: Line 330 – last 5 minutes of the working standards were used. How long is the stabilization time, how does it vary between gas species. RESPONSE: Text now reads: "Reference gases (WSSs or targets) were measured for a total of 12 minutes after a two minute, high flow rate (250 mL/min) purge of the sample line. During purges the reference gas flow is not directed to the instrument, but vented at the junction closest to the instrument. A stable signal is generally reached after 6 minutes of measurements for all measurands."

COMMENT: Line 538 – The flask time-series sentence is not a sentence. Please correct. RESPONSE: Done

COMMENT: Line 550 – If there is such a difference between air masses at NDAO and NOAA sites then how can either site be taken as representative for the area. I think that this sentence is badly phrased. The NOAA site will miss the diurnal variations though. RESPONSE: Text now reads: "It should be noted that this is not a direct assessment

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of the compatibility between the two measurement programs, since the two stations do not really measure the same air masses at exactly the same time; the sites are about 2 km apart and have a height differential of 32 m. This can be of consequence since the boundary layer oscillations in the local wind field often create considerable heterogeneity in flow, resulting in spatial and temporal gradients of trace gases (Lindesay and Tyson, 1990). While small differences between concurrent measurements at the two sites would be expected, the synoptic variability, seasonality, and long-term trend should be the same, and this is what is observed (for a discussion of this see Section 3.11). After excluding outliers smaller than 3σ, the average absolute difference of all concurrent measurements (using one-hour means for the in situ data) was 0.43 ppm for CO2, 2.4 ppb for CH4, 0.25 ppb for N2O, and 3.4 ppb for CO."

COMMENT: Reference list – Dlugokencky et al. is only half of a reference. RESPONSE: Done.

COMMENT: Fig.5 – Caption needs more development and information. Please indicate on the figure where the target gas was changed. RESPONSE: Target changes are indicated by dashed vertical lines, text now reads: "Target measurements for all measurands over the station lifetime, plotted as measured value minus assigned value for each cylinder. The assigned value comes from analysis done at MPI-BGC laboratories. The biases of each tank (differences between the MPI-BGC assigned value and the average NDAO determination) are given in Table 4. The dashed vertical lines indicate a target tank change and the dashed horizontal lines delineate the WMO/GAW measurement compatibility goals."

COMMENT:Fig 7 caption – not just the working tank and only CO shown, so need to correct the caption. RESPONSE: Text now reads: "Detail of the working tank correction for the OA-ICOS instrument, showing the correction process for the entire time series (left) and an arbitrarily selected week (right) for N2O only. In the first row, \ce{N2O} is shown with only calibrations applied ("Cal only"). In the second row, a drift correction based on the working tank measurements has been applied to the calibrated data

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("Cal + WTcorr"). In the third row, the correction factors that were used to produce the data in the second panel are shown ("Corr Factors"). These are determined by calculating the difference between each working tank measurement and the average of all working tank measurements and fitting a curve to groups of consecutive working tank measurements with no gaps (i.e., every two hours). In the fourth panel, target measurements ("Targets") are shown using the calibrated only data (gray points) and the drift corrected and calibrated data (red points)."

COMMENT: Fig 11 – The 1 hour averages have so much variation and the points are so close together that it is not clear what is being shown. Daily averages might be clearer and will at least cut out the diurnal variation. Figure 10 might also be more informative shown as daily averages. Yes it will reduce the methane peaks, but they will appear relative to a well-defined baseline. RESPONSE: Figures 10 and 11 have been altered to show daily averages.

COMMENT: Tables 3 and 4 captions need a little more explanation. For example where can we find the equations used to create these figures in the text. RESPONSE: table 2 caption now reads: "Comparison of Water Correction Function Fit Parameters (Equation 6), with Water Vapor in Percent."

COMMENT: Table 4 caption – these are biases relative to what? Please clarify. RESPONSE: Table 4 caption now reads: "Target Tank Biases (Mean of NDAO Target Measurements - Assigned Value from MPI-BGC)"

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 1511, 2015.

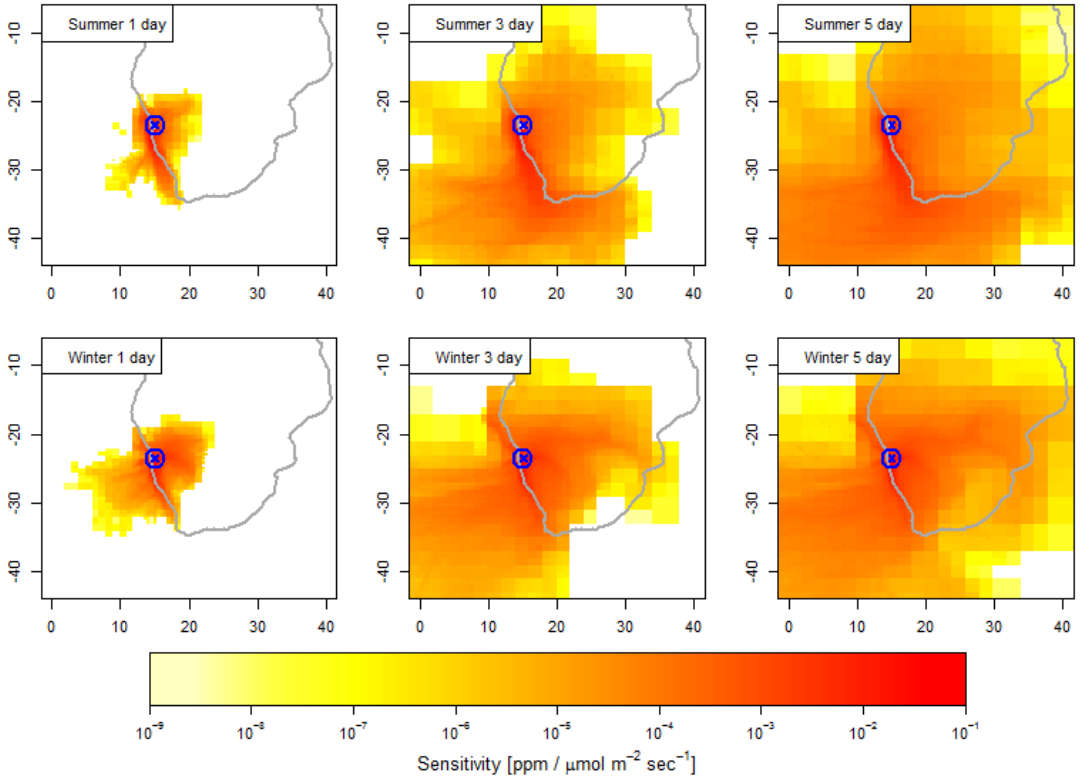

Fig. 1.

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