(16-210416-A) **The Revised CO_2 Calibration Scale at the World Calibration Centre WCC-Empa**

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Empa operates the World Calibration Centre for Carbon Monoxide, Methane, Carbon Dioxide and Surface Ozone (WCC-Empa) since 1996 as a Swiss contribution to the Global Atmosphere Watch (GAW) programme. We have conducted over 100 system- and performance audits over the past 25 years as independent checks of the measurement's traceability to the accepted standards of the WMO/GAW programme. This significantly contributes to sustain and improve the data quality required for climate and environmental research. Performance audits are done by comparison of travelling standards which were calibrated against the highest-level laboratory standards (tertiary standards from NOAA/GML) at WCC-Empa. Over the past two decades, 14 tertiary standards were obtained from NOAA. We now used these standards to assess the internal consistency of the WMO WMO-CO_2-2007 and WMO-CO_2-2019 calibration scales. Overall, the scale revision by NOAA/GML lead to improved internal consistency, which is shown in Figure 1 where the bias between NOAA and WCC-Empa is plotted against the amount fraction and the age of the standard. The agreement was well within the WMO/GAW compatibility goal for the amount fraction range defining the scale. A similar analysis will be presented for the current CH_4 calibration scale, and different calibration strategies will be discussed.

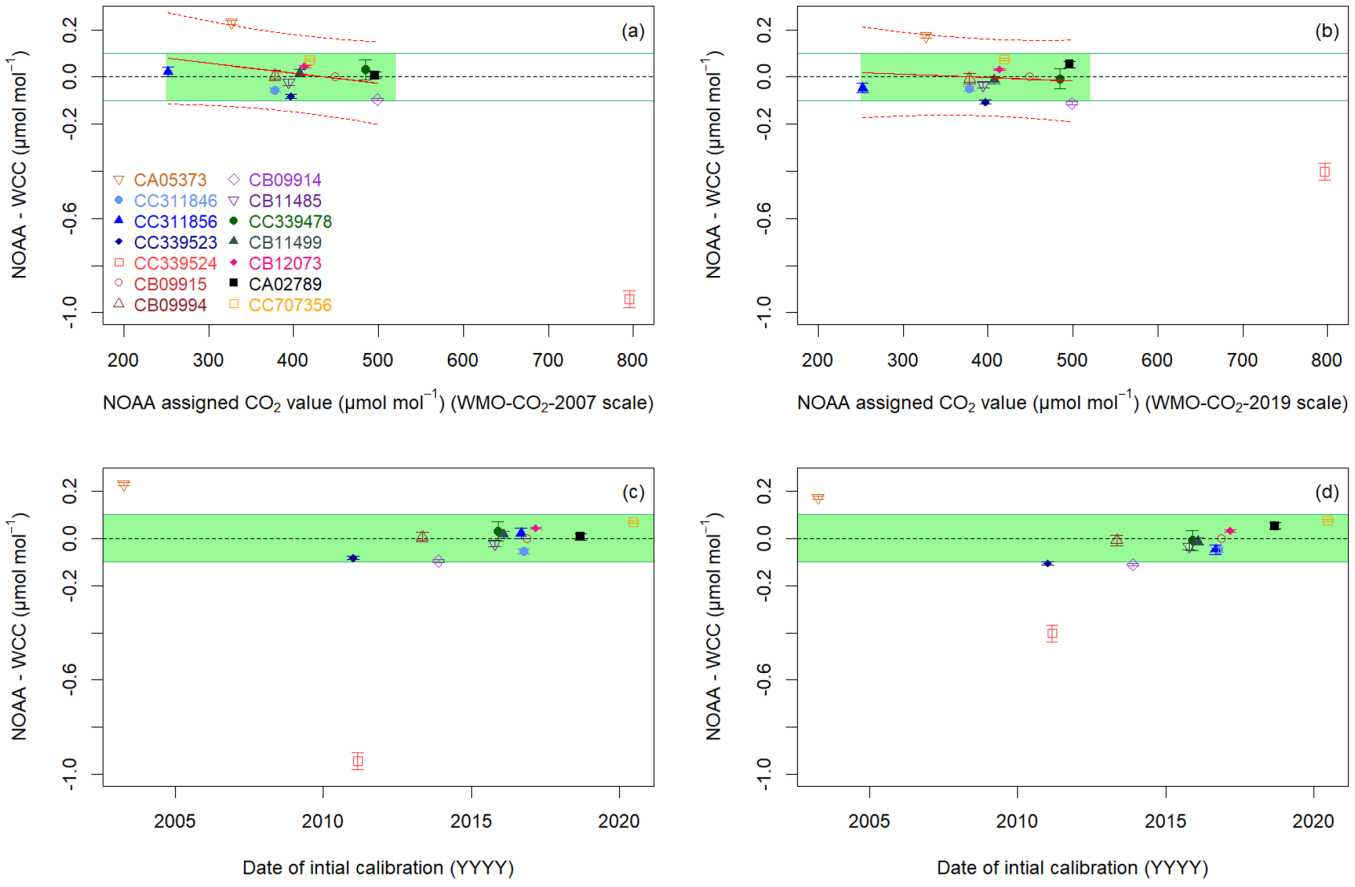

Figure 1. Figure 1: (a) Difference between NOAA assigned CO_2 value and WCC-Empa measurements (reference: CB09915) vs. NOAA assignment for different CO_2 standards on the WMO-CO_2-2007 calibration scale. The green area corresponds to the WMO/GAW network compatibility goals for the amount fraction range defining the WMO-CO_2-2007 calibration scale. The red line shows the linear regression analysis (excluding CC339524) with 95% confidence intervals. (b) Same as (a) on the WMO-CO_2-2019 calibration scale. (c) Difference between NOAA assigned CO_2 value (WMO-CO_2-2007) and WCC-Empa measurements vs. the year of the initial analysis at NOAA (corresponds to the age of the standard). (d) Same as (c) on the WMO-CO_2-2019 calibration scale.