RETRIEVAL ADVANCES OF BrO/SO2 MOLAR RATIOS FROM NOVAC

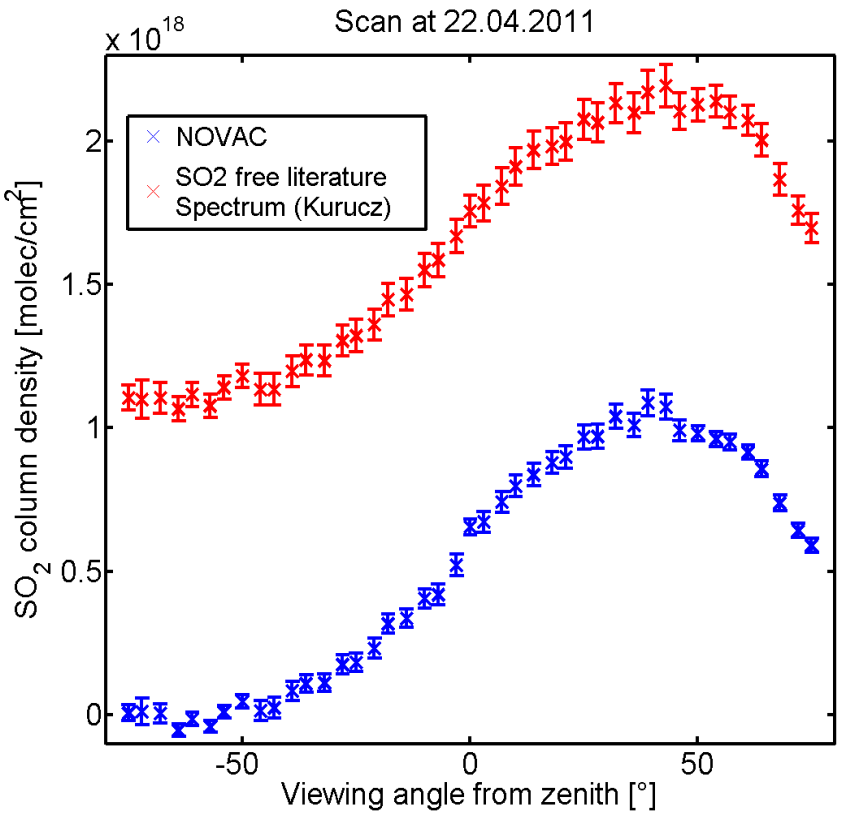
Elsa Wilken

Master Thesis

January 23, 2018

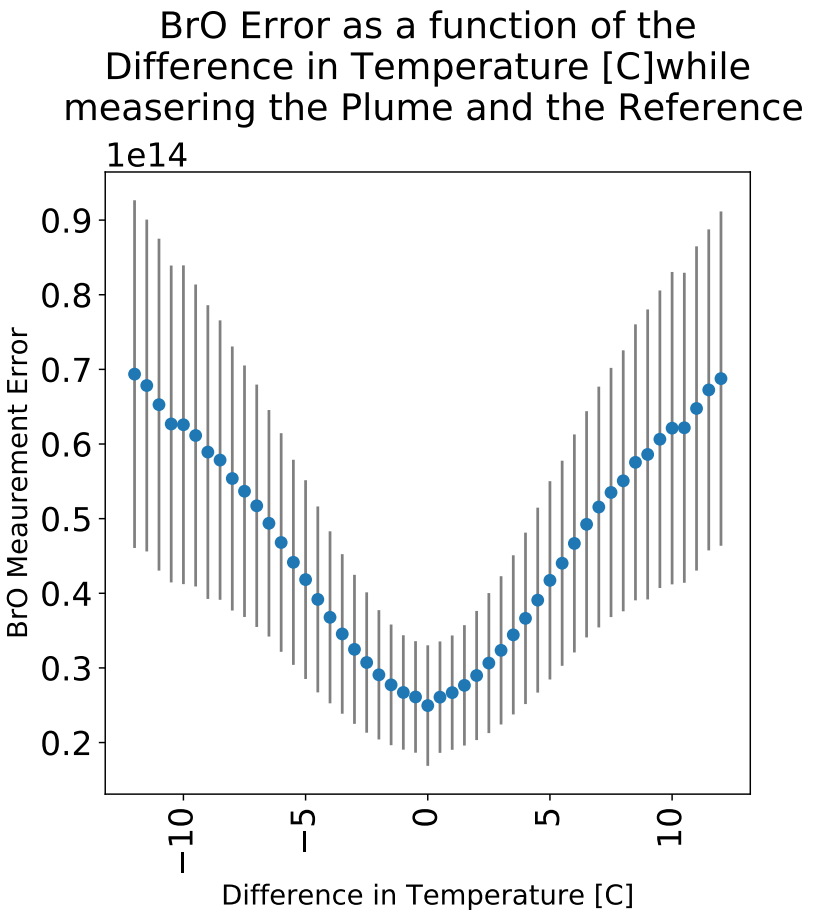
Contamination Problem

- 10% of the Data are contaminated in Nevado Del Ruiz
- 6.4% of the Data are contaminated in Tungurhua

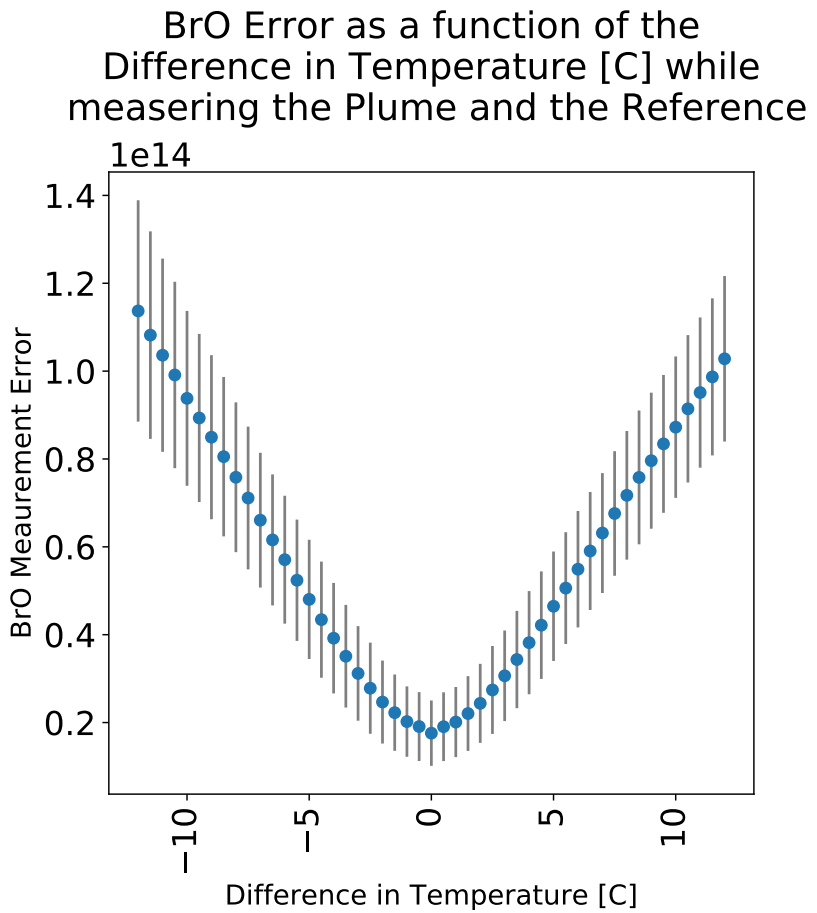


In the following we only work with the contaminated data

BrO Error Tungurhua /Nevado Del Ruiz

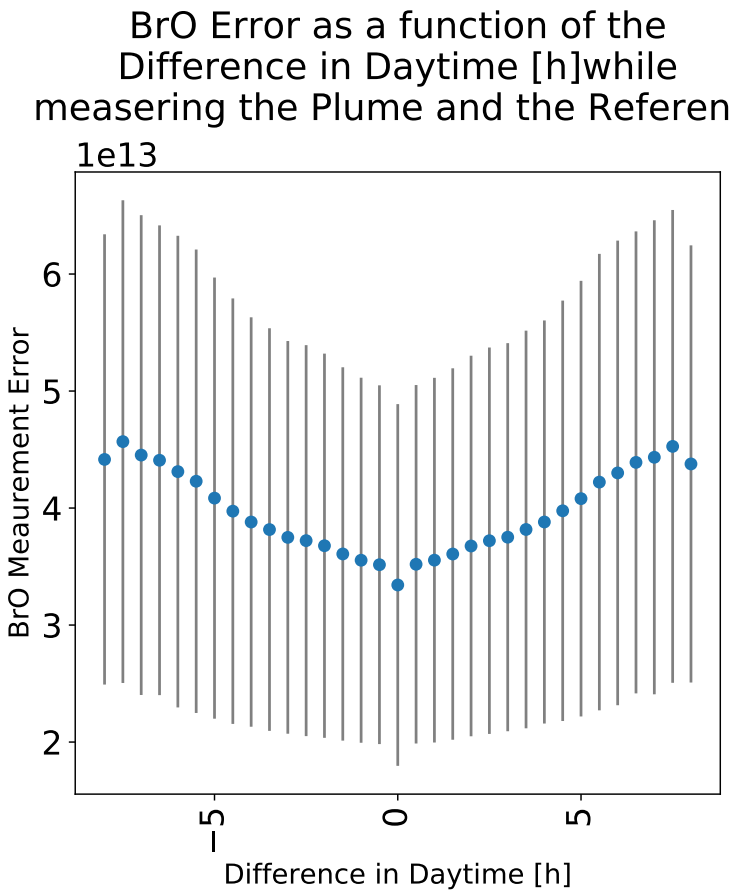


(a) Data of Tungurahua

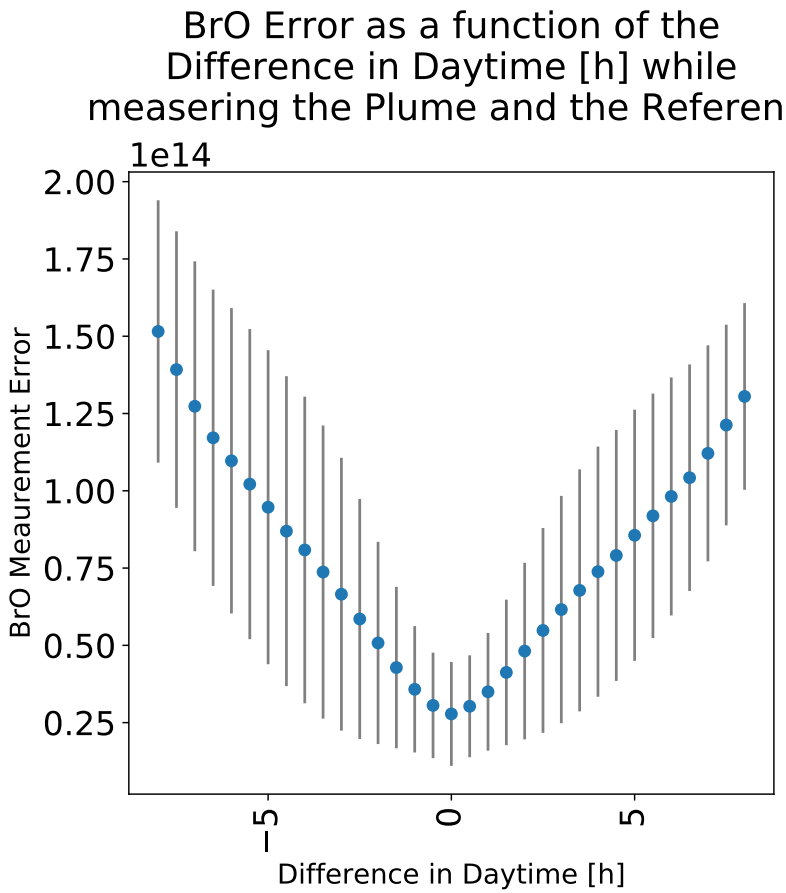


(b) Data of Nevado Del Riz

BrO Error Tungurhua /Nevado Del Ruiz

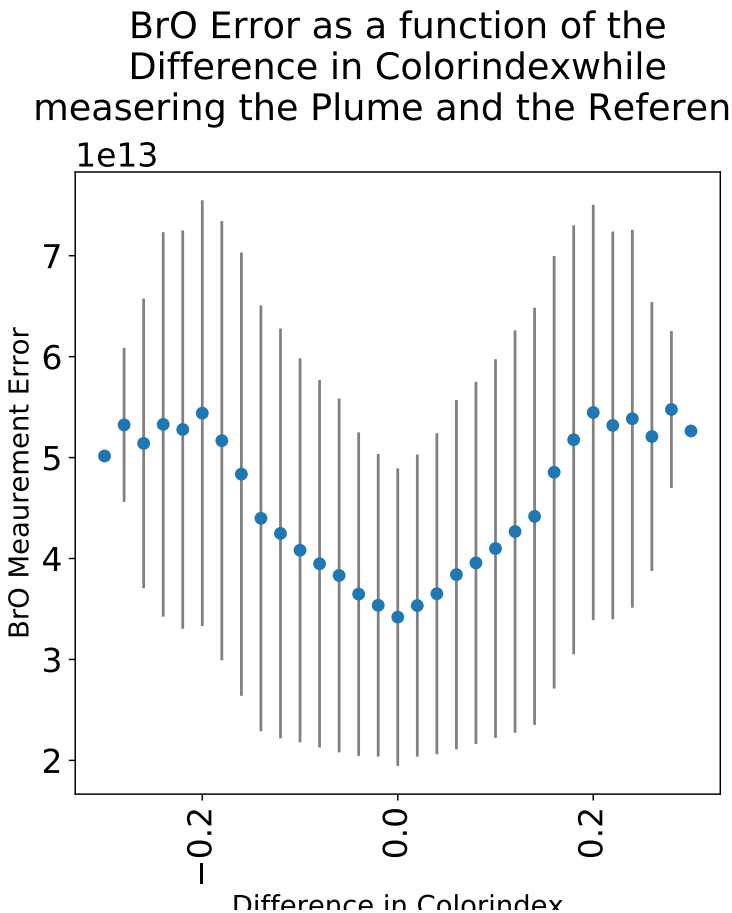


(a) Data of Tungurahua

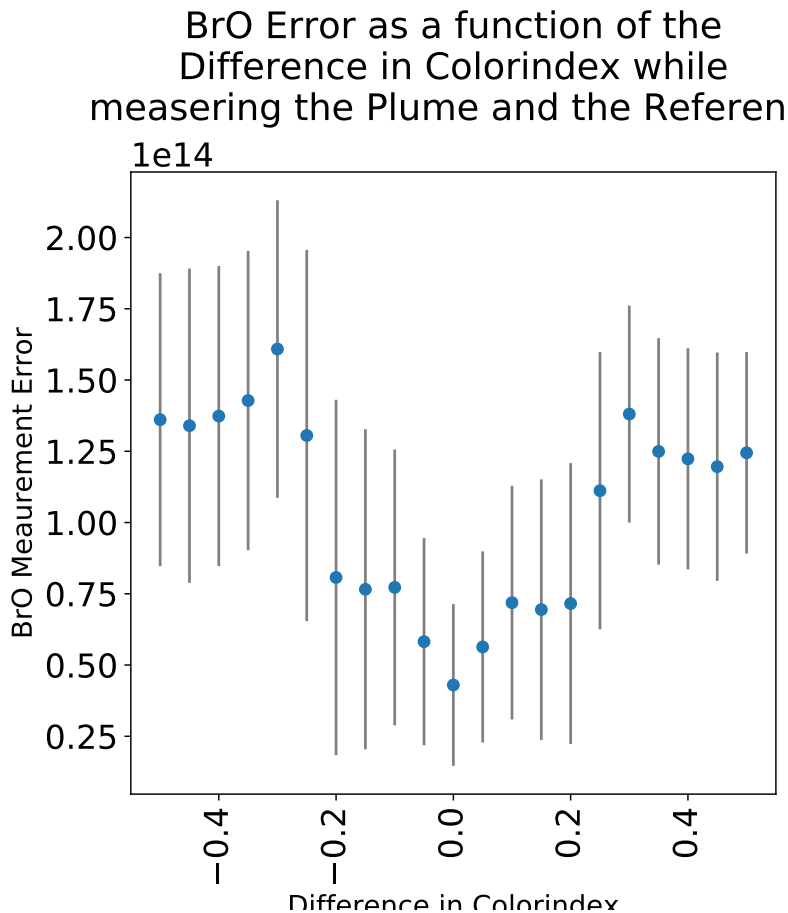


(b) Data of Nevado Del Riz

BrO Error Tungurhua /Nevado Del Ruiz

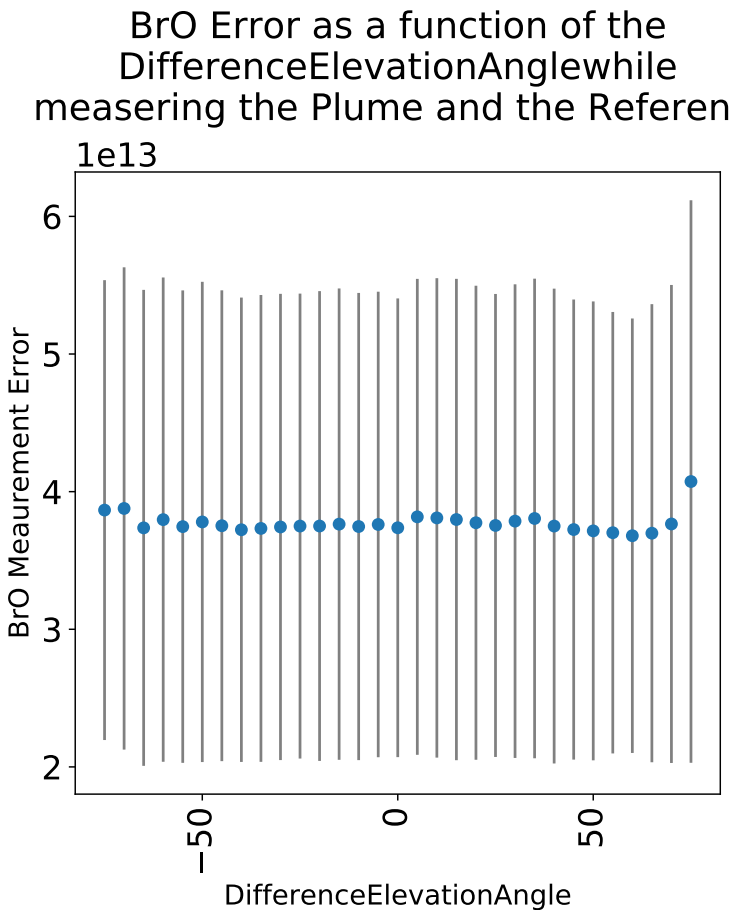


(a) Data of Tungurahua

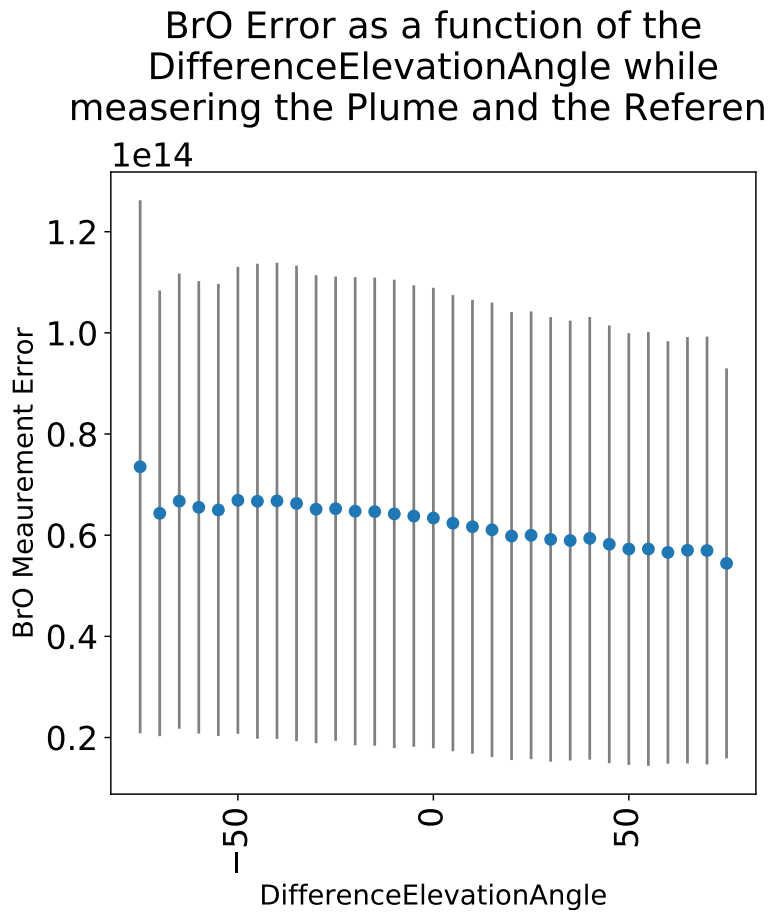


(b) Data of Nevado Del Riz

BrO Error Tungurhua /Nevado Del Ruiz

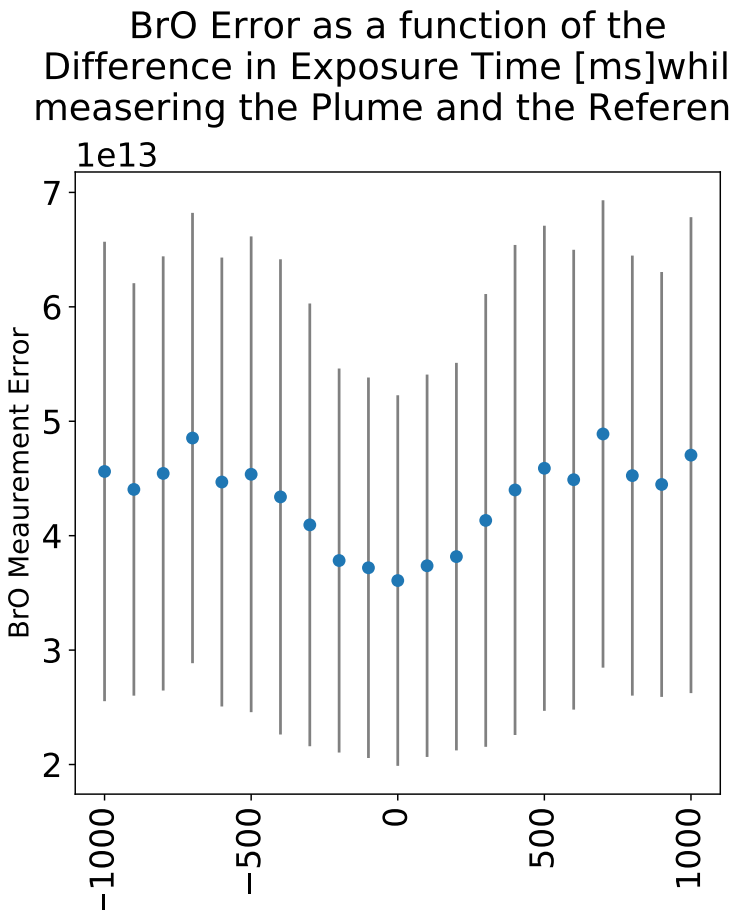


(a) Data of Tungurahua

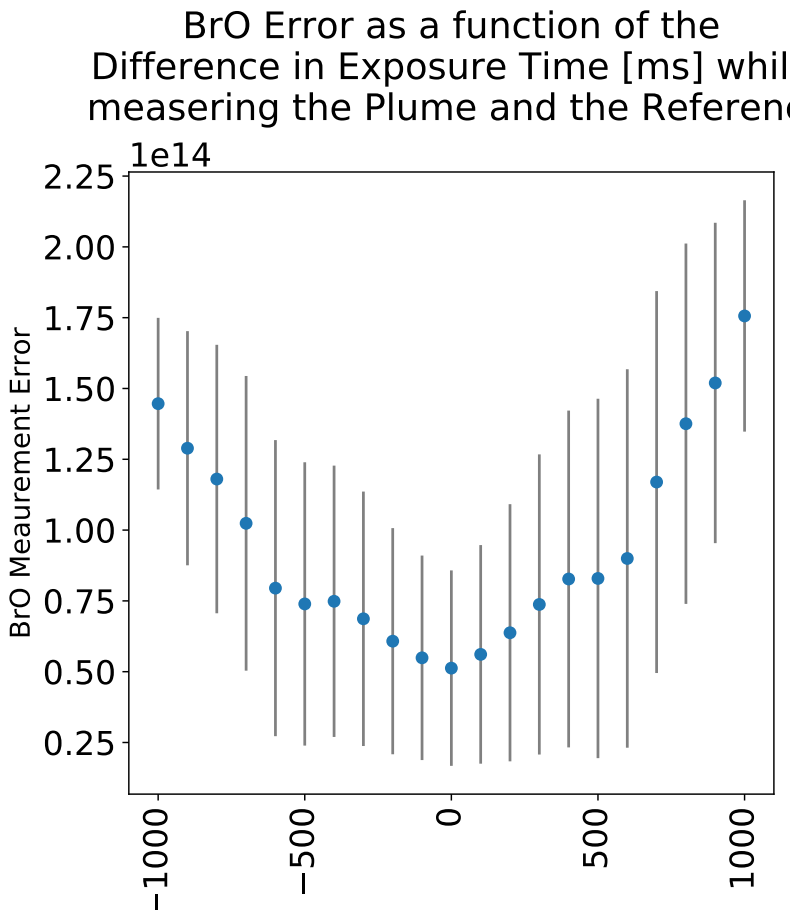


(b) Data of Nevado Del Riz

BrO Error Tungurhua /Nevado Del Ruiz

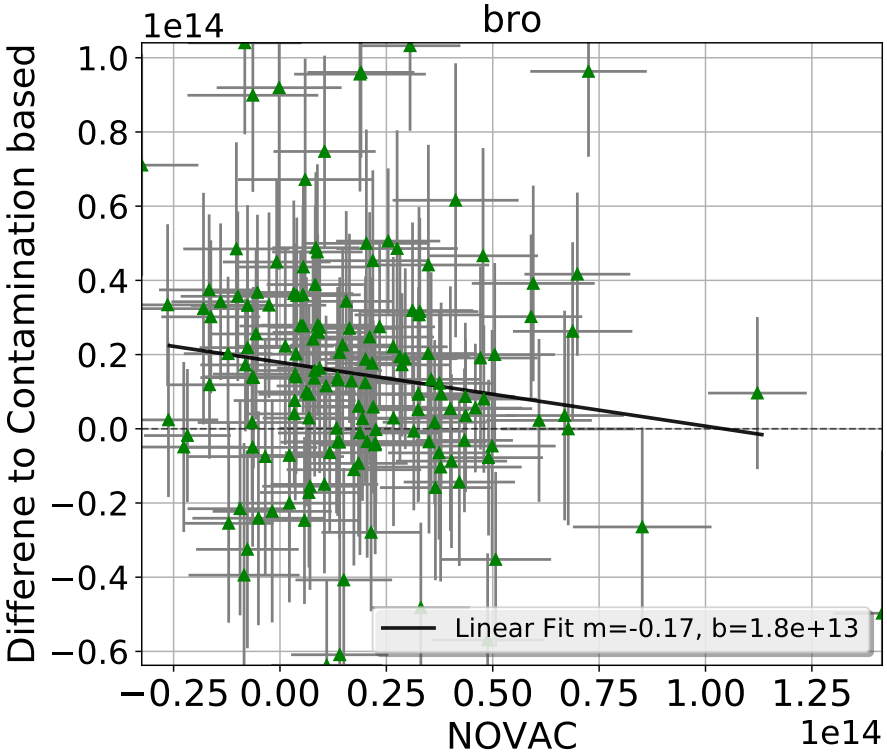


(a) Data of Tungurahua

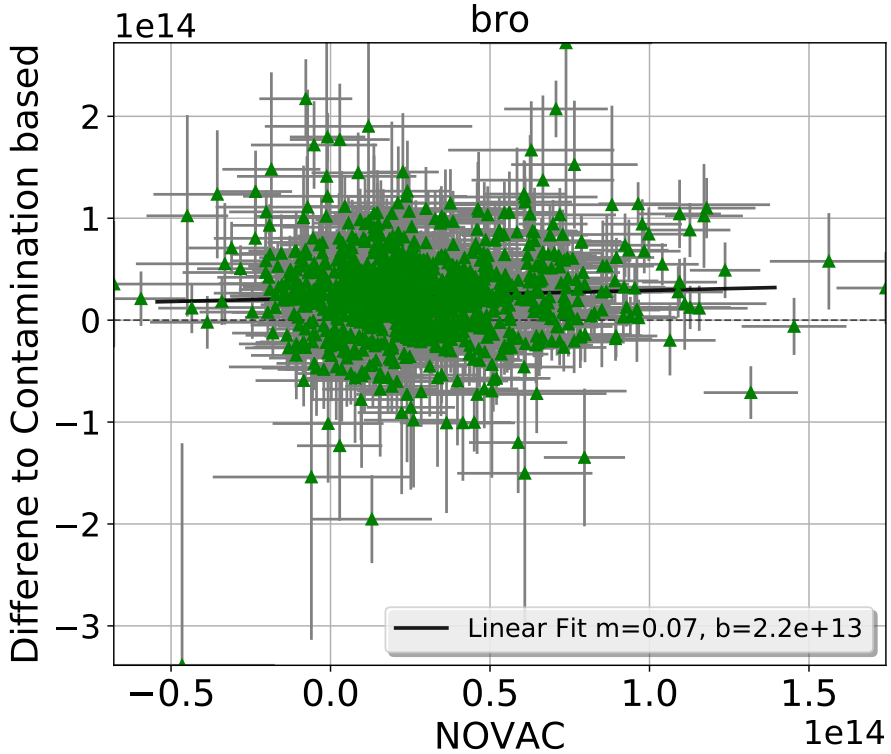


(b) Data of Nevado Del Riz

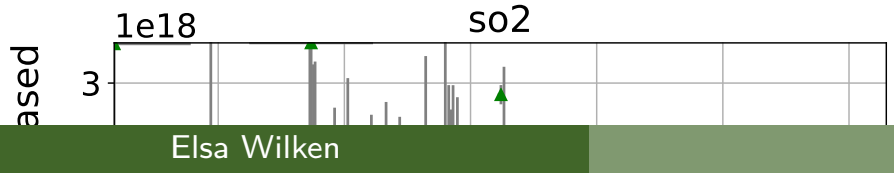
BrO Error Tungurhua /Nevado Del Ruiz

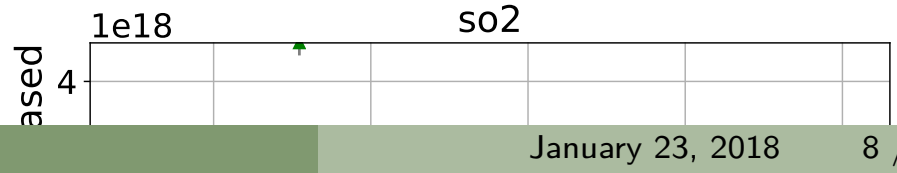


(a) Data of Tungurahua



(b) Data of Nevado Del Riz





Calculations

- linear approximation of the Data

$$\Delta\epsilon_{BrO} = a_t \cdot \Delta t + a_{temp} \cdot \Delta temp + a_{daytime} \cdot \Delta daytime + a_{coloridx} \cdot \Delta coloridx$$

Calculations

Difference in Constants

Constant	importance	deviation
a_T	0.661	29%
a_{ET}	0.011	164%
a_t	0.133	50%
a_{dt}	0.138	65%
a_c	0.061	136%

Results

SO2 Evaluation

- Increase if the SO2 column densities of: 84%
  - PILLATE: 62%
  - HUAYRAPATE: 122%
  - BAYUSHIG: 23% (very view data)
- More Data relative to the NOVAC-Evaluation: 206%

a

[a] Fit uses only data where SO2 column density is higher than $7 \cdot 10^{17} \frac{molec}{cm^2}$

BrO Evalutaion

- Instrument PILLATE
  - Increase of BrO column density: 30%
- Instrument HUAYRAPATE
  - Increase of BrO column density: 87%
- Instrument BAYUSHIG (very view data)
  - Increase of BrO column density: 35%

BrO Evaluation

- Increase of BrO column density: 52%
- Factor the absolute error increases relative to the NOVAC-evaluation: 1.65
- Factor the relative error increases relative to the optimal-results: 1.5

[a]

[a] Fit uses only data where SO2 column density is higher than $7 \cdot 10^{17} \frac{molec}{cm^2}$

Other Methods

		Error	Amount of Data	valid data
All Variables	independent dependent	1.51 1.40	95% 98%	10,5% 8%
Exposure Time	independent All	1.47 1.39	97% 98%	10% 7%
Exp.Time u Coloridx	independent All	1.40 1.35	98% 98%	11 7%

- In the optimal results are 15% valid data

Ratio Evaluation

- Decrease of gas ratio: 25%
  - PILLATE: 32%
  - HUAYRAPATE: 12%
- BAYUSHIG: -6%(very view data)

Total evaluation

- More BrO Data: 51%
- More valid BrO Data: 38%

Tungurahua

Menge an Daten insgesamt: ——————————————————————————
5883 ≈ 1
Davon: Menge an daten (auch kontaminierten)(NOVAC Auswertung) über plume limit– 712 ≈ 0.121
Davon: Menge an Daten, die nicht Kontaminiert sind:———————————— 5504 ≈ 0.936
Davon im Plume-limit: ——————————————————————————- 599 ≈ 0.102
Davon über dem Detection Limit:————————————————— 36 ≈ 0.006
Davon sind kontaminiert: ——————————————————————— 379 ≈ 0.064
Menge an kontamininierten Daten, mit NOVac ausgewertet, über plume limit:– 114 ≈ 0.301
Menge an contaminierten Daten (Neue Auswertung) über plume

Nevado Del Ruiz

Menge an Daten insgesamt:——————————————————14005 ≈ 1
Davon: Menge (auch cont)(NOVAC) über plume limit—-1818 ≈ 0.130
Davon: Menge an Daten, die nicht Kontaminiert sind:———12613≈ 0.901
Davon im Plume-limit:————————————————————-1238 ≈ 0.088
Davon über dem Detection Limit:——————————————-234 ≈ 0.017
Davon sind kontaminiert:————————————————————-1392 ≈ 0.099
Menge an kontamininierten Daten, mit NOVAC, über plume limit:———581 ≈ 0.417
Menge an contaminierten Daten (Neue Auswertung) über plume limit——1140 ≈ 0.819
Dh in den kontaminierten daten sind mit NOVAC ausgewerteten daten 3.215 häufiger über dem plume limit