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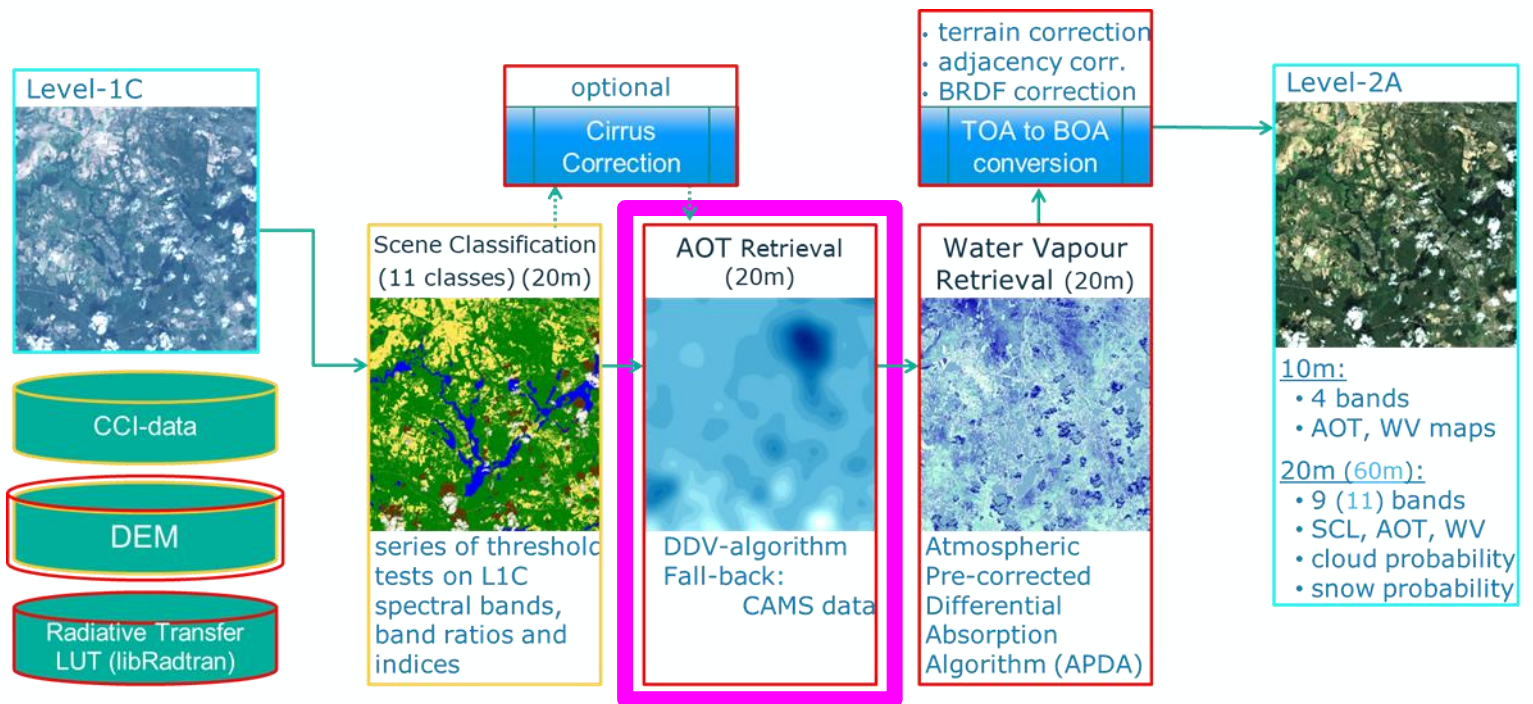
# Comparison of DDV-algorithm for AOT estimation in Sen2Cor and use of AOT from CAMS data

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- ❖ AOT retrieval performance of operational processing
- ❖ AOT retrieval performance of DDV-algorithm compared to CAMS data use
  - ❖ Method
  - ❖ Data set
  - ❖ Average results
  - ❖ Detailed results
- ❖ Conclusions



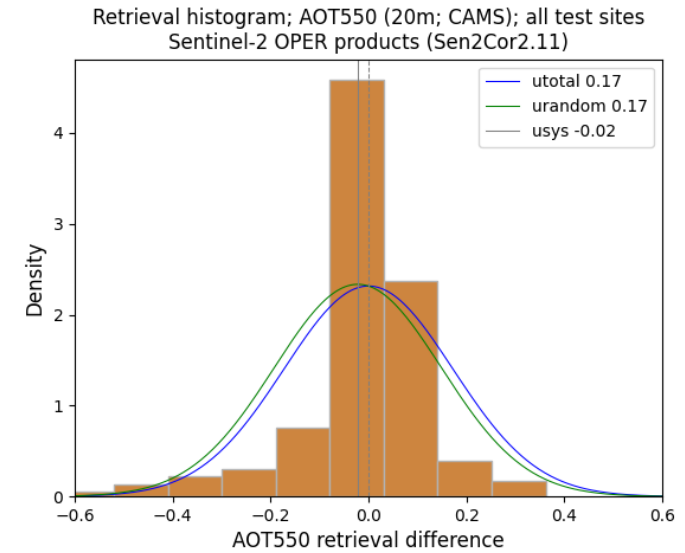
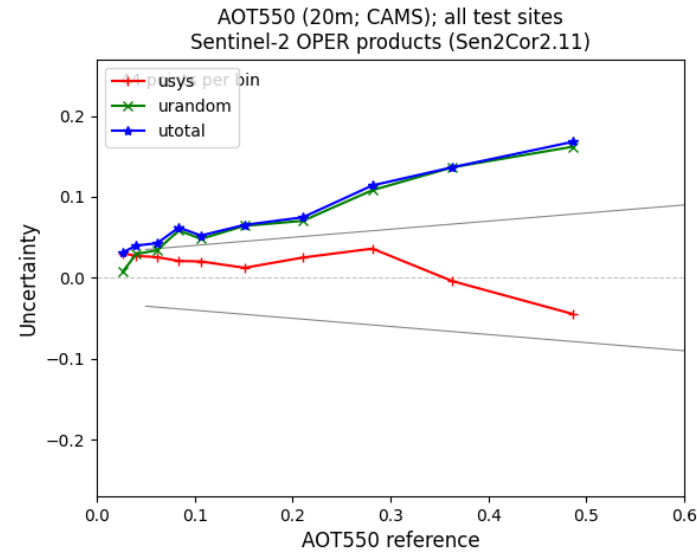
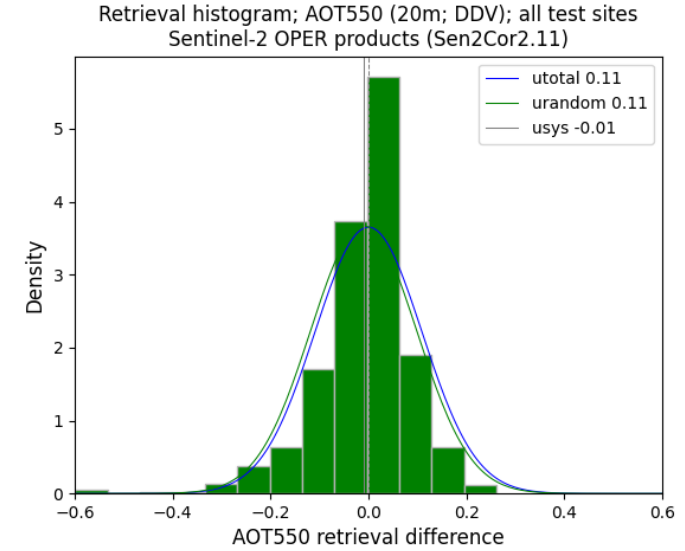
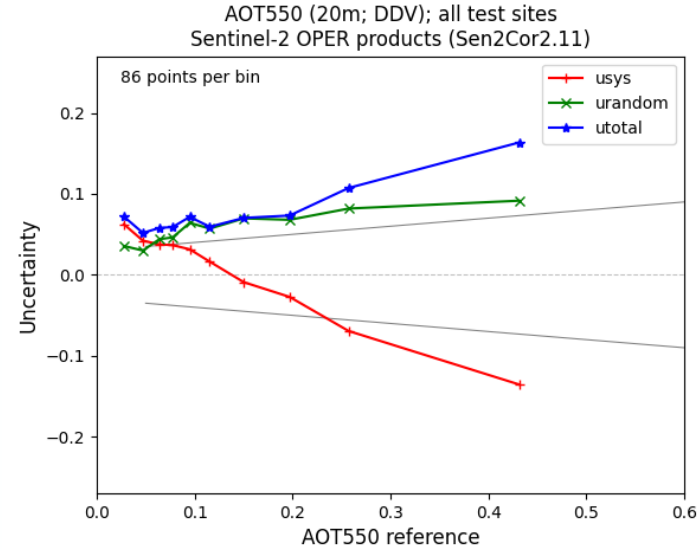
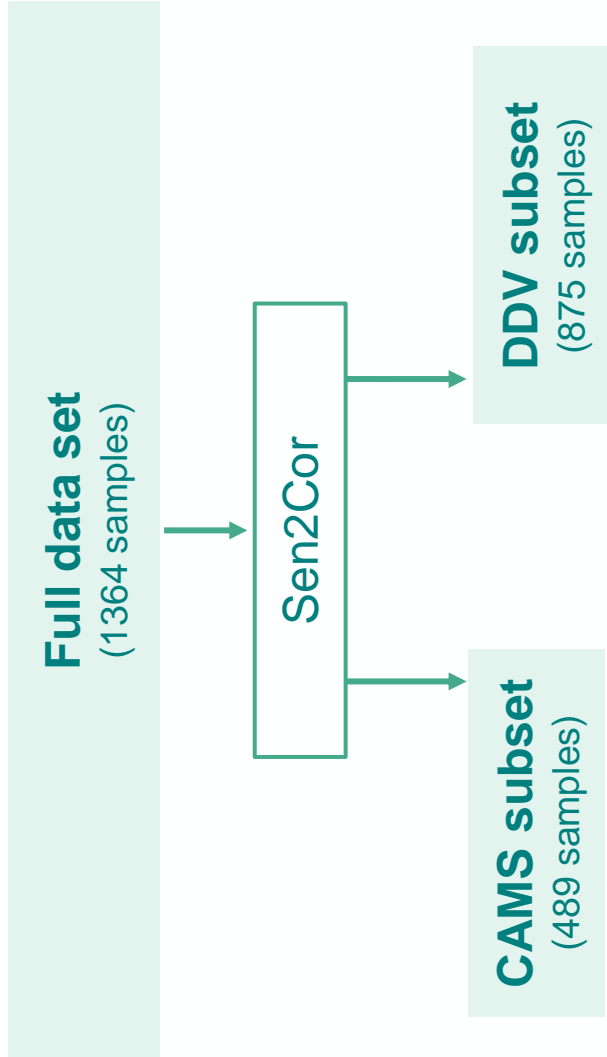
# Operational processing



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Latitude	AOT <sub>DDV</sub>	Sample size	U <sub>sys</sub> (Bias)	MedAE	U <sub>total</sub> (RMSD)	within spec	range	AOT <sub>CAMS</sub>	Sample size	U <sub>sys</sub> (Bias)	MedAE	U <sub>total</sub> (RMSD)	within spec	range
> 60°N	Polar	55	0.05	0.05	0.08	27%	0.02 – 0.46	Polar	35	0.02	0.02	0.04	69%	0.02 – 0.25
45 - 60 °N	Boreal	214	0.00	0.03	0.06	64%	0.02 – 0.54	Boreal	21	0.00	0.03	0.07	81%	0.02 – 1.0
30 - 60 °N	Midlat. N	358	0.02	0.05	0.09	47%	0.02 – 0.96	Midlat. N	181	-0.01	0.03	0.16	59%	0.01 – 2.3
15 - 30 °N	Subtrop. N	106	-0.11	0.08	0.20	36%	0.03 – 1.6	Subtrop. N	126	-0.05	0.08	0.23	40%	0.03 – 1.8
15°S - 15°N	Tropical	82	-0.07	0.06	0.14	43%	0.06 – 0.95	Tropical	51	-0.03	0.08	0.21	41%	0.05 – 1.4
15 - 30 °S	Subtrop. S	45	-0.03	0.07	0.09	33%	0.05 – 0.45	Subtrop. S	25	-0.09	0.11	0.16	32%	0.09 – 0.92
> 30° S	Midlat._S	15	0.04	0.04	0.05	47%	0.04 – 0.14	Midlat._S	41	0.01	0.02	0.03	78%	0.09 – 0.19
	All data	875	-0.01	0.04	0.11	47%	0.02 – 1.6	All data	489	-0.02	0.04	0.17	54%	0.01 – 2.3

Specification:  $U < 0.1 * AOT_{550} + 0.03$

$$\Delta AOT = AOT_{550_{SEN2COR}} - AOT_{550_{REFERENCE}}$$

$$U_{sys} = \sqrt{\frac{1}{(n-1)} \cdot \sum_{i=1}^n \Delta AOT_i}$$

$$U_{random} = \sqrt{\frac{1}{(n-1)} \cdot \sum_{i=1}^n (\Delta AOT_i - u_{sys})^2}$$

$$MedAE = Median(|\Delta AOT_i|)$$

$$U_{total} = \sqrt{U_{sys}^2 + U_{random}^2}$$



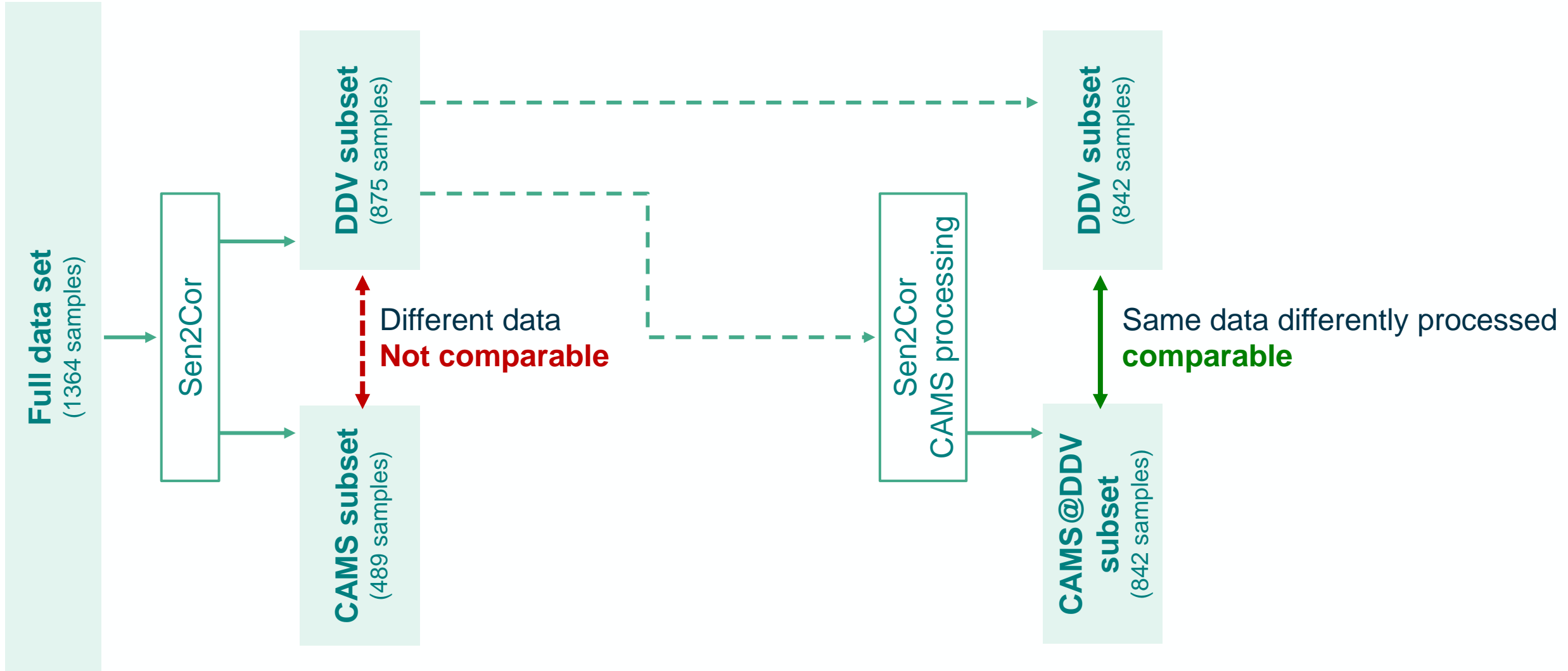
# DDV compared with CAMS: Method



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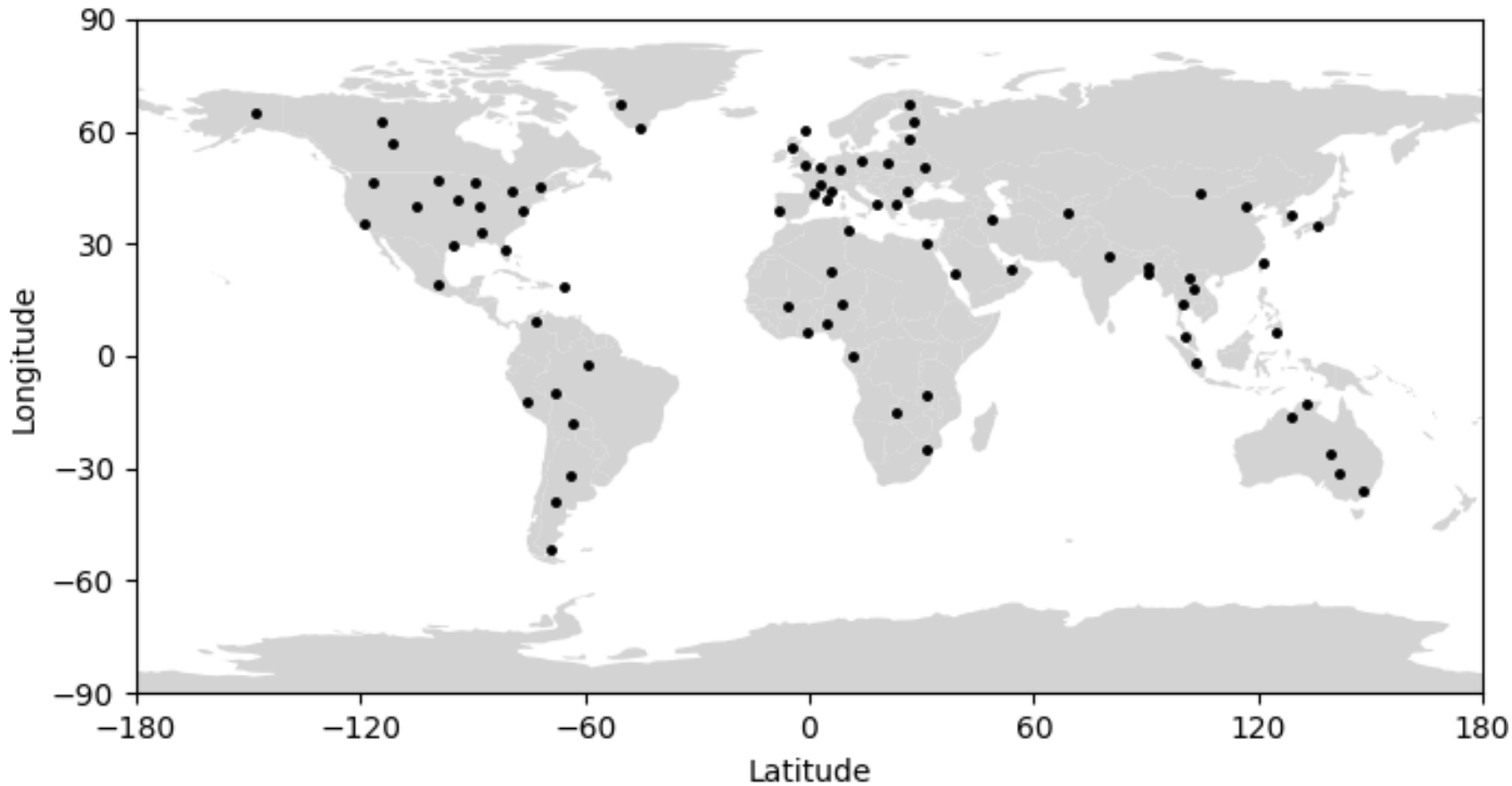
# DDV compared with CAMS: Data set



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DDV subset	Sites	Samples	range
Polar	5	53	0.02 - 0.46
Boreal	13	212	0.02 - 0.54
Midlat. N	16	349	0.02 - 0.66
Subtrop. N	7	86	0.03 - 0.80
Tropical	8	82	0.06 - 0.95
Subtrop. S	3	45	0.05 - 0.45
Midlat. N	2	15	0.04 - 0.14
All data	54	842	0.02 - 0.95



# DDV compared with CAMS: Average results



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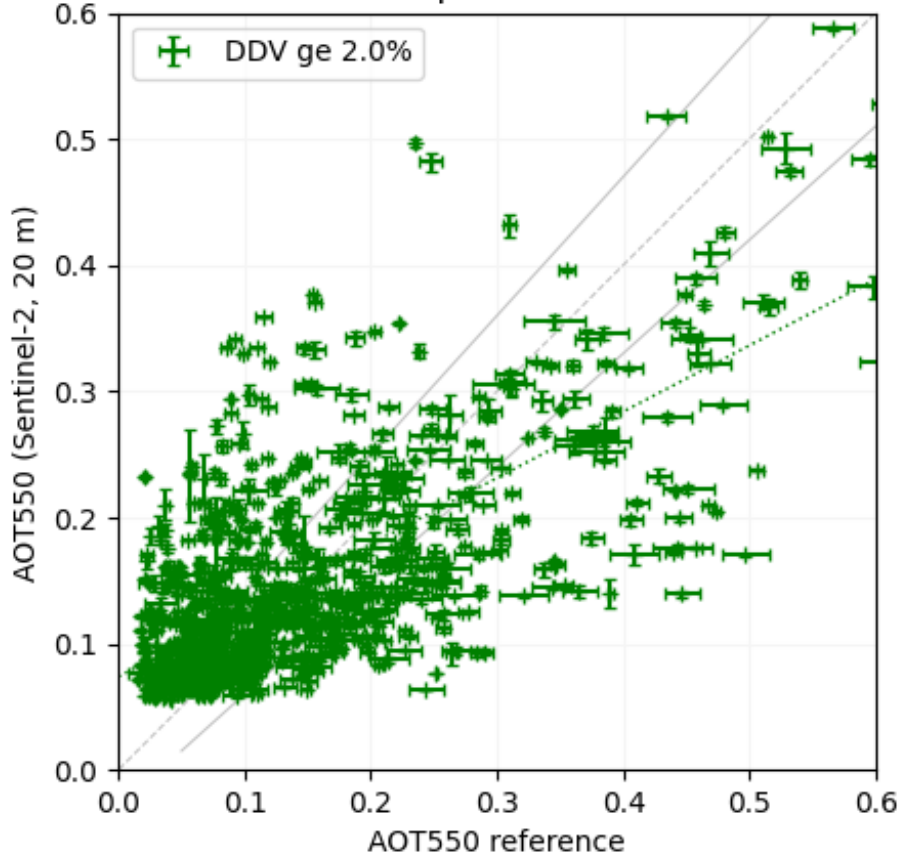
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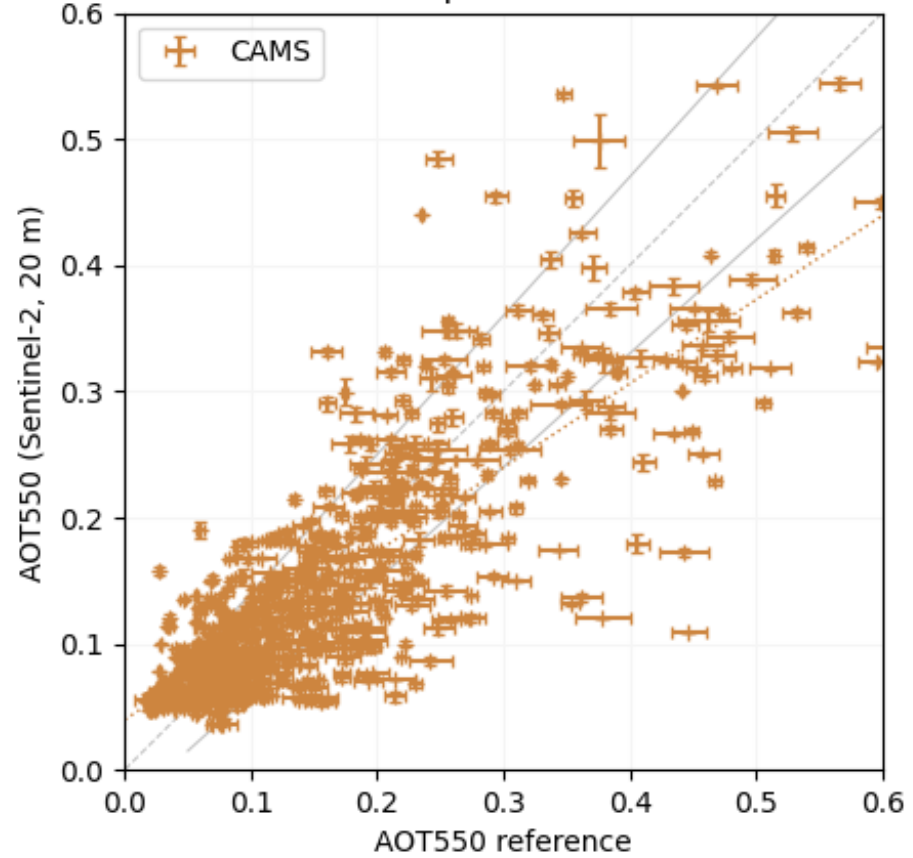
DDV

CAMS

AOT550 (20m; DDV); all test sites  
Sentinel-2 USER products (Sen2Cor2.11)



AOT550 (20m; CAMS); all test sites  
Sentinel-2 USER products (Sen2Cor2.11)



# DDV compared with CAMS: Average results



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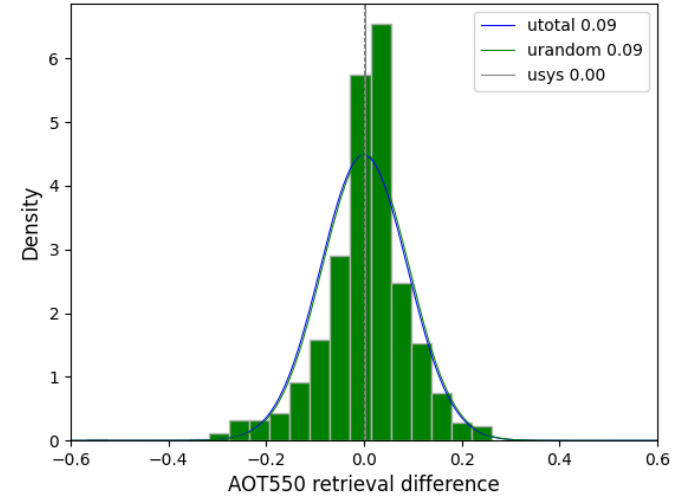


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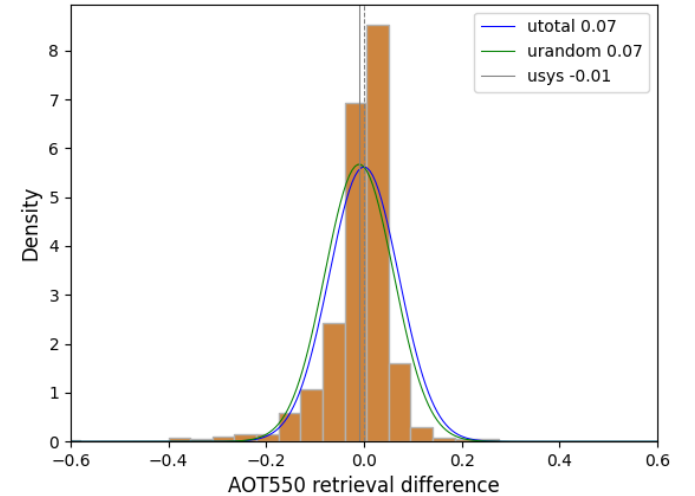


$AOT_{DDV}$	$U_{sys}$ (Bias)	$U_{sys}$ (Bias)	MedAE	MedAE	$U_{total}$ (RMSD)	$U_{total}$ (RMSD)	within spec	within spec
	DDV	CAMS	DDV	CAMS	DDV	CAMS	DDV	CAMS
Polar	0.06	0.01	0.05	0.02	0.08	0.03	28%	79%
Boreal	0.00	0.00	0.03	0.02	0.05	0.05	62%	70%
Midlat. N	0.03	0.00	0.05	0.03	0.09	0.06	42%	68%
Subtrop. N	-0.06	-0.05	0.06	0.05	0.09	0.11	44%	51%
Tropical	-0.06	-0.02	0.05	0.04	0.14	0.12	46%	52%
Subtrop. S	-0.02	-0.02	0.06	0.03	0.09	0.08	40%	67%
Midlat. S	0.04	0.00	0.04	0.01	0.05	0.03	40%	93%
All data	0.00	-0.01	0.05	0.03	0.09	0.07	47%	66%

Retrieval histogram; AOT550 (20m; DDV); all test sites Sentinel-2 USER products (Sen2Cor2.11)



Retrieval histogram; AOT550 (20m; CAMS); all test sites Sentinel-2 USER products (Sen2Cor2.11)







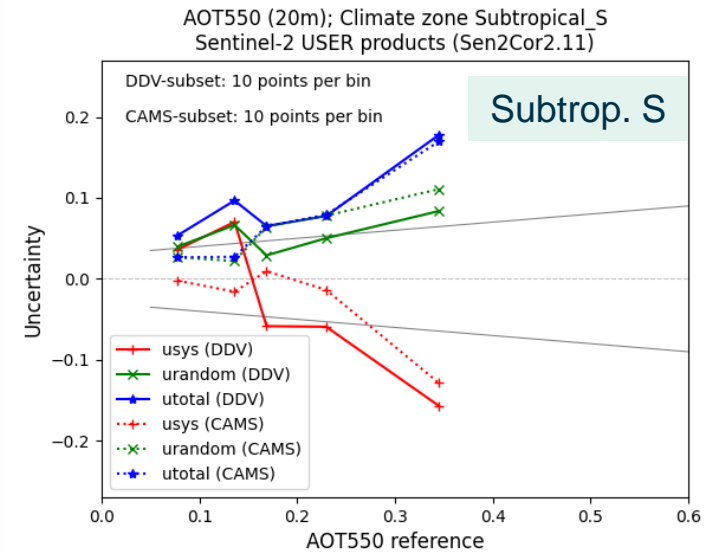
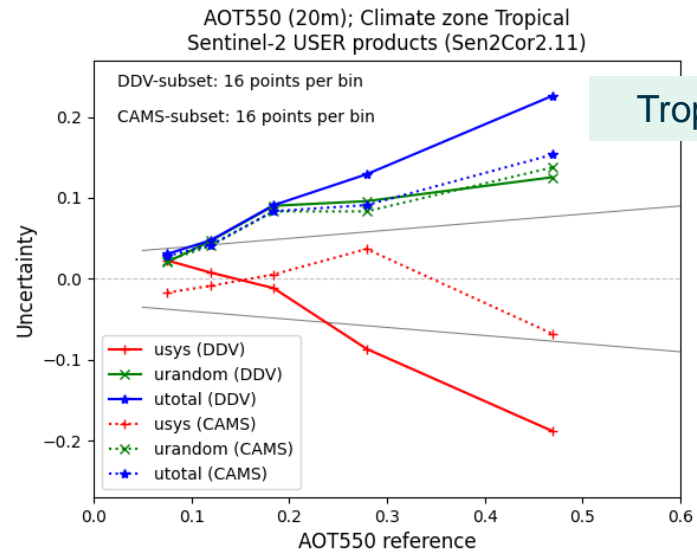
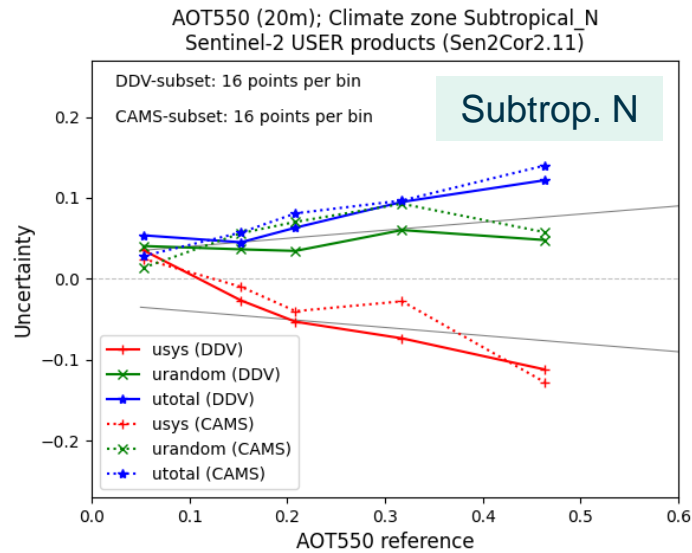
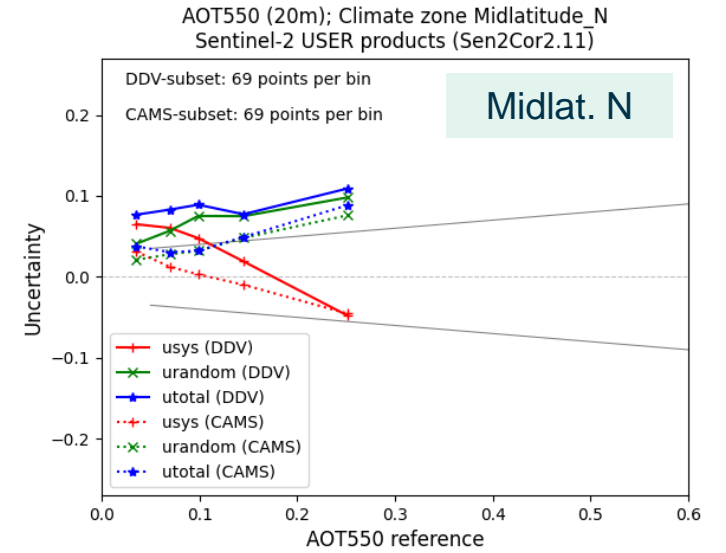
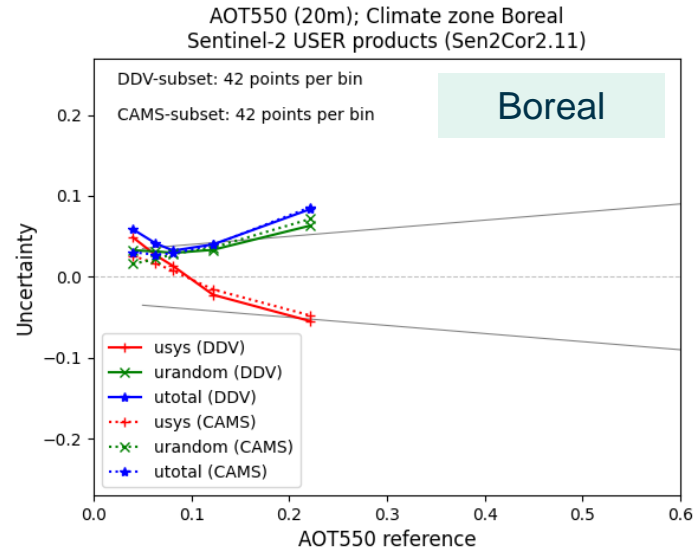
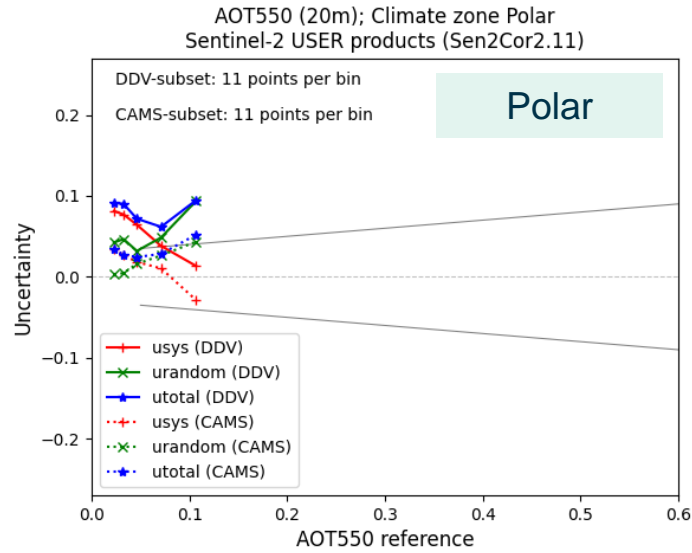
# DDV compared with CAMS: Detailed results



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## Conclusions

- ❖ Uncertainty of AOT retrieval for complete data set:  $0.03 < U_{total} < 0.25$
- ❖ Uncertainty of AOT retrieval for DDV subset:  $0.03 < U_{total} < 0.15$
- ❖ Uncertainty for Europe almost within specification  $U < 0.1 * AOT_{550} + 0.03$
  
- ❖ Direct comparison DDV <-> CAMS
  - ❖ CAMS has lower  $U_{sys}$  ;  $U_{total}$
  - ❖ DDV has lower  $U_{random}$
  - ❖ DDV has the potential to better represent spatial variations

Sen2Cor processor



ATBD version 2.10



monthly L2A Data Quality Reports:



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OPT-MPC



# Thank you!

# Sen2Cor configuration: force to CAMS processing



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## L2A\_CAL\_AC\_GIPP\_batch.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<Level-2A_CAL_AC_Ground_Image_Processing_Parameter
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xsi:noNamespaceSchemaLocation="L2A_CAL_AC_GIPP.xsd">
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  ...
  ...
  ...
  </Flags>
  <References>
  <Lib_Dir>lib</Lib_Dir>
  </References>
  <Sensor>
  ...
  ...
  ...
  </Sensor>
  <ACL_Prio_1>
  <AC_Min_Ddv_Area>100.0</AC_Min_Ddv_Area>
  <AC_Swir_Refl_Lower_Th>0.01</AC_Swir_Refl_Lower_Th>
  <AC_Swir_22um_Red_Refl_Ratio>0.5</AC_Swir_22um_Red_Ref
  ...
  ...
  ...
```

