Brief demonstration of ncompare: to compare the structure, groups, variables, and attributes of two netCDF files

Atmospheric Science Data Center

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In	stallation instructions for ncompare can be found in either of these locations:	
	• GitHub repository	

1 ncompare's command line arguments, provided by the --help description

Syntax Note: Commands preceded by an exclamation point "!" (which is needed to run shell commands in a Jupyter notebook) can be run from a terminal. In a shell/terminal, the exclamation point should not be used.

[--file-xlsx FILE_XLSX] [--no-color] [--show-attributes]
[--show-chunks]
[--column-widths COLUMN_WIDTHS COLUMN_WIDTHS]
nc_a nc_b

Compare the variables contained within two different NetCDF datasets

positional arguments:

nc_a First NetCDF file nc_b First NetCDF file

options:

-h, --help show this help message and exit

-v COMPARISON_VAR_NAME, --comparison_var_name COMPARISON_VAR_NAME

Comparison variable name

-g COMPARISON_VAR_GROUP, --comparison_var_group COMPARISON_VAR_GROUP

Comparison variable group

--file-text FILE_TEXT

A text file to which the output will be written.

--file-csv FILE_CSV A csv (comma separated values) file to which the

output will be written.

--file-xlsx FILE XLSX

An Excel file to which the output will be written.

--no-color Turn off all colorized output

--show-attributes Include variable attributes in comparison

--show-chunks Include chunk sizes in the table that compares

variables

--column-widths COLUMN_WIDTHS COLUMN_WIDTHS

Width, in number of characters, of the three columns

in the comparison report

2 ## Example 1: Two netCDF files with the same groups, variables, and attributes

The two files are first defined. The example here uses two files from NASA's Measurements Of Pollution In The Troposphere (MOPITT) instrument, and they can be downloaded from these URLs: - https://l5ftl01.larc.nasa.gov/ops/misrl2l3/MOPITT/MOP03JM.008/2022.05.01/MOP03JM-202205-L3V95.6.3.he5 - https://l5ftl01.larc.nasa.gov:22000/misrl2l3/MOPITT/MOP03JM.009/2022.05.01/MOP0202205-L3V95.9.3.he5

```
filepath_1 = "notebook_example_data/MOPO3JM-202205-L3V95.6.3.he5"
filepath_2 = "notebook_example_data/MOP03JM-202205-L3V95.9.3.he5"
```

Next, we pass the two filepaths to ncompare, and any differences would be printed in red. In this case, there are no differences; therefore, all of the variables are printed in black.

Syntax Note: the curly brackets, "{" and "}", that follow are simply a way to substitute python variables into a shell command. In a shell/terminal, one can just write out the full arguments, separated by spaces. For example, the following command would be run at the terminal as ncompare notebook_example_data/MOP03JM-202205-L3V95.6.3.he5 notebook_example_data/MOP03JM-202205-L3V95.9.3.he5

ncompare Options Note: the --column-widths 28 34 34 arguments are optional, and they are being used here to shrink the columns width-wise from their defaults to a size that fits better in the GitHub notebook renderer.

```
! ncompare --column-widths 28 34 34 {filepath_1} {filepath_2}
File A: notebook_example_data/MOPO3JM-202205-L3V95.6.3.he5
File B: notebook_example_data/MOP03JM-202205-L3V95.9.3.he5
```

Are all items the same? ---> True. (No items exist.)

Root-level Groups:

Root-level Dimensions:

Are all items the same? ---> True. ['HDFEOS', 'HDFEOS INFORMATION']

No variable group selected for comparison. Skipping

All va

labie group s	erected 101	comparison. Skipping	
ariables:		D41 -	Α.
All	Variables	File .	A
num vaniahlaa			
num variables	in group:		0
	GROUP #01 -	/HDFEO	s

num variables in group:

GROUP #02 num variables in group:	/HDFEOS INFORMATION 2	/HDFEOS INFO
VARIABLE: dtype: shape:	StructMetadata.0 <class 'str'=""> ()</class>	StructMeta <class< td=""></class<>
VARIABLE: dtype: shape:	<pre>coremetadata.0</pre>	coremeta <class< td=""></class<>
GROUP #03 num variables in group:	/HDFEOS/ADDITIONAL 0	/HDFEOS/ADD:
GROUP #04 num variables in group:	/HDFEOS/GRIDS 0	
GROUP #05 num variables in group:	/HDFEOS/ADDITIONAL/FILE_ATTRIBUTES 0	/HDFEOS/ADDITIONAL/FILE_ATTI
GROUP #06 num variables in group:	/HDFEOS/GRIDS/MOPO3	
VARIABLE: dtype: shape:VARIABLE: dtype:	NTW0 int32 (2,) Prs float32	
shape: VARIABLE: dtype: shape:	(9,) Prs1 float32 (10,)	:
VARIABLE: dtype: shape:VARIABLE:	Prs2 float32 (10,) XDim	:
dtype: shape: VARIABLE: dtype:	float64 (360,) YDim float64	; ;

(180,)shape: GROUP #07 ---/HDFEOS/GRIDS/MOPO3/Data Fields ---/HDFEOS/GRIDS/MOPO3/Data num variables in group: ----VARIABLE----: APrioriCOMixingRatioProfileDay APrioriCOMixingRatioPro dtype: shape: (360, 180, 9)(360,----VARIABLE----: APrioriCOMixingRatioProfileNight APrioriCOMixingRatioProfi dtype: float32 (360, 180, 9)(360,shape: ----VARIABLE----: APrioriCOSurfaceMixingRatioDay APrioriCOSurfaceMixingR dtype: float32 (360, 180)(36 shape: ----VARIABLE----: APrioriCOSurfaceMixingRatioNight APrioriCOSurfaceMixingRat float32 dtype: shape: (360, 180)(36 ----VARIABLE---: APrioriCOTotalColumnDay APrioriCOTotalCo dtype: float32 shape: (360, 180)(36 ----VARIABLE---: APrioriCOTotalColumnNight APrioriCOTotalColu dtype: float32 shape: (360, 180)(36)----VARIABLE----: APrioriSurfaceEmissivityDay APrioriSurfaceEmissi float32 dtype: (360, 180)shape: ----VARIABLE----: APrioriSurfaceEmissivityNight APrioriSurfaceEmissivi dtype: float32 (360, 180)shape: ----VARIABLE---: APrioriSurfaceTemperatureDay APrioriSurfaceTempera float32 dtype: (360, 180)shape: ----VARIABLE----: APrioriSurfaceTemperatureNight APrioriSurfaceTemperatu dtype: float32 (360, 180)(36 shape: ----VARIABLE---: DEMAltitudeDay DEMAlti dtype: float32 shape: (360, 180)(36 DEMAltitu ----VARIABLE----: DEMAltitudeNight dtype: float32 (360, 180)(36 shape:

DEMAltitudeVariabilityDay

float32

DEMAltitudeVariabi

----VARIABLE----:

dtype:

shape:	(360, 180)	(360
VARIABLE:	${\tt DEMAltitudeVariabilityNight}$	DEMAltitudeVariabili
dtype:	float32	=
shape:	(360, 180)	(36)
VARIABLE:	${\tt DegreesofFreedomforSignalDay}$	DegreesofFreedomforSig
dtype:	float32	=
shape:	(360, 180)	(36)
VARIABLE:	${\tt DegreesofFreedomforSignalNight}$	DegreesofFreedomforSigna
dtype:	float32	:
shape:	(360, 180)	(36)
VARIABLE:	DryAirColumnDay	DryAirCo
dtype:	float32	·
shape:	(360, 180)	(36)
VARIABLE:	DryAirColumnNight	DryAirColu
dtype:	float32	·
shape:	(360, 180)	(360
VARIABLE:	Latitude	L
dtype:	float32	-
shape:	(180,)	
VARIABLE:	Longitude	Lo
dtype:	float32	
shape:	(360,)	
_	MeasurementErrorCovarianceMatrixDay	MeasurementErrorCovariance
dtype:	float32	
shape:	(360, 180, 10, 10)	(360, 180,
_	MeasurementErrorCovarianceMatrixNig	
dtype:	float32	
shape:	(360, 180, 10, 10)	(360, 180,
VARIABLE:	NumberofPixelsDay	NumberofPi:
dtype:	int32	Number eri
shape:	(360, 180)	(36)
VARIABLE:	NumberofPixelsNight	NumberofPixe:
dtype:	int32	Number err ine.
shape:	(360, 180)	(36)
VARIABLE:	Pressure	P
dtype:	float32	
shape:	(9,)	
VARIABLE:	Pressure2	Pro
dtype:	float32	r r
shape:	(10,)	
VARIABLE:	RetrievalAveragingKernelMatrixDay	RetrievalAveragingKernelMa
	float32	or revary ser agring verneria
dtype:	(360, 180, 10, 10)	(360, 180,
shape:	(300, 100, 10, 10)	(300, 100,

```
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                            dtype:
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                            shape:
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                            dtype:
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                            dtype:
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                            shape:
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                            shape:
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float32 (360, 180)

----VARIABLE----: RetrievedCOSurfaceMixingRatioVariabilityNight RetrievedCOSurfa

(36

dtype:

shape:

	float32	dtype:
(36	(360, 180)	shape:
	RetrievedCOTotalColumnDay	VARIABLE:
	float32	dtype:
(36	(360, 180)	shape:
	RetrievedCOTotalColumnDiagnosticsDay	•
	float32	dtype:
(360,	(360, 180, 2)	shape:
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ite ti le vedo lo talco lu	float32	dtype:
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	RetrievedCOTotalColumnVariabilityNig	shape:
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(36	(360, 180)	shape:
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	float32	dtype:
(36	(360, 180)	shape:
ityDay RetrievedSurfaceTemp	RetrievedSurfaceTemperatureVariabil	VARIABLE:
_	float32	dtype:
(36	(360, 180)	shape:
ityNight RetrievedSurfaceTe	RetrievedSurfaceTemperatureVariabil	VARIABLE:
	float32	dtype:
(36	(360, 180)	shape:
SatelliteZenithA	SatelliteZenithAngleDay	VARIABLE:
	float32	dtype:
(36	(360, 180)	shape:
SatelliteZenithAng	SatelliteZenithAngleNight	VARIABLE:
	float32	dtype:
(36	(360, 180)	shape:
Signal	SignalChi2Day	VARIABLE:
9	float32	dtype:
(36	(360, 180)	shape:
SignalCh	SignalChi2Night	VARIABLE:
<u> </u>	float32	dtype:
(36	(360, 180)	shape:
SignalChi2Variabi	SignalChi2VariabilityDay	VARIABLE:
C	float32	dtype:
(36	(360, 180)	shape:
SignalChi2Variabili	SignalChi2VariabilityNight	VARIABLE:
3	float32	dtype:
(36	(360, 180)	shape:
SmoothingErrorCovarianceMa	SmoothingErrorCovarianceMatrixDay	VARIABLE:
	float32	dtype:
(360, 180,	(360, 180, 10, 10)	shape:
	SmoothingErrorCovarianceMatrixNight	•

float32

(360, 180,

(360, 180, 10, 10)

dtype:

shape:

```
----VARIABLE----:
                                             SolarZenithAngleDay
                                                                                 SolarZenithA
                                                         float32
                      dtype:
                                                       (360, 180)
                                                                                           (36
                      shape:
         ----VARIABLE----:
                                           SolarZenithAngleNight
                                                                               SolarZenithAng
                      dtype:
                                                         float32
                                                       (360, 180)
                                                                                           (36
                      shape:
         ----VARIABLE----:
                                                 SurfaceIndexDay
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                      dtype:
                                                            int32
                                                       (360, 180)
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                      shape:
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         ----VARIABLE----:
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                      dtype:
                                                       (360, 180)
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                      shape:
         ----VARIABLE----:
                                              SurfacePressureDay
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                      dtype:
                                                         float32
                                                       (360, 180)
                      shape:
         ----VARIABLE---:
                                            SurfacePressureNight
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                      dtype:
                                                         float32
                                                                                           (36
                                                       (360, 180)
                      shape:
         ----VARIABLE----:
                                  TotalColumnAveragingKernelDay
                                                                      TotalColumnAveragingKe
                                                         float32
                      dtype:
                                                                                       (360, 18)
                      shape:
                                                  (360, 180, 10)
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                                TotalColumnAveragingKernelNight
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                      dtype:
                                                         float32
                                                  (360, 180, 10)
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                      shape:
         ----VARIABLE----:
                                             WaterVaporColumnDay
                                                                                 WaterVaporCo
                                                         float32
                      dtype:
                                                       (360, 180)
                                                                                           (36
                      shape:
         ----VARIABLE----:
                                           WaterVaporColumnNight
                                                                               WaterVaporColu
                      dtype:
                                                         float32
                                                       (360, 180)
                      shape:
                                                                                           (36
Total number of shared items:
                                                                88
Total number of non-shared items:
                                                                     0
```

Done.

2.0.1 More file details can be examined by using the --show-attributes and --show-chunks options

! ncompare --show-attributes --show-chunks --column-widths 28 34 34 {filepath_1} {filepath_2}

```
Root-level Dimensions:
   Are all items the same? ---> True. (No items exist.)
Root-level Groups:
   Are all items the same? ---> True.
   ['HDFEOS', 'HDFEOS INFORMATION']
No variable group selected for comparison. Skipping..
All variables:
                                            File A
            All Variables
               GROUP #00 -----/ ------/
    num variables in group:
               num variables in group:
               GROUP #02 -----/HDFEOS INFORMATION -----/HDFEOS INFO
    num variables in group:
                     ----VARIABLE---:
                                    StructMetadata.0
                                                               StructMet
                                      <class 'str'>
                                                                 <class
                 dtype:
                 shape:
                                               ()
                                         contiguous
              chunksize:
                                                                   con
       ----VARIABLE----:
                                      coremetadata.0
                                                                coremet
                                      <class 'str'>
                 dtype:
                                                                 <class
                 shape:
                                             (1,)
              chunksize:
                                         contiguous
                                                                   con
               GROUP #03 -----/HDFEOS/ADDITIONAL -----/HDFEOS/ADD
    num variables in group:
               GROUP #04 -----/HDFEOS/GRIDS -----/HDFEOS
                                                0
    num variables in group:
```

File A: notebook_example_data/MOP03JM-202205-L3V95.6.3.he5 File B: notebook_example_data/MOP03JM-202205-L3V95.9.3.he5

-		
	/HDFEOS/ADDITIONAL/FILE_ATTRIBUTES	/HDFEOS/ADDITIONAL/FILE_ATT
num variables in group:	0	
_		
GROUP #06	/HDFEOS/GRIDS/MOPO3	/HDFEOS/GRIDS
num variables in group:	6	
-		
VARIABLE:	NTWO	
dtype:	int32	
shape:	(2,)	
chunksize:	contiguous	con
VARIABLE:	Prs	
dtype:	float32	
shape:	(9,)	
chunksize:	contiguous	con ⁴
units:	hPa	
VARIABLE:	Prs1	
dtype:	float32	:
shape:	(10,)	
chunksize:	contiguous	con ^o
units:	hPa	
VARIABLE:	Prs2	
dtype:	float32	;
shape:	(10,)	
chunksize:	contiguous	con
units:	hPa	
VARIABLE:	XDim	
dtype:	float64	
shape:	(360,)	
chunksize:	contiguous	con
units:	degrees_east	degree
VARIABLE:	YDim	
dtype:	float64	
shape:	(180,)	
chunksize:	contiguous	con ¹
units:	degrees_north	degrees
GROUP #07	/HDFEOS/GRIDS/MOP03/Data Fields	/HDFEOS/GRIDS/MOPO3/Data
num variables in group:	80	
- VARIABLE:	APrioriCOMixingRatioProfileDay	

=	float32	dtype:
(360,	(360, 180, 9)	shape:
[60,	[60, 30, 9]	chunksize:
	-9999.0	_FillValue:
A Priori CO Mixing Ratio 1	A Priori CO Mixing Ratio Profile Day	long_name:
	ppbv	units:
APrioriCOMixingRatioProfi	APrioriCOMixingRatioProfileNight	VARIABLE:
=	float32	dtype:
(360,	(360, 180, 9)	shape:
[60,	[60, 30, 9]	chunksize:
	-9999.0	_FillValue:
ht A Priori CO Mixing Ratio	A Priori CO Mixing Ratio Profile Nig	long_name:
J	ppbv	units:
APrioriCOSurfaceMixingRa	APrioriCOSurfaceMixingRatioDay	VARIABLE:
:	float32	dtype:
(36)	(360, 180)	shape:
[0	[60, 30]	chunksize:
	-9999.0	_FillValue:
A Priori CO Surface Mixing	A Priori CO Surface Mixing Ratio Day	_
	ppbv	units:
APrioriCOSurfaceMixingRat	APrioriCOSurfaceMixingRatioNight	VARIABLE:
-	float32	dtype:
(36)	(360, 180)	shape:
Γ	[60, 30]	chunksize:
	-9999.0	_FillValue:
ht A Priori CO Surface Mix	A Priori CO Surface Mixing Ratio Nig	-
no n liloli oo ballass nin	ppbv	units:
APrioriCOTotalCo	APrioriCOTotalColumnDay	VARIABLE:
m rigirogradaros.	float32	dtype:
(36	(360, 180)	shape:
(3)	[60, 30]	chunksize:
	-9999.0	_FillValue:
A Priori CO Total Col	A Priori CO Total Column Day	long_name:
m	mol/cm ²	units:
APrioriCOTotalColu	APrioriCOTotalColumnNight	VARIABLE:
ATTIOTIOUTOUTOUT	float32	
(36)	(360, 180)	dtype:
(30		shape: chunksize:
L	[60, 30]	
A Draigna CO Total Calama	-9999.0	_FillValue:
A Priori CO Total Colum	A Priori CO Total Column Night	long_name:
MO	mol/cm^2	units:
APrioriSurfaceEmissi	APrioriSurfaceEmissivityDay	VARIABLE:

float32

dtype:

	-9999.0	_rillvalue.
A Priori Surface Emissiv	A Priori Surface Emissivity Day	long_name:
	NA	units:
APrioriSurfaceEmissivi	APrioriSurfaceEmissivityNight	VARIABLE:
	float32	dtype:
(36)	(360, 180)	shape:
L	[60, 30]	chunksize:
	-9999.0	_FillValue:
A Priori Surface Emissivit	· ·	long_name:
	NA	units:
APrioriSurfaceTempera	APrioriSurfaceTemperatureDay	VARIABLE:
=	float32	dtype:
(36)	(360, 180)	shape:
[•	[60, 30]	chunksize:
-	-9999.0	_FillValue:
A Priori Surface Temperat	A Priori Surface Temperature Day	long_name:
	K	units:
APrioriSurfaceTemperatu:	${\tt APrioriSurfaceTemperatureNight}$	VARIABLE:
:	float32	dtype:
(36)	(360, 180)	shape:
[0	[60, 30]	chunksize:
	-9999.0	_FillValue:
A Priori Surface Temperature	A Priori Surface Temperature Night	<pre>long_name:</pre>
	K	units:
DEMAlti	${ t DEMAltitudeDay}$	VARIABLE:
=	float32	dtype:
(36)	(360, 180)	shape:
[0	[60, 30]	chunksize:
	-9999.0	_FillValue:
DEM Altit	DEM Altitude Day	<pre>long_name:</pre>
	m	units:
DEMAltitue	${\tt DEMAltitudeNight}$	VARIABLE:
:	float32	dtype:
(36)	(360, 180)	shape:
[0	[60, 30]	chunksize:
	-9999.0	_FillValue:
DEM Altitud	DEM Altitude Night	long_name:
	m	units:
DEMAltitudeVariabi	${\tt DEMAltitudeVariabilityDay}$	VARIABLE:
:	float32	dtype:
(26)	(260 100)	ghana.

(360, 180)

(360, 180)

[60, 30]

-9999.0

shape:

chunksize:
_FillValue:

(36

(36

[

shape:

[6	[60, 30]	chunksize:
	-9999.0	_FillValue:
DEM Altitude Variabil:	DEM Altitude Variability Day	long_name:
	m	units:
DEMAltitudeVariabili	DEMAltitudeVariabilityNight	VARIABLE:
;	float32	dtype:
(36)	(360, 180)	shape:
Le	[60, 30]	chunksize:
	-9999.0	_FillValue:
DEM Altitude Variabilit	DEM Altitude Variability Night	long_name:
	m	units:
${\tt DegreesofFreedomforSig}$	${\tt DegreesofFreedomforSignalDay}$	VARIABLE:
, 1	float32	dtype:
(360	(360, 180)	shape:
[•	[60, 30]	chunksize:
•	-9999.0	_FillValue:
Degrees of Freedom for Sign	Degrees of Freedom for Signal Day	<pre>long_name:</pre>
	NA	units:
${\tt DegreesofFreedomforSign}$	${\tt DegreesofFreedomforSignalNight}$	VARIABLE:
;	float32	dtype:
(360	(360, 180)	shape:
[6	[60, 30]	chunksize:
•	-9999.0	_FillValue:
Degrees of Freedom for Sign	Degrees of Freedom for Signal Night	<pre>long_name:</pre>
	NA	units:
DryAirCo:	${\tt DryAirColumnDay}$	VARIABLE:
:	float32	dtype:
(360	(360, 180)	shape:
[6	[60, 30]	chunksize:
+	-9999.0	_FillValue:
Dry Air Col	Dry Air Column Day	<pre>long_name:</pre>
mo	mol/cm^2	units:
DryAirColu	${\tt DryAirColumnNight}$	VARIABLE:
:	float32	dtype:
(360	(360, 180)	shape:
[6	[60, 30]	chunksize:
-	-9999.0	_FillValue:
Dry Air Colum	Dry Air Column Night	<pre>long_name:</pre>
me	mol/cm^2	units:
L	Latitude	VARIABLE:
;	float32	dtype:
	(180,)	shape:
		-hli

contiguous

con

chunksize:

degre	degrees_north	units:
I	Longitude	VARIABLE:
	float32	dtype:
	(360,)	shape:
co	contiguous	chunksize:
degr	degrees_east	units:
y MeasurementErrorCovariano	MeasurementErrorCovarianceMatrixDay	VARIABLE:
	float32	dtype:
(360, 180,	(360, 180, 10, 10)	shape:
[60, 30,	[60, 30, 10, 10]	chunksize:
	-9999.0	_FillValue:
x Day Measurement Error Cov	Measurement Error Covariance Matrix	<pre>long_name:</pre>
	NA	units:
ght MeasurementErrorCovaria	MeasurementErrorCovarianceMatrixNigh	VARIABLE:
	float32	dtype:
(360, 180,	(360, 180, 10, 10)	shape:
[60, 30,	[60, 30, 10, 10]	chunksize:
	-9999.0	_FillValue:
x Night Measurement Error (Measurement Error Covariance Matrix	<pre>long_name:</pre>
	NA	units:
NumberofF	${\tt NumberofPixelsDay}$	VARIABLE:
	int32	dtype:
(3	(360, 180)	shape:
	[60, 30]	chunksize:
	-9999	_FillValue:
Number of F	Number of Pixel Day	<pre>long_name:</pre>
	NA	units:
NumberofPix	${\tt NumberofPixelsNight}$	VARIABLE:
	int32	dtype:
(3	(360, 180)	shape:
	[60, 30]	chunksize:
	-9999	_FillValue:
Number of Pix	Number of Pixel Night	<pre>long_name:</pre>
	NA	units:
	Pressure	VARIABLE:
	float32	dtype:
	(9,)	shape:
co	contiguous	chunksize:
	hPa	units:
F	Pressure2	VARIABLE:
	float32	dtype:
	(10,)	shape:
		-hl

contiguous

con

chunksize:

units:	hPa
VARIABLE:	
dtype:	float32
shape:	(360, 180, 10, 10) (360, 180,
chunksize:	[60, 30, 10, 10] [60, 30,
_FillValue:	-9999.0
	Retrieval Averaging Kernel Matrix Day Retrieval Averaging Kerne
units:	NA
	RetrievalAveragingKernelMatrixNight RetrievalAveragingKernelMatrix
dtype:	float32
shape:	(360, 180, 10, 10) (360, 180,
chunksize:	[60, 30, 10, 10] [60, 30,
_FillValue:	-9999.0
long_name: units:	Retrieval Averaging Kernel Matrix Night Retrieval Averaging Kernel NA
	RetrievalErrorCovarianceMatrixDay RetrievalErrorCovarianceMatfloat32
dtype:	(360, 180, 10, 10) (360, 180,
shape: chunksize:	[60, 30, 10, 10]
_FillValue:	-9999.0
-	
units:	Retrieval Error Covariance Matrix Day Retrieval Error Covariance
	RetrievalErrorCovarianceMatrixNight RetrievalErrorCovarianceMatrix
dtype:	float32
shape:	(360, 180, 10, 10) (360, 180, 1
chunksize:	[60, 30, 10, 10]
_FillValue:	-9999.0
_	Retrieval Error Covariance Matrix Night Retrieval Error Covaria
units:	NA
VARIABLE:	
dtype:	float32
shape:	(360, 180, 9) (360, 1
chunksize:	[60, 30, 9]
_FillValue:	-9999.0
-	Retrieved CO Mixing Ratio Profile Day Retrieved CO Mixing Ratio
units:	ppbv
	RetrievedCOMixingRatioProfileMeanUncertaintyDay RetrievedCOMix:
dtype:	float32
shape:	(360, 180, 9) (360,
chunksize:	[60, 30, 9]
_FillValue:	-9999.0
-	Retrieved CO Mixing Ratio Profile Mean Uncertainty Day Retrieve
U= 	mah.

ppbv

units:

```
----VARIABLE----: RetrievedCOMixingRatioProfileMeanUncertaintyNig RetrievedCOMix
             dtype:
                                                float32
             shape:
                                          (360, 180, 9)
                                                                              (360,
                                            [60, 30, 9]
                                                                                [60,
         chunksize:
                                                -9999.0
        FillValue:
         long_name: Retrieved CO Mixing Ratio Profile Mean Uncertainty Night Retri-
                                                   ppbv
----VARIABLE----: RetrievedCOMixingRatioProfileNight RetrievedCOMixingRatioProfi
             dtype:
                                                float32
                                                                              (360,
             shape:
                                          (360, 180, 9)
                                            [60, 30, 9]
         chunksize:
                                                                                [60,
                                                -9999.0
        _FillValue:
         long_name: Retrieved CO Mixing Ratio Profile Night Retrieved CO Mixing Ratio
                                                   ppbv
----VARIABLE----: RetrievedCOMixingRatioProfileVariabilityDay RetrievedCOMixingR
             dtype:
                                                float32
             shape:
                                          (360, 180, 9)
                                                                              (360,
                                            [60, 30, 9]
                                                                                [60,
         chunksize:
        _FillValue:
                                                -9999.0
         long_name: Retrieved CO Mixing Ratio Profile Variability Day Retrieved CO
                                                   ppbv
-----VARIABLE----: RetrievedCOMixingRatioProfileVariabilityNight RetrievedCOMixing
             dtype:
                                                float32
                                                                              (360,
                                          (360, 180, 9)
             shape:
         chunksize:
                                            [60, 30, 9]
                                                                                [60,
                                                -9999.0
        _FillValue:
         long_name: Retrieved CO Mixing Ratio Profile Variability Night Retrieved
             units:
                                                   ppbv
----VARIABLE----:
                      RetrievedCOSurfaceMixingRatioDay
                                                          RetrievedCOSurfaceMixingR
                                                float32
             dtype:
                                                                                 (36
                                             (360, 180)
             shape:
         chunksize:
                                               [60, 30]
        FillValue:
                                                -9999.0
         long_name: Retrieved CO Surface Mixing Ratio Day Retrieved CO Surface Mix
                                                   ppbv
----VARIABLE----: RetrievedCOSurfaceMixingRatioMeanUncertaintyDay RetrievedCOSur
             dtype:
                                                float32
                                             (360, 180)
                                                                                 (36
             shape:
                                               [60, 30]
         chunksize:
                                                                                   -9999.0
        FillValue:
         long_name: Retrieved CO Surface Mixing Ratio Mean Uncertainty Day Retrieve
```

----VARIABLE----: RetrievedCOSurfaceMixingRatioMeanUncertaintyNig RetrievedCOSur

ppbv

units:

```
dtype:
                                                                                                                  float32
                                                                                                           (360, 180)
                                                                                                                                                                                                (36
                              shape:
                     chunksize:
                                                                                                                [60, 30]
                                                                                                                                                                                                     E
                   FillValue:
                                                                                                                 -9999.0
                     long name: Retrieved CO Surface Mixing Ratio Mean Uncertainty Night Retrie
                                                                                                                         ppbv
----VARIABLE----: RetrievedCOSurfaceMixingRatioNight RetrievedCOSurfaceMixingRat
                              dtype:
                                                                                                                  float32
                                                                                                           (360, 180)
                                                                                                                                                                                                (36
                              shape:
                     chunksize:
                                                                                                                [60, 30]
                                                                                                                                                                                                     -9999.0
                   _FillValue:
                     long name: Retrieved CO Surface Mixing Ratio Night Retrieved CO Surface M
                                                                                                                         ppbv
-----VARIABLE----: RetrievedCOSurfaceMixingRatioVariabilityDay RetrievedCOSurface
                              dtype:
                                                                                                                  float32
                                                                                                           (360, 180)
                                                                                                                                                                                                (36
                              shape:
                     chunksize:
                                                                                                                [60, 30]
                                                                                                                                                                                                     _FillValue:
                                                                                                                 -9999.0
                     long_name: Retrieved CO Surface Mixing Ratio Variability Day Retrieved CO
                              units:
                                                                                                                         ppbv
----VARIABLE----: RetrievedCOSurfaceMixingRatioVariabilityNight RetrievedCOSurfa
                              dtype:
                                                                                                                  float32
                              shape:
                                                                                                           (360, 180)
                                                                                                                                                                                                (36
                     chunksize:
                                                                                                                [60, 30]
                                                                                                                                                                                                     _FillValue:
                                                                                                                  -9999.0
                     long name: Retrieved CO Surface Mixing Ratio Variability Night Retrieved
                              units:
                                                                                                                         ppbv
----VARIABLE----:
                                                                      RetrievedCOTotalColumnDay
                                                                                                                                                           RetrievedCOTotalCo
                              dtype:
                                                                                                                  float32
                              shape:
                                                                                                           (360, 180)
                                                                                                                                                                                                (36
                                                                                                                [60, 30]
                                                                                                                                                                                                     [
                     chunksize:
                   _FillValue:
                                                                                                                  -9999.0
                                                                                                                                                 Retrieved CO Total Col
                     long_name:
                                                            Retrieved CO Total Column Day
                                                                                                               mol/cm^2
                              units:
----VARIABLE----: RetrievedCOTotalColumnDiagnosticsDay RetrievedCOTotalColumnDiagnost
                              dtype:
                                                                                                                  float32
                              shape:
                                                                                                   (360, 180, 2)
                                                                                                                                                                                         (360,
                     chunksize:
                                                                                                        [60, 30, 2]
                                                                                                                                                                                              [60,
                                                                                                                  -9999.0
                   _FillValue:
                     long_name: Retrieved CO Total Column Diagnostics Day Retrieved CO Total C
                                                                                                               mol/cm^2
                              units:
----VARIABLE----: RetrievedCOTotalColumnDiagnosticsNight RetrievedCOTotalColumnD
```

float32

dtype:

```
(360, 180, 2)
                                                                                 (360,
             shape:
                                              [60, 30, 2]
         chunksize:
                                                                                   [60,
                                                  -9999.0
        _FillValue:
         long_name: Retrieved CO Total Column Diagnostics Night Retrieved CO Total
                                                 mol/cm<sup>2</sup>
             units:
----VARIABLE----: RetrievedCOTotalColumnMeanUncertaintyDay RetrievedCOTotalColum
             dtype:
                                                  float32
             shape:
                                               (360, 180)
                                                                                    (36
                                                 [60, 30]
                                                                                      chunksize:
                                                  -9999.0
        FillValue:
         long name: Retrieved CO Total Column Mean Uncertainty Day Retrieved CO To
                                                 mol/cm<sup>2</sup>
             units:
-----VARIABLE----: RetrievedCOTotalColumnMeanUncertaintyNight RetrievedCOTotalCol
             dtype:
                                                  float32
             shape:
                                               (360, 180)
         chunksize:
                                                 [60, 30]
                                                                                      -9999.0
        _FillValue:
         long name: Retrieved CO Total Column Mean Uncertainty Night Retrieved CO '
             units:
                                                 mol/cm<sup>2</sup>
----VARIABLE----:
                            RetrievedCOTotalColumnNight
                                                                  RetrievedCOTotalColu
             dtype:
                                                  float32
                                               (360, 180)
                                                                                    (36
             shape:
         chunksize:
                                                 [60, 30]
                                                                                      Γ
        _FillValue:
                                                  -9999.0
                        Retrieved CO Total Column Night
         long_name:
                                                             Retrieved CO Total Column
             units:
                                                 mol/cm<sup>2</sup>
----VARIABLE----: RetrievedCOTotalColumnVariabilityDay RetrievedCOTotalColumnVar
             dtype:
                                                  float32
                                               (360, 180)
                                                                                    (36
             shape:
         chunksize:
                                                 [60, 30]
                                                                                      E
                                                  -9999.0
        FillValue:
         long_name: Retrieved CO Total Column Variability Day Retrieved CO Total C
             units:
                                                 mol/cm<sup>2</sup>
-----VARIABLE----: RetrievedCOTotalColumnVariabilityNight RetrievedCOTotalColumnV
                                                  float32
             dtype:
             shape:
                                               (360, 180)
                                                                                    (36)
         chunksize:
                                                 [60, 30]
                                                                                      FillValue:
                                                  -9999.0
         long_name: Retrieved CO Total Column Variability Night Retrieved CO Total
```

mol/cm²

float32

(360, 180)

RetrievedSurfaceEmissi

(36

 ${\tt RetrievedSurfaceEmissivityDay}$

units:

dtype:
shape:

----VARIABLE----:

```
[60, 30]
                      chunksize:
                                                                                                                     -9999.0
                    _FillValue:
                      long_name:
                                                      Retrieved Surface Emissivity Day
                                                                                                                                              Retrieved Surface Emissiv
                                units:
-----VARIABLE----: RetrievedSurfaceEmissivityMeanUncertaintyDay RetrievedSurfaceE
                                dtype:
                                                                                                                     float32
                                shape:
                                                                                                              (360, 180)
                                                                                                                                                                                                      (36
                      chunksize:
                                                                                                                   [60, 30]
                                                                                                                                                                                                           -9999.0
                    FillValue:
                      long_name: Retrieved Surface Emissivity Mean Uncertainty Day Retrieved Surface Emission Day Retrieved Surface Emi
                                                                                                                                 NA
                                units:
-----VARIABLE----: RetrievedSurfaceEmissivityMeanUncertaintyNight RetrievedSurface
                                                                                                                     float32
                                dtype:
                                                                                                              (360, 180)
                                                                                                                                                                                                      (36
                                shape:
                      chunksize:
                                                                                                                   [60, 30]
                    FillValue:
                                                                                                                     -9999.0
                      long_name: Retrieved Surface Emissivity Mean Uncertainty Night Retrieved
                                                                                                                                 NA
----VARIABLE----:
                                                         {\tt RetrievedSurfaceEmissivityNight}
                                                                                                                                                RetrievedSurfaceEmissivi
                                                                                                                     float32
                                dtype:
                                shape:
                                                                                                              (360, 180)
                                                                                                                                                                                                      (36
                      chunksize:
                                                                                                                   [60, 30]
                                                                                                                                                                                                           FillValue:
                                                                                                                     -9999.0
                      long_name: Retrieved Surface Emissivity Night Retrieved Surface Emissivit
                                                                                                                                 NA
                                units:
-----VARIABLE----: RetrievedSurfaceEmissivityVariabilityDay RetrievedSurfaceEmiss
                                dtype:
                                                                                                                     float32
                                shape:
                                                                                                              (360, 180)
                                                                                                                                                                                                      (36
                                                                                                                   [60, 30]
                      chunksize:
                    FillValue:
                                                                                                                     -9999.0
                      long_name: Retrieved Surface Emissivity Variability Day Retrieved Surface
-----VARIABLE----: RetrievedSurfaceEmissivityVariabilityNight RetrievedSurfaceEmi
                                dtype:
                                                                                                                     float32
                                                                                                                                                                                                      (36
                                shape:
                                                                                                              (360, 180)
                      chunksize:
                                                                                                                   [60, 30]
                                                                                                                                                                                                           -9999.0
                    FillValue:
                      long_name: Retrieved Surface Emissivity Variability Night Retrieved Surfa
                                units:
                                                                                                                                 NA
----VARIABLE----:
                                                           RetrievedSurfaceTemperatureDay
                                                                                                                                                   RetrievedSurfaceTempera
```

float32

[60, 30]

(36

(360, 180)

dtype:

shape:

chunksize:

	-9999.0	_FillValue:
-	Retrieved Surface Temperature Day	
	K	units:
· ·	RetrievedSurfaceTemperatureMeanUnce	
	float32	dtype:
(36)	(360, 180)	shape:
L	[60, 30]	chunksize:
	-9999.0	_FillValue:
· · · · · · · · · · · · · · · · · · ·	Retrieved Surface Temperature Mean	
	K	units:
• •	RetrievedSurfaceTemperatureMeanUnce	
	float32	dtype:
(36)	(360, 180)	shape:
[·	[60, 30]	chunksize:
	-9999.0	_FillValue:
Uncertainty Night Retrieved	Retrieved Surface Temperature Mean	
	K	units:
	1	VARIABLE:
:	float32	dtype:
(36)	(360, 180)	shape:
[1	[60, 30]	chunksize:
	-9999.0	_FillValue:
t Retrieved Surface Temperat	Retrieved Surface Temperature Night	<pre>long_name:</pre>
	K	units:
${ t lityDay \ t RetrievedSurfaceTemper}$	${\tt RetrievedSurfaceTemperatureVariabil}$	VARIABLE:
:	float32	dtype:
(36	(360, 180)	shape:
[-	[60, 30]	chunksize:
	-9999.0	_FillValue:
ability Day Retrieved Surfac	Retrieved Surface Temperature Varia	long_name:
	K	units:
lityNight RetrievedSurfaceTe	RetrievedSurfaceTemperatureVariabil	VARIABLE:
:	float32	dtype:
(36)	(360, 180)	shape:
[1	[60, 30]	chunksize:
	-9999.0	_FillValue:
ability Night Retrieved Surf	Retrieved Surface Temperature Varia	long_name:
_	K	units:
SatelliteZenithA	SatelliteZenithAngleDay	VARIABLE:
	float32	dtype:
(36)	(360, 180)	shape:
[1	[60, 30]	chunksize:
_	2000 0	D:2217

-9999.0

_FillValue:

Datelile Zenien Ang	batterine Zenron Angre Day	Tong_name:
	deg	units:
SatelliteZenithAng	${\tt SatelliteZenithAngleNight}$	VARIABLE:
=	float32	dtype:
(360	(360, 180)	shape:
[6	[60, 30]	chunksize:
-	-9999.0	_FillValue:
Satellite Zenith Angle	Satellite Zenith Angle Night	<pre>long_name:</pre>
	deg	units:
Signal	SignalChi2Day	VARIABLE:
=	float32	dtype:
(36)	(360, 180)	shape:
[6	[60, 30]	chunksize:
	-9999.0	_FillValue:
Signal Cl	Signal Chi2 Day	long_name:
	NA	units:
SignalCh:	SignalChi2Night	VARIABLE:
=	float32	dtype:
(36)	(360, 180)	shape:
[6	[60, 30]	chunksize:
-	-9999.0	_FillValue:
Signal Chi	Signal Chi2 Night	<pre>long_name:</pre>
	NA	units:
SignalChi2Variabi	SignalChi2VariabilityDay	VARIABLE:
=	float32	dtype:
(360	(360, 180)	shape:
[6	[60, 30]	chunksize:
-	-9999.0	_FillValue:
Signal Chi2 Variabil:	Signal Chi2 Variability Day	long_name:
-	NA	units:
SignalChi2Variabili	SignalChi2VariabilityNight	:
<u>-</u>	float32	dtype:
(36)	(360, 180)	shape:
[6	[60, 30]	chunksize:
-	-9999.0	_FillValue:
Signal Chi2 Variability	Signal Chi2 Variability Night	long_name:
-	NA	units:
SmoothingErrorCovarianceMa	SmoothingErrorCovarianceMatrixDay	VARIABLE:
-	float32	dtype:
(360, 180,	(360, 180, 10, 10)	shape:
[60, 30,	[60, 30, 10, 10]	chunksize:
• •	• • • •	

-9999.0

long_name: Smoothing Error Covariance Matrix Day Smoothing Error Covariance

Satellite Zenith Angle Day

Satellite Zenith An

_FillValue:

long_name:

units:	NA	
VARIABLE:	${\tt SmoothingErrorCovarianceMatrixNight}$	${f Smoothing Error Covariance Mat}$
dtype:	float32	
shape:	(360, 180, 10, 10)	(360, 180,
chunksize:	[60, 30, 10, 10]	[60, 30,
_FillValue:	-9999.0	•
<pre>long_name:</pre>	Smoothing Error Covariance Matrix N	ight Smoothing Error Covaria
units:	NA	
VARIABLE:	${\tt SolarZenithAngleDay}$	SolarZenithAı
dtype:	float32	
shape:	(360, 180)	(360
chunksize:	[60, 30]	[6
_FillValue:	-9999.0	
<pre>long_name:</pre>	Solar Zenith Angle Day	Solar Zenith Ang
units:	deg	
VARIABLE:	${\tt SolarZenithAngleNight}$	${f Solar Zenith Angl}$
dtype:	float32	:
shape:	(360, 180)	(360
chunksize:	[60, 30]	[6
_FillValue:	-9999.0	•
long_name:	Solar Zenith Angle Night	Solar Zenith Angle
units:	deg	
VARIABLE:	${ t Surface Index Day}$	SurfaceIı
dtype:	int32	
shape:	(360, 180)	(360
chunksize:	[60, 30]	[6
_FillValue:	-9999	
long_name:	Surface Index Day	Surface Inc
units:	NA	
VARIABLE:	${\tt SurfaceIndexNight}$	SurfaceInde
dtype:	int32	
shape:	(360, 180)	(360
chunksize:	[60, 30]	[6
_FillValue:	-9999	
long_name:	Surface Index Night	Surface Inde
units:	NA	
VARIABLE:	${ t Surface Pressure Day}$	SurfacePress
dtype:	float32	;
shape:	(360, 180)	(360
chunksize:	[60, 30]	[6
_FillValue:	-9999.0	
<pre>long_name:</pre>	Surface Pressure Day	Surface Pressi

hPa

units:

VARIABLE:	${f Surface Pressure Night}$	SurfacePressu
dtype:	float32	
shape:	(360, 180)	(360
chunksize:	[60, 30]	[6
_FillValue:	-9999.0	Ţ.
long_name:	Surface Pressure Night	Surface Pressure
units:	hPa	
VARIABLE:	${\tt TotalColumnAveragingKernelDay}$	${ t TotalColumnAveragingKet}$
dtype:	float32	
shape:	(360, 180, 10)	(360, 18
chunksize:	[60, 30, 10]	[60, ;
_FillValue:	-9999.0	•
long_name:	Total Column Averaging Kernel Day	Total Column Averaging Ker
units:	<pre>mol/(cm^2 log(VMR))</pre>	mol/(cm^2 log
VARIABLE:	${\tt TotalColumnAveragingKernelNight}$	${ t TotalColumnAveraging Kerne}$
dtype:	float32	-
shape:	(360, 180, 10)	(360, 18
chunksize:	[60, 30, 10]	[60, 3
_FillValue:	-9999.0	1
long_name:	Total Column Averaging Kernel Night	Total Column Averaging Kern
units:	<pre>mol/(cm^2 log(VMR))</pre>	mol/(cm^2 log
VARIABLE:	${\tt WaterVaporColumnDay}$	WaterVaporCo:
dtype:	float32	;
shape:	(360, 180)	(360
chunksize:	[60, 30]	[6
_FillValue:	-9999.0	†
long_name:	Water Vapor Column Day	Water Vapor Col
units:	mol/cm^2	me
VARIABLE:	${\tt WaterVaporColumnNight}$	WaterVaporColu
dtype:	float32	<u> </u>
shape:	(360, 180)	(36)
chunksize:	[60, 30]	[•
_FillValue:	-9999.0	.
long_name:	Water Vapor Column Night	Water Vapor Colum
units:	mol/cm^2	m(
Total number of shared items	88	

0

Done.

Total number of non-shared items:

3 ## Example 2: Two netCDF files with different groups, variables, and attributes

The two files are first defined. The example here uses two **preliminary**, draft files that were produced as part of preparations for the Tropospheric Emissions: Monitoring of POllution (TEMPO) instrument that will provide air quality measurements over North America. In essense, this example mimics a comparison of real to simulated data.

```
filepath_1 = "notebook_example_data/TEMPO_NO2_L2_V01_20130701T131754Z_S001G04.nc"
filepath 2 = "notebook example data/TEMPO NO2-PROXY L2 V01 20130731T141759Z S006G04.nc"
! ncompare --column-widths 28 34 34 {filepath_1} {filepath_2}
File A: notebook_example_data/TEMPO_NO2_L2_V01_20130701T131754Z_S001G04.nc
File B: notebook_example_data/TEMPO_NO2-PROXY_L2_VO1_20130731T141759Z_S006G04.nc
Root-level Dimensions:
   Are all items the same? ---> True.
   [('mirror_step', 123), ('xtrack', 2048)]
Root-level Groups:
   Are all items the same? ---> False. (4 items are shared, out of 5 total.)
   Which items are different?
                                             File A
                    #00 -----geolocation -----geolocation
                    #01 -----product ------
                    #02 -----qa_statistics -----qa_sta
                    #03 -----support_data -----support_data -----suppor
                    #04 -----true_qua
 Number of non-shared items:
No variable group selected for comparison. Skipping..
All variables:
                                             File A
            All Variables
               GROUP #00 -----/ -----/
    num variables in group:
                      - -----
```

	milioi_boop	VIII (III DEE .
	int32	dtype:
	(123,)	shape:
	xtrack	VARIABLE:
	int32	dtype:
	(2048,)	shape:
		•
/geolo	/geolocation	GROUP #01
	10	num variables in group:
1:	latitude	VARIABLE:
=	float32	dtype:
(123	(123, 2048)	shape:
latitude	latitude_bounds	VARIABLE:
=	float32	dtype:
(123, 20	(123, 2048, 4)	shape:
lo	longitude	VARIABLE:
=	float32	dtype:
(123	(123, 2048)	shape:
longitude	longitude_bounds	VARIABLE:
=	float32	dtype:
(123, 20	(123, 2048, 4)	shape:
relative_azimutl	relative_azimuth_angle	VARIABLE:
<u>:</u>	float32	dtype:
(123	(123, 2048)	shape:
solar_azimutl	solar_azimuth_angle	VARIABLE:
=	float32	dtype:
(123	(123, 2048)	shape:
solar_zenitl	solar_zenith_angle	VARIABLE:
=	float32	dtype:
(123	(123, 2048)	shape:
	time	VARIABLE:
=	float64	dtype:
	(123,)	shape:
viewing_azimutl	viewing_azimuth_angle	VARIABLE:
-	float32	dtype:
(123	(123, 2048)	shape:
viewing_zenitl	viewing_zenith_angle	VARIABLE:
<u> </u>	float32	dtype:
(123	(123, 2048)	shape:
		-
/1	/product	GROUP #02
	· •	

5

mirror_step

mirr

----VARIABLE----:

num variables in group:

		_
main_data_quali	main_data_quality_flag	VARIABLE:
	int16	dtype:
(123	(123, 2048)	shape:
vertical_column_strate	vertical_column_stratosphere	VARIABLE:
:	float64	dtype:
(123	(123, 2048)	shape:
vertical_colum	vertical_column_total	VARIABLE:
:	float64	dtype:
(123	(123, 2048)	shape:
vertical_column_total_unce	vertical_column_total_uncertainty	VARIABLE:
:	float64	dtype:
(123	(123, 2048)	shape:
vertical_column_trop	vertical_column_troposphere	VARIABLE:
:	float64	dtype:
(123	(123, 2048)	shape:
/qa_sta	/qa_statistics	GROUP #03
	2	num variables in group:
fit_convergen	fit_convergence_flag	VARIABLE:
	int16	dtype:
(123	(123, 2048)	shape:
fit_rms_r	fit_rms_residual	VARIABLE:
;	float32	dtype:
(123	(123, 2048)	shape:
/suppo:	/support_data	GROUP #04
	17	num variables in group:
	albedo	VARIABLE:
:	float32	dtype:
(123	(123, 2048)	shape:
amf_cloud_f	amf_cloud_fraction	VARIABLE:
	float32	dtype:
(123	(123, 2048)	shape:
amf_cloud_p	amf_cloud_pressure	VARIABLE:
	float32	dtype:
(123	(123, 2048)	shape:
amf_diagnost	amf_diagnostic_flag	VARIABLE:
_ 3	int16	dtype:
(123	(123, 2048)	shape:
amf_strate	amf_stratosphere	VARIABLE:
-	_ 1	

dtype:	float32	:
shape:	(123, 2048)	(123
VARIABLE:	amf_total	am
dtype:	float32	:
shape:	(123, 2048)	(123
VARIABLE:		${\tt amf_total_unce}$
dtype:		i
shape:		(123
VARIABLE:	amf_troposphere	amf_trope
dtype:	float32	:
shape:	(123, 2048)	(123
VARIABLE:	${\tt eff_cloud_fraction}$	
dtype:	float32	
shape:	(123, 2048)	
VARIABLE:	fitted_slant_column	fitted_slant]
dtype:	float64	:
shape:	(123, 2048)	(123
VARIABLE:	fitted_slant_column_uncertainty	fitted_slant_column_unce:
dtype:	float64	:
shape:	(123, 2048)	(123
VARIABLE:	gas_profile	gas_j
dtype:	float32	
shape:	(123, 2048, 72)	(123, 204
VARIABLE:	<pre>ground_pixel_quality_flag</pre>	ground_pixel_quali
dtype:	int32	9
shape:	(123, 2048)	(123
VARIABLE:	scattering_weights	scattering_v
dtype:	float32	3
shape:	(123, 2048, 72)	(123, 204
VARIABLE:	<pre>snow_ice_fraction</pre>	snow_ice_f:
dtype:	float32	
shape:	(123, 2048)	(123
VARIABLE:	surface_pressure	surface_p
dtype:	float32	
shape:	(123, 2048)	(123
VARIABLE:	terrain_height	terrain
dtype:	int16	
shape:	(123, 2048)	(123
VARIABLE:	tropopause_pressure	tropopause_p
dtype:	float32	
shape:	(123, 2048)	(123
P • •	\===, 2020 /	(==0

GROUP #05 -----/true_qua

```
num variables in group:
                                                      0
        ----VARIABLE----:
                   dtype:
                   shape:
                                                                           (123)
        ----VARIABLE----:
                                                                             am
                   dtype:
                   shape:
                                                                           (123)
        ----VARIABLE---:
                                                                           gas_
                   dtype:
                                                                        (123, 20)
                   shape:
        ----VARIABLE---:
                                                                     scattering_
                   dtype:
                   shape:
                                                                        (123, 20)
        ----VARIABLE---:
                                                                   vertical_column
                   dtype:
                                                                           (123)
                   shape:
Total number of shared items:
                                                      35
Total number of non-shared items:
                                                          1
Done.
! ncompare --show-attributes --show-chunks --column-widths 28 34 34 {filepath_1} {filepath_2
File A: notebook_example_data/TEMPO_NO2_L2_V01_20130701T131754Z_S001G04.nc
File B: notebook_example_data/TEMPO_NO2-PROXY_L2_V01_20130731T141759Z_S006G04.nc
Root-level Dimensions:
   Are all items the same? ---> True.
   [('mirror_step', 123), ('xtrack', 2048)]
Root-level Groups:
   Are all items the same? ---> False. (4 items are shared, out of 5 total.)
   Which items are different?
                                                 File A
                      #00 -----geolocation -----geolocation
                      #01 ------
                      #02 -----qa_statistics -----qa_statistics
                      #03 -----support_data -----support_data
                      #04 -----true_qua
 Number of non-shared items:
                                                      0
```

No variable group selected for comparison. Skipping..

All variables:

	File A	
All Variables		
-		
GROUP #00	/	
num variables in group:	2	
VARIABLE:	mirror aton	
	mirror_step int32	mirro
dtype:	(123,)	
shape: chunksize:	·	
	contiguous scan mirror position index	gcan mirror pogition
long_name:VARIABLE:	xtrack	scan mirror position
	int32	
dtype:	(2048,)	
shape: chunksize:	-	
	contiguous	nivel index elec
long_name:	pixel index along slit	pixel index alor
GROUP #01	/geolocation	/geol
num variables in group:	10	
VARIABLE:	latitude	 1;
dtype:	float32	±°.
shape:	(123, 2048)	(123
chunksize:	contiguous	[123
_FillValue:	-1e+30	[125
bounds:	latitude_bounds	latitude
comment:	latitude at pixel center	latitude at pixel
long_name:	pixel center latitude	pixel center 1:
standard_name:	latitude	pixel centel i
units:	degrees_north	degree
valid_max:	90.0	degree.
valid_max. valid_min:	-90.0	
VARIABLE:	latitude_bounds	latitude
dtype:	float32	iatitude.
shape:	(123, 2048, 4)	(123, 20
chunksize:	contiguous	[123, 20
_FillValue:	-1e+30	[120, 20
-	latitude at pixel corners (SW,SE,NE,NW)) latitude at pixel corn
		*

pixel corner degre	pixel corner latitude	<pre>long_name: units:</pre>
dogio	90.0	valid_max:
	-90.0	valid_max. valid_min:
1		varid_min. VARIABLE:
1	longitude float32	
(12	(123, 2048)	dtype:
[12	contiguous	shape: chunksize:
LIZ	-1e+30	_FillValue:
longitud		_rilivalue. bounds:
longitud	longitude_bounds	
longitude at pixe	longitude at pixel center	comment:
pixel center l	pixel center longitude	long_name:
1	longitude	standard_name:
degr	degrees_east	units:
	180.0	valid_max:
	-180.0	valid_min:
longitud	longitude_bounds	VARIABLE:
*	float32	dtype:
(123,	(123, 2048, 4)	shape:
[123,	contiguous	chunksize:
	-1e+30	_FillValue:
_	longitude at pixel corners (SW,SE,NE,NW	
pixel corner l	pixel corner longitude	long_name:
degr		units:
	180.0	<pre>valid_max:</pre>
	-180.0	valid_min:
relative_azimu	relative_azimuth_angle	VARIABLE:
	float32	dtype:
(12	(123, 2048)	shape:
[12	contiguous	chunksize:
	-1e+30	_FillValue:
longitude	time longitude latitude	coordinates:
r relative azimuth angle	relative azimuth angle at pixel center	<pre>long_name:</pre>
	degrees	units:
	180.0	<pre>valid_max:</pre>
	-180.0	<pre>valid_min:</pre>
solar_azimu	solar_azimuth_angle	VARIABLE:
	float32	dtype:
(12	(123, 2048)	shape:
[12	contiguous	chunksize:
	-1e+30	_FillValue:

time longitude latitude

long_name: solar azimuth angle at pixel center solar azimuth angle at pix

longitude la

coordinates:

```
degrees
             units:
                                                   180.0
         valid_max:
         valid_min:
                                                  -180.0
----VARIABLE----:
                                     solar_zenith_angle
                                                                          solar_zenit
             dtype:
                                                 float32
                                             (123, 2048)
                                                                                  (123
             shape:
         chunksize:
                                              contiguous
                                                                                  [123
        _FillValue:
                                                  -1e+30
       coordinates:
                                                                          longitude la
                                time longitude latitude
         long_name: solar zenith angle at pixel center solar zenith angle at pixel
             units:
                                                 degrees
                                                    90.0
         valid_max:
                                                     0.0
         valid_min:
----VARIABLE----:
                                                    time
             dtype:
                                                 float64
                                                  (123,)
             shape:
         chunksize:
                                              contiguous
        _FillValue:
                                                  -1e+30
          calendar:
                                               gregorian
         long name:
                           radiance exposure start time
                                                                radiance exposure star
     standard name:
             units: seconds since 2000-01-01T12:00:00Z seconds since 2000-01-01T12
----VARIABLE----:
                                  viewing_azimuth_angle
                                                                       viewing_azimut
                                                 float32
             dtype:
             shape:
                                             (123, 2048)
                                                                                  (123
                                                                                  [123
         chunksize:
                                              contiguous
        _FillValue:
                                                  -1e+30
       coordinates:
                                time longitude latitude
                                                                          longitude la
         long_name: viewing azimuth angle at pixel center viewing azimuth angle at
             units:
                                                 degrees
         valid_max:
                                                   180.0
         valid_min:
                                                  -180.0
----VARIABLE----:
                                                                        viewing_zenit
                                   viewing_zenith_angle
             dtype:
                                                 float32
                                             (123, 2048)
             shape:
                                                                                  (123)
         chunksize:
                                              contiguous
                                                                                  [123
        _FillValue:
                                                  -1e+30
       coordinates:
                                time longitude latitude
                                                                          longitude la
         long_name: viewing zenith angle at pixel center viewing zenith angle at p
             units:
                                                 degrees
         valid_max:
                                                    90.0
```

0.0

valid_min:

/1	/product	GROUP #02
	5	num variables in group:
		_
main_data_quali	main_data_quality_flag	VARIABLE:
	int16	dtype:
(123	(123, 2048)	shape:
[123	contiguous	chunksize:
	-1	_FillValue:
longitude la	time longitude latitude	coordinates:
normal suspici	normal suspicious bad	flag_meanings:
[0, 1,	[0, 1, 2,]	flag_values:
main data quali	main data quality flag	long_name:
	2	valid_max:
	0	valid_min:
$ ext{vertical_column_strate}$	vertical_column_stratosphere	:
;	float64	dtype:
(123	(123, 2048)	shape:
[123	contiguous	chunksize:
	-1e+30	_FillValue:
longitude la	time longitude latitude	coordinates:
cal column stratosphere nit:	stratosphere nitrogen dioxide verti	long_name:
mole	molecules/cm^2	units:
vertical_colum	vertical_column_total	:
:	float64	dtype:
(123	(123, 2048)	shape:
[123	contiguous	chunksize:
	-1e+30	_FillValue:
termined from fitted slant	nitrogen dioxide vertical column de	comment:
longitude la	time longitude latitude	coordinates:
nitrogen dioxide vertical	•	long_name:
mole	molecules/cm^2	units:
vertical_column_total_unce		:
-		dtype:
(123	(123, 2048)	shape:
[123	contiguous	chunksize:
	-1e+30	_FillValue:
longitude la	time longitude latitude	coordinates:
_	nitrogen dioxide vertical column un	•
mole	molecules/cm^2	units:
vertical_column_trop	vertical_column_troposphere	VARIABLE:
į	float64	dtype:
(123	(123, 2048)	shape:
F400		_1,

contiguous

[123

chunksize:

	-1e+30	_FillValue:
longitude l	time longitude latitude	coordinates:
column troposphere nitro	troposphere nitrogen dioxide vertical col	long_name:
mol	molecules/cm^2	units:
/qa_sta	/qa_statistics	GROUP #03
• -	2	num variables in group:
fit_convergen	fit_convergence_flag	VARIABLE:
	int16	dtype:
(123	(123, 2048)	shape:
[123	contiguous	chunksize:
	-30000	_FillValue:
longitude l	time longitude latitude	coordinates:
iled maxiter_exceeded s	failed maxiter_exceeded suspect good fail	flag_meanings:
[-2, -1, 0,	[-2, -1, 0, 1,]	flag_values:
radiance fit convergen	radiance fit convergence flag r	long_name:
	12344	valid_max:
	-10	<pre>valid_min:</pre>
fit_rms_r	fit_rms_residual	VARIABLE:
	float32	dtype:
(123	(123, 2048)	shape:
[123	contiguous	chunksize:
	-1e+30	_FillValue:
longitude l	time longitude latitude	coordinates:
radiance fit RMS r	radiance fit RMS residual	long_name:
	0.01	valid_max:
	0.0	<pre>valid_min:</pre>
/suppo	/support_data	GROUP #04
	17	num variables in group:
	albedo	VARIABLE:
:	float32	dtype:
(123	(123, 2048)	shape:
[123	contiguous	chunksize:
longitude l	time longitude latitude	coordinates:
surface	surface albedo	long_name:
	1.0	valid_max:
	0.0	valid_min:
amf_cloud_f	amf_cloud_fraction	VARIABLE:
:	float32	dtype:
(123	(123, 2048)	shape:
		1

comment:	cloud radiance fraction for AMF com	nputation cloud radiance fra
coordinates:	time longitude latitude	longitude la
<pre>long_name:</pre>	cloud fraction	cloud fi
${\tt valid_max}$:	1.0	
valid_min:	0.0	
VARIABLE:	amf_cloud_pressure	amf_cloud_p:
dtype:	float32	:
shape:	(123, 2048)	(123
chunksize:	contiguous	[123
_FillValue:	-1e+30	
comment:	cloud pressure for ${\tt AMF}$ computation	cloud pressure for AMF calcu
coordinates:	time longitude latitude	longitude la
<pre>long_name:</pre>	cloud pressure	cloud p
units:	hPa	
${\tt valid_max}$:	1200.0	
<pre>valid_min:</pre>	0.0	
VARIABLE:	amf_diagnostic_flag	${\tt amf_diagnost:}$
dtype:	int16	
shape:	(123, 2048)	(123
chunksize:	contiguous	[123
_FillValue:	-1	
coordinates:	time longitude latitude	longitude la
<pre>flag_masks:</pre>	[1, 2, 4, 8, 16,]	[-2, 220, 500
<pre>flag_meanings:</pre>	<pre>geometric_AMF glint snow_correction</pre>	n no_cloud_pressure adjusted
<pre>long_name:</pre>	nitrogen dioxide air mass factor di	iagnostic flag nitrogen diox:
VARIABLE:	${\tt amf_stratosphere}$	amf_strate
dtype:	float32	:
shape:	(123, 2048)	(123
chunksize:	contiguous	[123
_FillValue:	-1e+30	
coordinates:	time longitude latitude	longitude la
<pre>long_name:</pre>	nitrogen dioxide stratospheric air	mass factor nitrogen dioxide
<pre>valid_min:</pre>	0.0	
VARIABLE:	amf_total	am:
dtype:	float32	
shape:	(123, 2048)	(123
chunksize:	contiguous	[123
_FillValue:	-1e+30	
comment:	total nitrogen dioxide air mass fac	ctor (AMF) calculated from su
coordinates:	time longitude latitude	longitude la
7		

long_name: nitrogen dioxide air mass factor nitrogen dioxide air mass

contiguous

-1.0

[123

chunksize:

_FillValue:

[125		Chunksize.
		_FillValue:
longitude la		coordinates:
nitrogen dioxide air mass fa	n	<pre>long_name:</pre>
		<pre>valid_min:</pre>
amf_trop	${\tt amf_troposphere}$	VARIABLE:
:	float32	dtype:
(123	(123, 2048)	shape:
[123	contiguous	chunksize:
	-1e+30	_FillValue:
longitude la	time longitude latitude	coordinates:
ass factor nitrogen dioxide	nitrogen dioxide tropospheric air ma	long_name:
	0.0	<pre>valid_min:</pre>
	eff_cloud_fraction	VARIABLE:
	float32	dtype:
	(123, 2048)	shape:
	contiguous	chunksize:
	-1.0	_FillValue:
retrieval	effective cloud fraction from cloud :	comment:
	time longitude latitude	coordinates:
	effective cloud fraction	long_name:
	1.0	<pre>valid_max:</pre>
	0.0	<pre>valid_min:</pre>
fitted_slant	fitted_slant_column	VARIABLE:
:	float64	dtype:
(123	(123, 2048)	shape:
[123	contiguous	chunksize:
	-1e+30	_FillValue:
longitude la	time longitude latitude	coordinates:
n nitrogen dioxide fitted si	nitrogen dioxide fitted slant column	long_name:
mol	molecules/cm^2	units:
fitted_slant_column_unce	fitted_slant_column_uncertainty	VARIABLE:
:	float64	dtype:
(123	(123, 2048)	shape:
[123	contiguous	chunksize:
	-1e+30	_FillValue:
longitude l	time longitude latitude	coordinates:
G	nitrogen dioxide fitted slant column	long_name:
mole	molecules/cm^2	units:

0.0

amf_total_unce

(123 [123

 ${\tt valid_min:}$

chunksize:

dtype:
shape:

----VARIABLE----:

```
----VARIABLE----:
                                             gas_profile
                                                                                  gas_
             dtype:
                                                 float32
             shape:
                                         (123, 2048, 72)
                                                                              (123, 20)
                                          [123, 128, 72]
                                                                                [41, 6]
         chunksize:
                                time longitude latitude
       coordinates:
                                                                          longitude la
         long_name: vertical profile of nitrogen dioxide partial column vertical partial
                                         molecules/cm^2
         valid_min:
                                                     0.0
----VARIABLE----:
                              ground_pixel_quality_flag
                                                                   ground pixel quali-
             dtype:
                                                   int32
                                             (123, 2048)
                                                                                  (123)
             shape:
                                                                                  [123
         chunksize:
                                              contiguous
       coordinates:
                                time longitude latitude
                                                                          longitude 1
     flag_meanings: shallow_ocean land shallow_inland_water shoreline intermittent
       flag_values:
                                   [0, 1, 2, 3, 4, \ldots]
                                                                        [0, 1, 2, 3,
         long_name:
                              ground pixel quality flag
                                                                   ground pixel quali-
----VARIABLE----:
                                     scattering_weights
                                                                          scattering_
             dtype:
                                                 float32
                                         (123, 2048, 72)
                                                                              (123, 20)
             shape:
         chunksize:
                                          [123, 128, 72]
                                                                                [41, 6]
           comment: vertical profile of scattering weights vertical profile of sca
                                time longitude latitude
       coordinates:
                                                                          longitude la
         long_name:
                                     scattering weights
                                                                          scattering
         valid_min:
----VARIABLE----:
                                      snow_ice_fraction
                                                                           snow_ice_f:
                                                 float32
             dtype:
                                             (123, 2048)
             shape:
                                                                                  (123)
                                              contiguous
         chunksize:
                                                                                  [123
        _FillValue:
                                                  -1e+30
       coordinates:
                                time longitude latitude
                                                                          longitude la
         long_name: fraction of pixel area covered by snow and/or ice Fraction of
         valid_max:
                                                     1.0
         valid_min:
                                                     0.0
----VARIABLE----:
                                                                            surface_p
                                       surface_pressure
             dtype:
                                                 float32
             shape:
                                             (123, 2048)
                                                                                  (123)
                                                                                  [123
         chunksize:
                                              contiguous
             Eta_A: [0.0, 0.04804826, 6.593752, 13.1348, 19.61311, ...] [0.0, 0.04
             Eta_B: [1.0, 0.984952, 0.963406, 0.941865, 0.920387, ...] [1.0, 0.984
        _FillValue:
                                                  -1e+30
       coordinates:
                                time longitude latitude
                                                                          longitude la
```

surface pressure

hPa

surface p

long_name:

units:

1200.0	
0.0	
terrain_height te	errain
int16	
(123, 2048)	(123
contiguous	[123
-30000	
time longitude latitude longit	tude l
terrain height te	errain
m	
10000	
-1000	
tropopause_pressure tropopa	ause_pi
float32	
(123, 2048)	(123
contiguous	[123
-1e+30	
time longitude latitude longit	tude la
tropopause pressure tropopa	
hPa	1
1200.0	
0.0	
/tru	rue_quai
0	
	(123
	[123
longit	tude la
surface albedo from	
bulluot dibodo ilon	m mode.
	am:
	ani.
	(123
	[123
	[123
	lo oim
total nitrogen dioxide	
_	tude la
nitrogen dioxide air	r mass

valid_min:

----VARIABLE----: gas_ dtype: shape: (123, 20 chunksize: [41, 6]longitude la coordinates: long_name: vertical profile of nitroger units: valid_min: ----VARIABLE----: scattering_ dtype: (123, 204)shape: chunksize: [41, 6 comment: vertical profile of scatter. coordinates: longitude la long_name: scattering valid_min: ----VARIABLE----: vertical_column dtype: shape: (123 chunksize: [123 _FillValue: nitrogen dioxide vertical c comment: coordinates: longitude la long_name: nitrogen dioxide vertical units: Total number of shared items: 35 Total number of non-shared items: 1

Done.

END of Notebook.