

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

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Installation instructions for ncompare can be found in either of these locations:

- [GitHub repository](#)
- [Pip entry](#)

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

Syntax Note: Commands preceeded 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.

```
! ncompare --help
```

```
usage: ncompare [-h] [-v COMPARISON_VAR_NAME] [-g COMPARISON_VAR_GROUP]
               [--file-text FILE_TEXT] [--file-csv FILE_CSV]
```

```

[--file-xlsx FILE_XLSX] [--no-color] [--show-attributes]
[--show-chunks]
[--column-widths 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 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/MOP03JM-202205-L3V95.9.3.he5>

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

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

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:

| | All Variables | File A |
|-------------------------|---------------|--------|
| | - ----- | ----- |
| GROUP #00 | -----/ | ----- |
| num variables in group: | 0 | |
| | - ----- | ----- |
| GROUP #01 | -----/HDFEOS | ----- |
| num variables in group: | 0 | |
| | - ----- | ----- |

```

GROUP #02 -----/HDFEOS INFORMATION -----/HDFEOS INFO
num variables in group: 2
-----VARIABLE-----: StructMetadata.0 StructMet
dtype: <class 'str'> <class
shape: ()
-----VARIABLE-----: coremetadata.0 coremeta
dtype: <class 'str'> <class
shape: (1,)

GROUP #03 -----/HDFEOS/ADDITIONAL -----/HDFEOS/ADD
num variables in group: 0
-----

GROUP #04 -----/HDFEOS/GRIDS -----/HDFEOS/GRIDS
num variables in group: 0
-----

GROUP #05 /HDFEOS/ADDITIONAL/FILE_ATTRIBUTES /HDFEOS/ADDITIONAL/FILE_ATT
num variables in group: 0
-----

GROUP #06 -----/HDFEOS/GRIDS/MOP03 -----/HDFEOS/GRIDS
num variables in group: 6
-----VARIABLE-----: NTWO
dtype: int32
shape: (2,)
-----VARIABLE-----: Prs
dtype: float32
shape: (9,)
-----VARIABLE-----: Prs1
dtype: float32
shape: (10,)
-----VARIABLE-----: Prs2
dtype: float32
shape: (10,)
-----VARIABLE-----: XDim
dtype: float64
shape: (360,)
-----VARIABLE-----: YDim
dtype: float64

```

```

                                shape:                                (180,)

GROUP #07 ---/HDFEOS/GRIDS/MOP03/Data Fields ---/HDFEOS/GRIDS/MOP03/Data
num variables in group:                                80
-----
-----VARIABLE-----:      APrioriCOMixingRatioProfileDay      APrioriCOMixingRatioProfi
dtype:                                float32
shape:                                (360, 180, 9)
-----VARIABLE-----:      APrioriCOMixingRatioProfileNight      APrioriCOMixingRatioProfi
dtype:                                float32
shape:                                (360, 180, 9)
-----VARIABLE-----:      APrioriCOSurfaceMixingRatioDay      APrioriCOSurfaceMixingRa
dtype:                                float32
shape:                                (360, 180)
-----VARIABLE-----:      APrioriCOSurfaceMixingRatioNight      APrioriCOSurfaceMixingRat
dtype:                                float32
shape:                                (360, 180)
-----VARIABLE-----:      APrioriCOTotalColumnDay      APrioriCOTotalCol
dtype:                                float32
shape:                                (360, 180)
-----VARIABLE-----:      APrioriCOTotalColumnNight      APrioriCOTotalColum
dtype:                                float32
shape:                                (360, 180)
-----VARIABLE-----:      APrioriSurfaceEmissivityDay      APrioriSurfaceEmissivi
dtype:                                float32
shape:                                (360, 180)
-----VARIABLE-----:      APrioriSurfaceEmissivityNight      APrioriSurfaceEmissivi
dtype:                                float32
shape:                                (360, 180)
-----VARIABLE-----:      APrioriSurfaceTemperatureDay      APrioriSurfaceTemperat
dtype:                                float32
shape:                                (360, 180)
-----VARIABLE-----:      APrioriSurfaceTemperatureNight      APrioriSurfaceTemperatu
dtype:                                float32
shape:                                (360, 180)
-----VARIABLE-----:      DEMAltitudeDay      DEMalti
dtype:                                float32
shape:                                (360, 180)
-----VARIABLE-----:      DEMAltitudeNight      DEMaltitu
dtype:                                float32
shape:                                (360, 180)
-----VARIABLE-----:      DEMAltitudeVariabilityDay      DEMAltitudeVariabi
dtype:                                float32

```

```

        shape: (360, 180)
-----VARIABLE-----: DEMAltitudeVariabilityNight DEMAltitudeVariability
        dtype: float32
        shape: (360, 180)
-----VARIABLE-----: DegreesofFreedomforSignalDay DegreesofFreedomforSignal
        dtype: float32
        shape: (360, 180)
-----VARIABLE-----: DegreesofFreedomforSignalNight DegreesofFreedomforSignal
        dtype: float32
        shape: (360, 180)
-----VARIABLE-----: DryAirColumnDay DryAirColumn
        dtype: float32
        shape: (360, 180)
-----VARIABLE-----: DryAirColumnNight DryAirColumn
        dtype: float32
        shape: (360, 180)
-----VARIABLE-----: Latitude Latitude
        dtype: float32
        shape: (180,)
-----VARIABLE-----: Longitude Longitude
        dtype: float32
        shape: (360,)
-----VARIABLE-----: MeasurementErrorCovarianceMatrixDay MeasurementErrorCovarianceMatrix
        dtype: float32
        shape: (360, 180, 10, 10)
-----VARIABLE-----: MeasurementErrorCovarianceMatrixNight MeasurementErrorCovarianceMatrix
        dtype: float32
        shape: (360, 180, 10, 10)
-----VARIABLE-----: NumberofPixelsDay NumberofPixels
        dtype: int32
        shape: (360, 180)
-----VARIABLE-----: NumberofPixelsNight NumberofPixels
        dtype: int32
        shape: (360, 180)
-----VARIABLE-----: Pressure Pressure
        dtype: float32
        shape: (9,)
-----VARIABLE-----: Pressure2 Pressure2
        dtype: float32
        shape: (10,)
-----VARIABLE-----: RetrievalAveragingKernelMatrixDay RetrievalAveragingKernelMatrix
        dtype: float32
        shape: (360, 180, 10, 10)

```

```

-----VARIABLE-----: RetrievalAveragingKernelMatrixNight RetrievalAveragingKernelMa
dtype: float32
shape: (360, 180, 10, 10) (360, 180, 10, 10)
-----VARIABLE-----: RetrievalErrorCovarianceMatrixDay RetrievalErrorCovarianceMa
dtype: float32
shape: (360, 180, 10, 10) (360, 180, 10, 10)
-----VARIABLE-----: RetrievalErrorCovarianceMatrixNight RetrievalErrorCovarianceMa
dtype: float32
shape: (360, 180, 10, 10) (360, 180, 10, 10)
-----VARIABLE-----: RetrievedCOMixingRatioProfileDay RetrievedCOMixingRatioProfi
dtype: float32
shape: (360, 180, 9) (360, 180, 9)
-----VARIABLE-----: RetrievedCOMixingRatioProfileMeanUncertaintyDay RetrievedCOMix
dtype: float32
shape: (360, 180, 9) (360, 180, 9)
-----VARIABLE-----: RetrievedCOMixingRatioProfileMeanUncertaintyNig RetrievedCOMix
dtype: float32
shape: (360, 180, 9) (360, 180, 9)
-----VARIABLE-----: RetrievedCOMixingRatioProfileNight RetrievedCOMixingRatioProfi
dtype: float32
shape: (360, 180, 9) (360, 180, 9)
-----VARIABLE-----: RetrievedCOMixingRatioProfileVariabilityDay RetrievedCOMixingRa
dtype: float32
shape: (360, 180, 9) (360, 180, 9)
-----VARIABLE-----: RetrievedCOMixingRatioProfileVariabilityNight RetrievedCOMixing
dtype: float32
shape: (360, 180, 9) (360, 180, 9)
-----VARIABLE-----: RetrievedCOSurfaceMixingRatioDay RetrievedCOSurfaceMixingRa
dtype: float32
shape: (360, 180) (360, 180)
-----VARIABLE-----: RetrievedCOSurfaceMixingRatioMeanUncertaintyDay RetrievedCOSur
dtype: float32
shape: (360, 180) (360, 180)
-----VARIABLE-----: RetrievedCOSurfaceMixingRatioMeanUncertaintyNig RetrievedCOSur
dtype: float32
shape: (360, 180) (360, 180)
-----VARIABLE-----: RetrievedCOSurfaceMixingRatioNight RetrievedCOSurfaceMixingRa
dtype: float32
shape: (360, 180) (360, 180)
-----VARIABLE-----: RetrievedCOSurfaceMixingRatioVariabilityDay RetrievedCOSurfacece
dtype: float32
shape: (360, 180) (360, 180)
-----VARIABLE-----: RetrievedCOSurfaceMixingRatioVariabilityNight RetrievedCOSurfa

```

```

dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedCOTotalColumnDay RetrievedCOTotalColumnNight
dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedCOTotalColumnDiagnosticsDay RetrievedCOTotalColumnDiagnosticsNight
dtype: float32
shape: (360, 180, 2)
-----VARIABLE-----: RetrievedCOTotalColumnDiagnosticsNight RetrievedCOTotalColumnDiagnosticsDay
dtype: float32
shape: (360, 180, 2)
-----VARIABLE-----: RetrievedCOTotalColumnMeanUncertaintyDay RetrievedCOTotalColumnMeanUncertaintyNight
dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedCOTotalColumnMeanUncertaintyNight RetrievedCOTotalColumnMeanUncertaintyDay
dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedCOTotalColumnNight RetrievedCOTotalColumnDay
dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedCOTotalColumnVariabilityDay RetrievedCOTotalColumnVariabilityNight
dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedCOTotalColumnVariabilityNight RetrievedCOTotalColumnVariabilityDay
dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedSurfaceEmissivityDay RetrievedSurfaceEmissivityNight
dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedSurfaceEmissivityMeanUncertaintyDay RetrievedSurfaceEmissivityMeanUncertaintyNight
dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedSurfaceEmissivityMeanUncertaintyNight RetrievedSurfaceEmissivityMeanUncertaintyDay
dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedSurfaceEmissivityNight RetrievedSurfaceEmissivityDay
dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedSurfaceEmissivityVariabilityDay RetrievedSurfaceEmissivityVariabilityNight
dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedSurfaceEmissivityVariabilityNight RetrievedSurfaceEmissivityVariabilityDay
dtype: float32

```



```

shape: (360, 180)
-----VARIABLE-----: RetrievedSurfaceTemperatureDay RetrievedSurfaceTemperature
dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedSurfaceTemperatureMeanUncertaintyDay RetrievedSurfaceTemperature
dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedSurfaceTemperatureMeanUncertaintyNight RetrievedSurfaceTemperature
dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedSurfaceTemperatureNight RetrievedSurfaceTemperature
dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedSurfaceTemperatureVariabilityDay RetrievedSurfaceTemperature
dtype: float32
shape: (360, 180)
-----VARIABLE-----: RetrievedSurfaceTemperatureVariabilityNight RetrievedSurfaceTemperature
dtype: float32
shape: (360, 180)
-----VARIABLE-----: SatelliteZenithAngleDay SatelliteZenithAngle
dtype: float32
shape: (360, 180)
-----VARIABLE-----: SatelliteZenithAngleNight SatelliteZenithAngle
dtype: float32
shape: (360, 180)
-----VARIABLE-----: SignalChi2Day SignalChi2
dtype: float32
shape: (360, 180)
-----VARIABLE-----: SignalChi2Night SignalChi2
dtype: float32
shape: (360, 180)
-----VARIABLE-----: SignalChi2VariabilityDay SignalChi2Variability
dtype: float32
shape: (360, 180)
-----VARIABLE-----: SignalChi2VariabilityNight SignalChi2Variability
dtype: float32
shape: (360, 180)
-----VARIABLE-----: SmoothingErrorCovarianceMatrixDay SmoothingErrorCovarianceMatrix
dtype: float32
shape: (360, 180, 10, 10)
-----VARIABLE-----: SmoothingErrorCovarianceMatrixNight SmoothingErrorCovarianceMatrix
dtype: float32
shape: (360, 180, 10, 10)

```

```

-----VARIABLE-----:          SolarZenithAngleDay          SolarZenithAngleDay
                        dtype:          float32
                        shape:          (360, 180)
-----VARIABLE-----:          SolarZenithAngleNight        SolarZenithAngleNight
                        dtype:          float32
                        shape:          (360, 180)
-----VARIABLE-----:          SurfaceIndexDay              SurfaceIndexDay
                        dtype:          int32
                        shape:          (360, 180)
-----VARIABLE-----:          SurfaceIndexNight            SurfaceIndexNight
                        dtype:          int32
                        shape:          (360, 180)
-----VARIABLE-----:          SurfacePressureDay            SurfacePressureDay
                        dtype:          float32
                        shape:          (360, 180)
-----VARIABLE-----:          SurfacePressureNight          SurfacePressureNight
                        dtype:          float32
                        shape:          (360, 180)
-----VARIABLE-----:          TotalColumnAveragingKernelDay  TotalColumnAveragingKernelDay
                        dtype:          float32
                        shape:          (360, 180, 10)
-----VARIABLE-----:          TotalColumnAveragingKernelNight TotalColumnAveragingKernelNight
                        dtype:          float32
                        shape:          (360, 180, 10)
-----VARIABLE-----:          WaterVaporColumnDay           WaterVaporColumnDay
                        dtype:          float32
                        shape:          (360, 180)
-----VARIABLE-----:          WaterVaporColumnNight         WaterVaporColumnNight
                        dtype:          float32
                        shape:          (360, 180)
-----
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}
```

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

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

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:

| | All Variables | File A |
|-------------------------|------------------------------------|--------------------------|
| | ----- | ----- |
| | GROUP #00 -----/ | ----- |
| num variables in group: | 0 | |
| | ----- | ----- |
| | GROUP #01 -----/HDFEOS | ----- |
| num variables in group: | 0 | |
| | ----- | ----- |
| | GROUP #02 -----/HDFEOS INFORMATION | -----/HDFEOS INFORMATION |
| num variables in group: | 2 | |
| | ----- | ----- |
| -----VARIABLE-----: | StructMetadata.0 | StructMetadata.0 |
| dtype: | <class 'str'> | <class 'str'> |
| shape: | () | () |
| chunksize: | contiguous | contiguous |
| -----VARIABLE-----: | coremetadata.0 | coremetadata.0 |
| dtype: | <class 'str'> | <class 'str'> |
| shape: | (1,) | (1,) |
| chunksize: | contiguous | contiguous |
| | ----- | ----- |
| | GROUP #03 -----/HDFEOS/ADDITIONAL | -----/HDFEOS/ADDITIONAL |
| num variables in group: | 0 | |
| | ----- | ----- |
| | GROUP #04 -----/HDFEOS/GRIDS | -----/HDFEOS/GRIDS |
| num variables in group: | 0 | |

```

- -----
GROUP #05 /HDFEOS/ADDITIONAL/FILE_ATTRIBUTES /HDFEOS/ADDITIONAL/FILE_ATTRIBUTES
num variables in group: 0
- -----

GROUP #06 -----/HDFEOS/GRIDS/MOP03 -----/HDFEOS/GRIDS/MOP03
num variables in group: 6
- -----

-----VARIABLE-----: NTWO
dtype: int32
shape: (2,)
chunksize: contiguous
-----VARIABLE-----: Prs
dtype: float32
shape: (9,)
chunksize: contiguous
units: hPa
-----VARIABLE-----: Prs1
dtype: float32
shape: (10,)
chunksize: contiguous
units: hPa
-----VARIABLE-----: Prs2
dtype: float32
shape: (10,)
chunksize: contiguous
units: hPa
-----VARIABLE-----: XDim
dtype: float64
shape: (360,)
chunksize: contiguous
units: degrees_east
-----VARIABLE-----: YDim
dtype: float64
shape: (180,)
chunksize: contiguous
units: degrees_north

GROUP #07 ---/HDFEOS/GRIDS/MOP03/Data Fields ---/HDFEOS/GRIDS/MOP03/Data Fields
num variables in group: 80
- -----

-----VARIABLE-----: APrioriCOMixingRatioProfileDay APrioriCOMixingRatioProfileDay

```

```

dtype: float32
shape: (360, 180, 9)
chunksize: [60, 30, 9]
_FillValue: -9999.0
long_name: A Priori CO Mixing Ratio Profile Day A Priori CO Mixing Ratio
units: ppbv
-----VARIABLE-----: APrioriCOMixingRatioProfileNight APrioriCOMixingRatioProfi
dtype: float32
shape: (360, 180, 9)
chunksize: [60, 30, 9]
_FillValue: -9999.0
long_name: A Priori CO Mixing Ratio Profile Night A Priori CO Mixing Ratio
units: ppbv
-----VARIABLE-----: APrioriCOSurfaceMixingRatioDay APrioriCOSurfaceMixingRa
dtype: float32
shape: (360, 180)
chunksize: [60, 30]
_FillValue: -9999.0
long_name: A Priori CO Surface Mixing Ratio Day A Priori CO Surface Mixing
units: ppbv
-----VARIABLE-----: APrioriCOSurfaceMixingRatioNight APrioriCOSurfaceMixingRa
dtype: float32
shape: (360, 180)
chunksize: [60, 30]
_FillValue: -9999.0
long_name: A Priori CO Surface Mixing Ratio Night A Priori CO Surface Mix
units: ppbv
-----VARIABLE-----: APrioriCOTotalColumnDay APrioriCOTotalColo
dtype: float32
shape: (360, 180)
chunksize: [60, 30]
_FillValue: -9999.0
long_name: A Priori CO Total Column Day A Priori CO Total Colu
units: mol/cm^2
-----VARIABLE-----: APrioriCOTotalColumnNight APrioriCOTotalColum
dtype: float32
shape: (360, 180)
chunksize: [60, 30]
_FillValue: -9999.0
long_name: A Priori CO Total Column Night A Priori CO Total Colum
units: mol/cm^2
-----VARIABLE-----: APrioriSurfaceEmissivityDay APrioriSurfaceEmissi
dtype: float32

```

```

        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: A Priori Surface Emissivity Day
        units: NA
-----VARIABLE-----: APrioriSurfaceEmissivityNight
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: A Priori Surface Emissivity Night
        units: NA
-----VARIABLE-----: APrioriSurfaceTemperatureDay
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: A Priori Surface Temperature Day
        units: K
-----VARIABLE-----: APrioriSurfaceTemperatureNight
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: A Priori Surface Temperature Night
        units: K
-----VARIABLE-----: DEMAltitudeDay
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: DEM Altitude Day
        units: m
-----VARIABLE-----: DEMAltitudeNight
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: DEM Altitude Night
        units: m
-----VARIABLE-----: DEMAltitudeVariabilityDay
        dtype: float32
        shape: (360, 180)

```

```

        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: DEM Altitude Variability Day DEM Altitude Variabil
        units: m
-----VARIABLE-----: DEMAltitudeVariabilityNight DEMAltitudeVariabili
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: DEM Altitude Variability Night DEM Altitude Variability
        units: m
-----VARIABLE-----: DegreesofFreedomforSignalDay DegreesofFreedomforSig
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: Degrees of Freedom for Signal Day Degrees of Freedom for Sign
        units: NA
-----VARIABLE-----: DegreesofFreedomforSignalNight DegreesofFreedomforSigna
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: Degrees of Freedom for Signal Night Degrees of Freedom for Sign
        units: NA
-----VARIABLE-----: DryAirColumnDay DryAirColo
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: Dry Air Column Day Dry Air Colu
        units: mol/cm^2
-----VARIABLE-----: DryAirColumnNight DryAirColumn
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: Dry Air Column Night Dry Air Column
        units: mol/cm^2
-----VARIABLE-----: Latitude La
        dtype: float32
        shape: (180,)
        chunksize: contiguous

```

```

        units: degrees_north degrees
-----VARIABLE-----: Longitude Longitude
        dtype: float32
        shape: (360,)
        chunksize: contiguous
        units: degrees_east degrees
-----VARIABLE-----: MeasurementErrorCovarianceMatrixDay MeasurementErrorCovarianceMatrixNight
        dtype: float32
        shape: (360, 180, 10, 10) (360, 180, 10, 10)
        chunksize: [60, 30, 10, 10] [60, 30, 10, 10]
        _FillValue: -9999.0
        long_name: Measurement Error Covariance Matrix Day Measurement Error Covariance Matrix Night
        units: NA
-----VARIABLE-----: MeasurementErrorCovarianceMatrixNight MeasurementErrorCovarianceMatrixDay
        dtype: float32
        shape: (360, 180, 10, 10) (360, 180, 10, 10)
        chunksize: [60, 30, 10, 10] [60, 30, 10, 10]
        _FillValue: -9999.0
        long_name: Measurement Error Covariance Matrix Night Measurement Error Covariance Matrix Day
        units: NA
-----VARIABLE-----: NumberofPixelsDay NumberofPixelsNight
        dtype: int32
        shape: (360, 180) (360, 180)
        chunksize: [60, 30] [60, 30]
        _FillValue: -9999
        long_name: Number of Pixel Day Number of Pixel Night
        units: NA
-----VARIABLE-----: NumberofPixelsNight NumberofPixelsDay
        dtype: int32
        shape: (360, 180) (360, 180)
        chunksize: [60, 30] [60, 30]
        _FillValue: -9999
        long_name: Number of Pixel Night Number of Pixel Day
        units: NA
-----VARIABLE-----: Pressure Pressure2
        dtype: float32
        shape: (9,)
        chunksize: contiguous
        units: hPa
-----VARIABLE-----: Pressure2 Pressure
        dtype: float32
        shape: (10,)
        chunksize: contiguous

```



```

units: hPa
-----VARIABLE-----: RetrievalAveragingKernelMatrixDay RetrievalAveragingKernelMa
dtype: float32
shape: (360, 180, 10, 10) (360, 180,
chunksize: [60, 30, 10, 10] [60, 30,
_FillValue: -9999.0
long_name: Retrieval Averaging Kernel Matrix Day Retrieval Averaging Kerna
units: NA
-----VARIABLE-----: RetrievalAveragingKernelMatrixNight RetrievalAveragingKernelMa
dtype: float32
shape: (360, 180, 10, 10) (360, 180,
chunksize: [60, 30, 10, 10] [60, 30,
_FillValue: -9999.0
long_name: Retrieval Averaging Kernel Matrix Night Retrieval Averaging Ker
units: NA
-----VARIABLE-----: RetrievalErrorCovarianceMatrixDay RetrievalErrorCovarianceMa
dtype: float32
shape: (360, 180, 10, 10) (360, 180,
chunksize: [60, 30, 10, 10] [60, 30,
_FillValue: -9999.0
long_name: Retrieval Error Covariance Matrix Day Retrieval Error Covarian
units: NA
-----VARIABLE-----: RetrievalErrorCovarianceMatrixNight RetrievalErrorCovarianceMa
dtype: float32
shape: (360, 180, 10, 10) (360, 180,
chunksize: [60, 30, 10, 10] [60, 30,
_FillValue: -9999.0
long_name: Retrieval Error Covariance Matrix Night Retrieval Error Covari
units: NA
-----VARIABLE-----: RetrievedCOMixingRatioProfileDay RetrievedCOMixingRatioPro
dtype: float32
shape: (360, 180, 9) (360,
chunksize: [60, 30, 9] [60,
_FillValue: -9999.0
long_name: Retrieved CO Mixing Ratio Profile Day Retrieved CO Mixing Rati
units: ppbv
-----VARIABLE-----: RetrievedCOMixingRatioProfileMeanUncertaintyDay RetrievedCOMix
dtype: float32
shape: (360, 180, 9) (360,
chunksize: [60, 30, 9] [60,
_FillValue: -9999.0
long_name: Retrieved CO Mixing Ratio Profile Mean Uncertainty Day Retrie
units: ppbv

```

```

-----VARIABLE-----: RetrievedCOMixingRatioProfileMeanUncertaintyNig RetrievedCOMix:
dtype: float32
shape: (360, 180, 9) (360, 1
chunksize: [60, 30, 9] [60,
_FillValue: -9999.0
long_name: Retrieved CO Mixing Ratio Profile Mean Uncertainty Night Retri
units: ppbv
-----VARIABLE-----: RetrievedCOMixingRatioProfileNight RetrievedCOMixingRatioProfi
dtype: float32
shape: (360, 180, 9) (360, 1
chunksize: [60, 30, 9] [60,
_FillValue: -9999.0
long_name: Retrieved CO Mixing Ratio Profile Night Retrieved CO Mixing Ra
units: ppbv
-----VARIABLE-----: RetrievedCOMixingRatioProfileVariabilityDay RetrievedCOMixingRa
dtype: float32
shape: (360, 180, 9) (360, 1
chunksize: [60, 30, 9] [60,
_FillValue: -9999.0
long_name: Retrieved CO Mixing Ratio Profile Variability Day Retrieved CO
units: ppbv
-----VARIABLE-----: RetrievedCOMixingRatioProfileVariabilityNight RetrievedCOMixing
dtype: float32
shape: (360, 180, 9) (360, 1
chunksize: [60, 30, 9] [60,
_FillValue: -9999.0
long_name: Retrieved CO Mixing Ratio Profile Variability Night Retrieved C
units: ppbv
-----VARIABLE-----: RetrievedCOSurfaceMixingRatioDay RetrievedCOSurfaceMixingRa
dtype: float32
shape: (360, 180) (360,
chunksize: [60, 30] [
_FillValue: -9999.0
long_name: Retrieved CO Surface Mixing Ratio Day Retrieved CO Surface Mix
units: ppbv
-----VARIABLE-----: RetrievedCOSurfaceMixingRatioMeanUncertaintyDay RetrievedCOSur
dtype: float32
shape: (360, 180) (360,
chunksize: [60, 30] [
_FillValue: -9999.0
long_name: Retrieved CO Surface Mixing Ratio Mean Uncertainty Day Retrie
units: ppbv
-----VARIABLE-----: RetrievedCOSurfaceMixingRatioMeanUncertaintyNig RetrievedCOSur

```

```

dtype: float32
shape: (360, 180)
chunksize: [60, 30]
_FillValue: -9999.0
long_name: Retrieved CO Surface Mixing Ratio Mean Uncertainty Night Retrieved CO Surface Mixing Ratio
units: ppbv
-----VARIABLE-----: RetrievedCOSurfaceMixingRatioNight RetrievedCOSurfaceMixingRatioNight
dtype: float32
shape: (360, 180)
chunksize: [60, 30]
_FillValue: -9999.0
long_name: Retrieved CO Surface Mixing Ratio Night Retrieved CO Surface Mixing Ratio Night
units: ppbv
-----VARIABLE-----: RetrievedCOSurfaceMixingRatioVariabilityDay RetrievedCOSurfaceMixingRatioVariabilityDay
dtype: float32
shape: (360, 180)
chunksize: [60, 30]
_FillValue: -9999.0
long_name: Retrieved CO Surface Mixing Ratio Variability Day Retrieved CO Surface Mixing Ratio Variability Day
units: ppbv
-----VARIABLE-----: RetrievedCOSurfaceMixingRatioVariabilityNight RetrievedCOSurfaceMixingRatioVariabilityNight
dtype: float32
shape: (360, 180)
chunksize: [60, 30]
_FillValue: -9999.0
long_name: Retrieved CO Surface Mixing Ratio Variability Night Retrieved CO Surface Mixing Ratio Variability Night
units: ppbv
-----VARIABLE-----: RetrievedCOTotalColumnDay RetrievedCOTotalColumnDay
dtype: float32
shape: (360, 180)
chunksize: [60, 30]
_FillValue: -9999.0
long_name: Retrieved CO Total Column Day Retrieved CO Total Column Day
units: mol/cm^2
-----VARIABLE-----: RetrievedCOTotalColumnDiagnosticsDay RetrievedCOTotalColumnDiagnosticsDay
dtype: float32
shape: (360, 180, 2)
chunksize: [60, 30, 2]
_FillValue: -9999.0
long_name: Retrieved CO Total Column Diagnostics Day Retrieved CO Total Column Diagnostics Day
units: mol/cm^2
-----VARIABLE-----: RetrievedCOTotalColumnDiagnosticsNight RetrievedCOTotalColumnDiagnosticsNight
dtype: float32

```

```

        shape: (360, 180, 2) (360, 180, 2)
        chunksize: [60, 30, 2] [60, 30, 2]
        _FillValue: -9999.0 -9999.0
        long_name: Retrieved CO Total Column Diagnostics Night Retrieved CO Total Column Diagnostics Night
        units: mol/cm^2 mol/cm^2
-----VARIABLE-----: RetrievedCOTotalColumnMeanUncertaintyDay RetrievedCOTotalColumnMeanUncertaintyDay
        dtype: float32 float32
        shape: (360, 180) (360, 180)
        chunksize: [60, 30] [60, 30]
        _FillValue: -9999.0 -9999.0
        long_name: Retrieved CO Total Column Mean Uncertainty Day Retrieved CO Total Column Mean Uncertainty Day
        units: mol/cm^2 mol/cm^2
-----VARIABLE-----: RetrievedCOTotalColumnMeanUncertaintyNight RetrievedCOTotalColumnMeanUncertaintyNight
        dtype: float32 float32
        shape: (360, 180) (360, 180)
        chunksize: [60, 30] [60, 30]
        _FillValue: -9999.0 -9999.0
        long_name: Retrieved CO Total Column Mean Uncertainty Night Retrieved CO Total Column Mean Uncertainty Night
        units: mol/cm^2 mol/cm^2
-----VARIABLE-----: RetrievedCOTotalColumnNight RetrievedCOTotalColumnNight
        dtype: float32 float32
        shape: (360, 180) (360, 180)
        chunksize: [60, 30] [60, 30]
        _FillValue: -9999.0 -9999.0
        long_name: Retrieved CO Total Column Night Retrieved CO Total Column Night
        units: mol/cm^2 mol/cm^2
-----VARIABLE-----: RetrievedCOTotalColumnVariabilityDay RetrievedCOTotalColumnVariabilityDay
        dtype: float32 float32
        shape: (360, 180) (360, 180)
        chunksize: [60, 30] [60, 30]
        _FillValue: -9999.0 -9999.0
        long_name: Retrieved CO Total Column Variability Day Retrieved CO Total Column Variability Day
        units: mol/cm^2 mol/cm^2
-----VARIABLE-----: RetrievedCOTotalColumnVariabilityNight RetrievedCOTotalColumnVariabilityNight
        dtype: float32 float32
        shape: (360, 180) (360, 180)
        chunksize: [60, 30] [60, 30]
        _FillValue: -9999.0 -9999.0
        long_name: Retrieved CO Total Column Variability Night Retrieved CO Total Column Variability Night
        units: mol/cm^2 mol/cm^2
-----VARIABLE-----: RetrievedSurfaceEmissivityDay RetrievedSurfaceEmissivityDay
        dtype: float32 float32
        shape: (360, 180) (360, 180)

```

```

        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: Retrieved Surface Emissivity Day Retrieved Surface Emissiv
        units: NA
-----VARIABLE-----: RetrievedSurfaceEmissivityMeanUncertaintyDay RetrievedSurfaceE
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: Retrieved Surface Emissivity Mean Uncertainty Day Retrieved Sur
        units: NA
-----VARIABLE-----: RetrievedSurfaceEmissivityMeanUncertaintyNight RetrievedSurface
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: Retrieved Surface Emissivity Mean Uncertainty Night Retrieved S
        units: NA
-----VARIABLE-----: RetrievedSurfaceEmissivityNight RetrievedSurfaceEmissivi
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: Retrieved Surface Emissivity Night Retrieved Surface Emissivity
        units: NA
-----VARIABLE-----: RetrievedSurfaceEmissivityVariabilityDay RetrievedSurfaceEmiss
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: Retrieved Surface Emissivity Variability Day Retrieved Surface
        units: NA
-----VARIABLE-----: RetrievedSurfaceEmissivityVariabilityNight RetrievedSurfaceEmi
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: Retrieved Surface Emissivity Variability Night Retrieved Surfa
        units: NA
-----VARIABLE-----: RetrievedSurfaceTemperatureDay RetrievedSurfaceTemperat
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]

```

```

        _FillValue: -9999.0
        long_name: Retrieved Surface Temperature Day Retrieved Surface Temperature
        units: K
-----VARIABLE-----: RetrievedSurfaceTemperatureMeanUncertaintyDay RetrievedSurfaceTemperature
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: Retrieved Surface Temperature Mean Uncertainty Day Retrieved Surface Temperature
        units: K
-----VARIABLE-----: RetrievedSurfaceTemperatureMeanUncertaintyNight RetrievedSurfaceTemperature
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: Retrieved Surface Temperature Mean Uncertainty Night Retrieved Surface Temperature
        units: K
-----VARIABLE-----: RetrievedSurfaceTemperatureNight RetrievedSurfaceTemperature
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: Retrieved Surface Temperature Night Retrieved Surface Temperature
        units: K
-----VARIABLE-----: RetrievedSurfaceTemperatureVariabilityDay RetrievedSurfaceTemperature
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: Retrieved Surface Temperature Variability Day Retrieved Surface Temperature
        units: K
-----VARIABLE-----: RetrievedSurfaceTemperatureVariabilityNight RetrievedSurfaceTemperature
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0
        long_name: Retrieved Surface Temperature Variability Night Retrieved Surface Temperature
        units: K
-----VARIABLE-----: SatelliteZenithAngleDay SatelliteZenithAngle
        dtype: float32
        shape: (360, 180)
        chunksize: [60, 30]
        _FillValue: -9999.0

```

```

        long_name:      Satellite Zenith Angle Day      Satellite Zenith Ang
        units:          deg
-----VARIABLE-----:      SatelliteZenithAngleNight      SatelliteZenithAng
        dtype:          float32
        shape:          (360, 180)                    (360
        chunksize:      [60, 30]                      [60
        _FillValue:      -9999.0                        -
        long_name:      Satellite Zenith Angle Night      Satellite Zenith Angl
        units:          deg
-----VARIABLE-----:      SignalChi2Day              Signal
        dtype:          float32
        shape:          (360, 180)                    (360
        chunksize:      [60, 30]                      [60
        _FillValue:      -9999.0                        -
        long_name:      Signal Chi2 Day              Signal Chi
        units:          NA
-----VARIABLE-----:      SignalChi2Night            SignalChi
        dtype:          float32
        shape:          (360, 180)                    (360
        chunksize:      [60, 30]                      [60
        _FillValue:      -9999.0                        -
        long_name:      Signal Chi2 Night            Signal Chi
        units:          NA
-----VARIABLE-----:      SignalChi2VariabilityDay      SignalChi2Variabili
        dtype:          float32
        shape:          (360, 180)                    (360
        chunksize:      [60, 30]                      [60
        _FillValue:      -9999.0                        -
        long_name:      Signal Chi2 Variability Day      Signal Chi2 Variabili
        units:          NA
-----VARIABLE-----:      SignalChi2VariabilityNight      SignalChi2Variabili
        dtype:          float32
        shape:          (360, 180)                    (360
        chunksize:      [60, 30]                      [60
        _FillValue:      -9999.0                        -
        long_name:      Signal Chi2 Variability Night      Signal Chi2 Variability
        units:          NA
-----VARIABLE-----:      SmoothingErrorCovarianceMatrixDay      SmoothingErrorCovarianceMa
        dtype:          float32
        shape:          (360, 180, 10, 10)            (360, 180,
        chunksize:      [60, 30, 10, 10]              [60, 30,
        _FillValue:      -9999.0                        -
        long_name:      Smoothing Error Covariance Matrix Day      Smoothing Error Covarian

```

```

units: NA
-----VARIABLE-----: SmoothingErrorCovarianceMatrixNight SmoothingErrorCovarianceMa
dtype: float32
shape: (360, 180, 10, 10) (360, 180, 10, 10)
chunksize: [60, 30, 10, 10] [60, 30, 10, 10]
_FillValue: -9999.0
long_name: Smoothing Error Covariance Matrix Night Smoothing Error Covari
units: NA
-----VARIABLE-----: SolarZenithAngleDay SolarZenithAng
dtype: float32
shape: (360, 180) (360, 180)
chunksize: [60, 30] [60, 30]
_FillValue: -9999.0
long_name: Solar Zenith Angle Day Solar Zenith Ang
units: deg
-----VARIABLE-----: SolarZenithAngleNight SolarZenithAng
dtype: float32
shape: (360, 180) (360, 180)
chunksize: [60, 30] [60, 30]
_FillValue: -9999.0
long_name: Solar Zenith Angle Night Solar Zenith Angl
units: deg
-----VARIABLE-----: SurfaceIndexDay SurfaceIn
dtype: int32
shape: (360, 180) (360, 180)
chunksize: [60, 30] [60, 30]
_FillValue: -9999
long_name: Surface Index Day Surface In
units: NA
-----VARIABLE-----: SurfaceIndexNight SurfaceInde
dtype: int32
shape: (360, 180) (360, 180)
chunksize: [60, 30] [60, 30]
_FillValue: -9999
long_name: Surface Index Night Surface Index
units: NA
-----VARIABLE-----: SurfacePressureDay SurfacePress
dtype: float32
shape: (360, 180) (360, 180)
chunksize: [60, 30] [60, 30]
_FillValue: -9999.0
long_name: Surface Pressure Day Surface Pressu
units: hPa

```



```

-----VARIABLE-----:          SurfacePressureNight          SurfacePressur
dtype:                  float32
shape:                  (360, 180)
chunksize:              [60, 30]
_FillValue:             -9999.0
long_name:              Surface Pressure Night          Surface Pressur
units:                  hPa
-----VARIABLE-----:          TotalColumnAveragingKernelDay      TotalColumnAveragingKer
dtype:                  float32
shape:                  (360, 180, 10)
chunksize:              [60, 30, 10]
_FillValue:             -9999.0
long_name:              Total Column Averaging Kernel Day Total Column Averaging Ker
units:                  mol/(cm^2 log(VMR))              mol/(cm^2 log
-----VARIABLE-----:          TotalColumnAveragingKernelNight    TotalColumnAveragingKerne
dtype:                  float32
shape:                  (360, 180, 10)
chunksize:              [60, 30, 10]
_FillValue:             -9999.0
long_name:              Total Column Averaging Kernel Night Total Column Averaging Ker
units:                  mol/(cm^2 log(VMR))              mol/(cm^2 log
-----VARIABLE-----:          WaterVaporColumnDay              WaterVaporColo
dtype:                  float32
shape:                  (360, 180)
chunksize:              [60, 30]
_FillValue:             -9999.0
long_name:              Water Vapor Column Day          Water Vapor Colu
units:                  mol/cm^2
-----VARIABLE-----:          WaterVaporColumnNight            WaterVaporColumn
dtype:                  float32
shape:                  (360, 180)
chunksize:              [60, 30]
_FillValue:             -9999.0
long_name:              Water Vapor Column Night        Water Vapor Column
units:                  mol/cm^2
-----
Total number of shared items:          88
Total number of non-shared items:      0

Done.

```

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 essence, this example mimics a comparison of real to simulated data.

```
filepath_1 = "notebook_example_data/TEMPO_N02_L2_V01_20130701T131754Z_S001G04.nc"
filepath_2 = "notebook_example_data/TEMPO_N02-PROXY_L2_V01_20130731T141759Z_S006G04.nc"
```

```
! ncompare --column-widths 28 34 34 {filepath_1} {filepath_2}
```

File A: notebook_example_data/TEMPO_N02_L2_V01_20130701T131754Z_S001G04.nc

File B: notebook_example_data/TEMPO_N02-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 | -----geol |
| #01 | -----product | -----p |
| #02 | -----qa_statistics | -----qa_sta |
| #03 | -----support_data | -----suppor |
| #04 | -----true_qual | -----true_qual |

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_step                mirro
dtype:                int32
shape:                (123,)
-----VARIABLE-----:                xtrack
dtype:                int32
shape:                (2048,)

GROUP #01 -----/geolocation -----/geol
num variables in group:                10
- -----

-----VARIABLE-----:                latitude                la
dtype:                float32
shape:                (123, 2048)                (123
-----VARIABLE-----:                latitude_bounds                latitude
dtype:                float32
shape:                (123, 2048, 4)                (123, 2
-----VARIABLE-----:                longitude                lon
dtype:                float32
shape:                (123, 2048)                (123
-----VARIABLE-----:                longitude_bounds                longitude
dtype:                float32
shape:                (123, 2048, 4)                (123, 2
-----VARIABLE-----:                relative_azimuth_angle                relative_azimutl
dtype:                float32
shape:                (123, 2048)                (123
-----VARIABLE-----:                solar_azimuth_angle                solar_azimutl
dtype:                float32
shape:                (123, 2048)                (123
-----VARIABLE-----:                solar_zenith_angle                solar_zenitl
dtype:                float32
shape:                (123, 2048)                (123
-----VARIABLE-----:                time
dtype:                float64
shape:                (123,)
-----VARIABLE-----:                viewing_azimuth_angle                viewing_azimutl
dtype:                float32
shape:                (123, 2048)                (123
-----VARIABLE-----:                viewing_zenith_angle                viewing_zenitl
dtype:                float32
shape:                (123, 2048)                (123

GROUP #02 -----/product -----/p
num variables in group:                5

```

| | | |
|-------------------------|-----------------------------------|-----------------------------|
| -----VARIABLE-----: | main_data_quality_flag | main_data_quali |
| dtype: | int16 | |
| shape: | (123, 2048) | (123 |
| -----VARIABLE-----: | vertical_column_stratosphere | vertical_column_strat |
| dtype: | float64 | : |
| shape: | (123, 2048) | (123 |
| -----VARIABLE-----: | vertical_column_total | vertical_column |
| dtype: | float64 | : |
| shape: | (123, 2048) | (123 |
| -----VARIABLE-----: | vertical_column_total_uncertainty | vertical_column_total_uncer |
| dtype: | float64 | : |
| shape: | (123, 2048) | (123 |
| -----VARIABLE-----: | vertical_column_troposphere | vertical_column_tropo |
| dtype: | float64 | : |
| shape: | (123, 2048) | (123 |
| GROUP #03 | -----/qa_statistics | -----/qa_sta |
| num variables in group: | 2 | |
| -----VARIABLE-----: | fit_convergence_flag | fit_convergen |
| dtype: | int16 | |
| shape: | (123, 2048) | (123 |
| -----VARIABLE-----: | fit_rms_residual | fit_rms_r |
| dtype: | float32 | : |
| shape: | (123, 2048) | (123 |
| GROUP #04 | -----/support_data | -----/suppor |
| num variables in group: | 17 | |
| -----VARIABLE-----: | albedo | |
| dtype: | float32 | : |
| shape: | (123, 2048) | (123 |
| -----VARIABLE-----: | amf_cloud_fraction | amf_cloud_fr |
| dtype: | float32 | : |
| shape: | (123, 2048) | (123 |
| -----VARIABLE-----: | amf_cloud_pressure | amf_cloud_p |
| dtype: | float32 | : |
| shape: | (123, 2048) | (123 |
| -----VARIABLE-----: | amf_diagnostic_flag | amf_diagnost |
| dtype: | int16 | |
| shape: | (123, 2048) | (123 |
| -----VARIABLE-----: | amf_stratosphere | amf_strato |

```

dtype: float32
shape: (123, 2048)
-----VARIABLE-----: amf_total
dtype: float32
shape: (123, 2048)
-----VARIABLE-----: amf_total_uncertainty
dtype: float32
shape: (123, 2048)
-----VARIABLE-----: amf_troposphere
dtype: float32
shape: (123, 2048)
-----VARIABLE-----: eff_cloud_fraction
dtype: float32
shape: (123, 2048)
-----VARIABLE-----: fitted_slant_column
dtype: float64
shape: (123, 2048)
-----VARIABLE-----: fitted_slant_column_uncertainty
dtype: float64
shape: (123, 2048)
-----VARIABLE-----: gas_profile
dtype: float32
shape: (123, 2048, 72)
-----VARIABLE-----: ground_pixel_quality_flag
dtype: int32
shape: (123, 2048)
-----VARIABLE-----: scattering_weights
dtype: float32
shape: (123, 2048, 72)
-----VARIABLE-----: snow_ice_fraction
dtype: float32
shape: (123, 2048)
-----VARIABLE-----: surface_pressure
dtype: float32
shape: (123, 2048)
-----VARIABLE-----: terrain_height
dtype: int16
shape: (123, 2048)
-----VARIABLE-----: tropopause_pressure
dtype: float32
shape: (123, 2048)

GROUP #05 -----/true_quali

```

```

num variables in group:                                0
-----
-----VARIABLE-----:
dtype:
shape: (123, 2048)
-----VARIABLE-----:
dtype:
shape: (123, 2048)
-----VARIABLE-----:
dtype:
shape: (123, 2048)
-----VARIABLE-----:
dtype:
shape: (123, 2048)
-----VARIABLE-----:
dtype:
shape: (123, 2048)
-----VARIABLE-----:
dtype:
shape: (123, 2048)
-----VARIABLE-----:
dtype:
shape: (123, 2048)
-----
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_N02_L2_V01_20130701T131754Z_S001G04.nc
File B: notebook_example_data/TEMPO_N02-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 -----geol
#01 -----product -----p
#02 -----qa_statistics -----qa_sta
#03 -----support_data -----suppor
#04 -----true_quan
Number of non-shared items:                                0

```

No variable group selected for comparison. Skipping..

All variables:

| | All Variables | File A |
|-------------------------|-----------------------------------------|-----------------------------------------|
| GROUP #00 | -----/ | ----- |
| num variables in group: | 2 | |
| -----VARIABLE-----: | | |
| mirror_step | | mirror_step |
| dtype: | int32 | |
| shape: | (123,) | |
| chunksize: | contiguous | |
| long_name: | scan mirror position index | scan mirror position index |
| -----VARIABLE-----: | | |
| xtrack | | xtrack |
| dtype: | int32 | |
| shape: | (2048,) | |
| chunksize: | contiguous | |
| long_name: | pixel index along slit | pixel index along slit |
| GROUP #01 | -----/geolocation | -----/geolocation |
| num variables in group: | 10 | |
| -----VARIABLE-----: | | |
| latitude | | latitude |
| dtype: | float32 | |
| shape: | (123, 2048) | (123, 2048) |
| chunksize: | contiguous | [123, 2048] |
| _FillValue: | -1e+30 | |
| bounds: | latitude_bounds | latitude_bounds |
| comment: | latitude at pixel center | latitude at pixel center |
| long_name: | pixel center latitude | pixel center latitude |
| standard_name: | latitude | |
| units: | degrees_north | degrees_north |
| valid_max: | 90.0 | |
| valid_min: | -90.0 | |
| -----VARIABLE-----: | | |
| latitude_bounds | | latitude_bounds |
| dtype: | float32 | |
| shape: | (123, 2048, 4) | (123, 2048, 4) |
| chunksize: | contiguous | [123, 2048, 4] |
| _FillValue: | -1e+30 | |
| comment: | latitude at pixel corners (SW,SE,NE,NW) | latitude at pixel corners (SW,SE,NE,NW) |

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        long_name:          pixel corner latitude          pixel corner lon
        units:              degrees
        valid_max:          90.0
        valid_min:          -90.0
-----VARIABLE-----:          longitude          lon
        dtype:              float32
        shape:              (123, 2048)          (123, 2048)
        chunksize:          contiguous          [123, 2048]
        _FillValue:         -1e+30
        bounds:              longitude_bounds          longitude_bounds
        comment:             longitude at pixel center          longitude at pixel center
        long_name:           pixel center longitude          pixel center longitude
        standard_name:        longitude
        units:                degrees_east          degrees_east
        valid_max:           180.0
        valid_min:           -180.0
-----VARIABLE-----:          longitude_bounds          longitude_bounds
        dtype:              float32
        shape:              (123, 2048, 4)          (123, 2048, 4)
        chunksize:           contiguous          [123, 2048, 4]
        _FillValue:         -1e+30
        comment:             longitude at pixel corners (SW,SE,NE,NW) longitude at pixel corners
        long_name:           pixel corner longitude          pixel corner longitude
        units:                degrees
        valid_max:           180.0
        valid_min:           -180.0
-----VARIABLE-----:          relative_azimuth_angle          relative_azimuth_angle
        dtype:              float32
        shape:              (123, 2048)          (123, 2048)
        chunksize:           contiguous          [123, 2048]
        _FillValue:         -1e+30
        coordinates:         time longitude latitude          longitude latitude
        long_name:           relative azimuth angle at pixel center relative azimuth angle at pixel center
        units:                degrees
        valid_max:           180.0
        valid_min:           -180.0
-----VARIABLE-----:          solar_azimuth_angle          solar_azimuth_angle
        dtype:              float32
        shape:              (123, 2048)          (123, 2048)
        chunksize:           contiguous          [123, 2048]
        _FillValue:         -1e+30
        coordinates:         time longitude latitude          longitude latitude
        long_name:           solar azimuth angle at pixel center solar azimuth angle at pixel center

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

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GROUP #02 -----/product -----/
num variables in group: 5
-----
-----VARIABLE-----:      main_data_quality_flag      main_data_quali
dtype:                  int16
shape:                  (123, 2048)                  (123
chunksize:              contiguous                  [123
_FillValue:             -1
coordinates:            time longitude latitude      longitude la
flag_meanings:          normal suspicious bad        normal suspici
flag_values:            [0, 1, 2, ...]              [0, 1, 2
long_name:              main data quality flag      main data quali
valid_max:              2
valid_min:              0
-----VARIABLE-----:      vertical_column_stratosphere      vertical_column_strato
dtype:                  float64
shape:                  (123, 2048)                  (123
chunksize:              contiguous                  [123
_FillValue:             -1e+30
coordinates:            time longitude latitude      longitude la
long_name: stratosphere nitrogen dioxide vertical column stratosphere nitr
units:                  molecules/cm^2              mole
-----VARIABLE-----:      vertical_column_total      vertical_column
dtype:                  float64
shape:                  (123, 2048)                  (123
chunksize:              contiguous                  [123
_FillValue:             -1e+30
comment: nitrogen dioxide vertical column determined from fitted slant c
coordinates:            time longitude latitude      longitude la
long_name: nitrogen dioxide vertical column      nitrogen dioxide vertical
units:                  molecules/cm^2              mole
-----VARIABLE-----:      vertical_column_total_uncertainty      vertical_column_total_unce
dtype:                  float64
shape:                  (123, 2048)                  (123
chunksize:              contiguous                  [123
_FillValue:             -1e+30
coordinates:            time longitude latitude      longitude la
long_name: nitrogen dioxide vertical column uncertainty nitrogen dioxide v
units:                  molecules/cm^2              mole
-----VARIABLE-----:      vertical_column_troposphere      vertical_column_tropo
dtype:                  float64
shape:                  (123, 2048)                  (123
chunksize:              contiguous                  [123

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        _FillValue: -1e+30
coordinates:      time longitude latitude      longitude latitude
        long_name: troposphere nitrogen dioxide vertical column troposphere nitrogen
        units:      molecules/cm^2      molecules/cm^2

GROUP #03 -----/qa_statistics -----/qa_statistics
num variables in group: 2
-----
-----VARIABLE-----:      fit_convergence_flag      fit_convergence_flag
        dtype:      int16
        shape:      (123, 2048)      (123, 2048)
        chunksize:      contiguous      contiguous
        _FillValue:      -30000
coordinates:      time longitude latitude      longitude latitude
flag_meanings: failed maxiter_exceeded suspect good failed maxiter_exceeded suspect good
flag_values:      [-2, -1, 0, 1, ...]      [-2, -1, 0, 1, ...]
        long_name:      radiance fit convergence flag      radiance fit convergence flag
        valid_max:      12344
        valid_min:      -10
-----VARIABLE-----:      fit_rms_residual      fit_rms_residual
        dtype:      float32
        shape:      (123, 2048)      (123, 2048)
        chunksize:      contiguous      contiguous
        _FillValue:      -1e+30
coordinates:      time longitude latitude      longitude latitude
        long_name:      radiance fit RMS residual      radiance fit RMS residual
        valid_max:      0.01
        valid_min:      0.0

GROUP #04 -----/support_data -----/support_data
num variables in group: 17
-----
-----VARIABLE-----:      albedo
        dtype:      float32
        shape:      (123, 2048)      (123, 2048)
        chunksize:      contiguous      contiguous
coordinates:      time longitude latitude      longitude latitude
        long_name:      surface albedo      surface albedo
        valid_max:      1.0
        valid_min:      0.0
-----VARIABLE-----:      amf_cloud_fraction      amf_cloud_fraction
        dtype:      float32
        shape:      (123, 2048)      (123, 2048)

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        chunksize:                contiguous                [123
    _FillValue:                    -1.0
        comment: cloud radiance fraction for AMF computation cloud radiance fra
coordinates:          time longitude latitude                longitude la
        long_name:                cloud fraction                cloud fr
        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 AMF computation cloud pressure for AMF calcula
coordinates:          time longitude latitude                longitude la
        long_name:                cloud pressure                cloud pr
        units:                    hPa
        valid_max:                1200.0
        valid_min:                0.0
-----VARIABLE-----:                amf_diagnostic_flag                amf_diagnosti
        dtype:                    int16
        shape:                    (123, 2048)                (123
        chunksize:                contiguous                [123
        _FillValue:                -1
coordinates:          time longitude latitude                longitude la
        flag_masks:                [1, 2, 4, 8, 16, ...]                [-2, 220, 500]
        flag_meanings: geometric_AMF glint snow_correction no_cloud_pressure adjusted
        long_name: nitrogen dioxide air mass factor diagnostic flag nitrogen dioxi
-----VARIABLE-----:                amf_stratosphere                amf_strato
        dtype:                    float32
        shape:                    (123, 2048)                (123
        chunksize:                contiguous                [123
        _FillValue:                -1e+30
coordinates:          time longitude latitude                longitude la
        long_name: nitrogen dioxide stratospheric air mass factor nitrogen dioxide
        valid_min:                0.0
-----VARIABLE-----:                amf_total                am
        dtype:                    float32
        shape:                    (123, 2048)                (123
        chunksize:                contiguous                [123
        _FillValue:                -1e+30
        comment: total nitrogen dioxide air mass factor (AMF) calculated from su
coordinates:          time longitude latitude                longitude la
        long_name:    nitrogen dioxide air mass factor    nitrogen dioxide air mass

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        valid_min:                                0.0
-----VARIABLE-----:                                amf_total_uncer
        dtype:
        shape:                                (123
        chunksize:                                [123
        _FillValue:
        coordinates:                                longitude la
        long_name:                                nitrogen dioxide air mass fa
        valid_min:
-----VARIABLE-----:                                amf_troposphere                                amf_tropo
        dtype:                                float32
        shape:                                (123, 2048)                                (123
        chunksize:                                contiguous                                [123
        _FillValue:                                -1e+30
        coordinates:                                time longitude latitude                                longitude la
        long_name: nitrogen dioxide tropospheric air mass factor nitrogen dioxide
        valid_min:                                0.0
-----VARIABLE-----:                                eff_cloud_fraction
        dtype:                                float32
        shape:                                (123, 2048)
        chunksize:                                contiguous
        _FillValue:                                -1.0
        comment: effective cloud fraction from cloud retrieval
        coordinates:                                time longitude latitude
        long_name:                                effective cloud fraction
        valid_max:                                1.0
        valid_min:                                0.0
-----VARIABLE-----:                                fitted_slant_column                                fitted_slant
        dtype:                                float64
        shape:                                (123, 2048)                                (123
        chunksize:                                contiguous                                [123
        _FillValue:                                -1e+30
        coordinates:                                time longitude latitude                                longitude la
        long_name: nitrogen dioxide fitted slant column nitrogen dioxide fitted s
        units:                                molecules/cm^2                                mol
-----VARIABLE-----:                                fitted_slant_column_uncertainty                                fitted_slant_column_uncer
        dtype:                                float64
        shape:                                (123, 2048)                                (123
        chunksize:                                contiguous                                [123
        _FillValue:                                -1e+30
        coordinates:                                time longitude latitude                                longitude la
        long_name: nitrogen dioxide fitted slant column uncertainty nitrogen diox
        units:                                molecules/cm^2                                mol

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-----VARIABLE-----:                gas_profile                gas_p
dtype:                float32                :
shape:                (123, 2048, 72)                (123, 2048, 72)
chunksize:                [123, 128, 72]                [41, 64, 72]
coordinates:                time longitude latitude                longitude la
long_name: vertical profile of nitrogen dioxide partial column vertical p
units:                molecules/cm^2                mol/cm^2
valid_min:                0.0
-----VARIABLE-----:                ground_pixel_quality_flag                ground_pixel_quali
dtype:                int32                :
shape:                (123, 2048)                (123, 2048)
chunksize:                contiguous                [123, 128, 72]
coordinates:                time longitude latitude                longitude la
flag_meanings: shallow_ocean land shallow_inland_water shoreline intermittent
flag_values:                [0, 1, 2, 3, 4, ...]                [0, 1, 2, 3, 4, ...]
long_name:                ground pixel quality flag                ground pixel quali
-----VARIABLE-----:                scattering_weights                scattering_w
dtype:                float32                :
shape:                (123, 2048, 72)                (123, 2048, 72)
chunksize:                [123, 128, 72]                [41, 64, 72]
comment: vertical profile of scattering weights vertical profile of sca
coordinates:                time longitude latitude                longitude la
long_name:                scattering weights                scattering w
valid_min:                0.0
-----VARIABLE-----:                snow_ice_fraction                snow_ice_fr
dtype:                float32                :
shape:                (123, 2048)                (123, 2048)
chunksize:                contiguous                [123, 128, 72]
_FillValue:                -1e+30
coordinates:                time longitude latitude                longitude la
long_name: fraction of pixel area covered by snow and/or ice Fraction of p
valid_max:                1.0
valid_min:                0.0
-----VARIABLE-----:                surface_pressure                surface_pr
dtype:                float32                :
shape:                (123, 2048)                (123, 2048)
chunksize:                contiguous                [123, 128, 72]
Eta_A: [0.0, 0.04804826, 6.593752, 13.1348, 19.61311, ...] [0.0, 0.04804826, 6.593752, 13.1348, 19.61311, ...]
Eta_B: [1.0, 0.984952, 0.963406, 0.941865, 0.920387, ...] [1.0, 0.984952, 0.963406, 0.941865, 0.920387, ...]
_FillValue:                -1e+30
coordinates:                time longitude latitude                longitude la
long_name:                surface pressure                surface pr
units:                hPa

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        valid_max:                1200.0
        valid_min:                0.0
-----VARIABLE-----:                terrain_height                terrain
        dtype:                int16
        shape:                (123, 2048)                (123
        chunksize:                contiguous                [123
        _FillValue:                -30000
        coordinates:                time longitude latitude                longitude la
        long_name:                terrain height                terrain
        units:                m
        valid_max:                10000
        valid_min:                -1000
-----VARIABLE-----:                tropopause_pressure                tropopause_p
        dtype:                float32
        shape:                (123, 2048)                (123
        chunksize:                contiguous                [123
        _FillValue:                -1e+30
        coordinates:                time longitude latitude                longitude la
        long_name:                tropopause pressure                tropopause pr
        units:                hPa
        valid_max:                1200.0
        valid_min:                0.0

        GROUP #05 -----/true_qual
num variables in group:                0
-----VARIABLE-----:
        dtype:
        shape:                (123
        chunksize:                [123
        coordinates:                longitude la
        long_name:                surface albedo from mode
        valid_max:
        valid_min:
-----VARIABLE-----:                am
        dtype:
        shape:                (123
        chunksize:                [123
        _FillValue:
        comment:                total nitrogen dioxide air m
        coordinates:                longitude la
        long_name:                nitrogen dioxide air mass
        valid_min:

```

```

-----VARIABLE-----:
dtype:
shape:
chunksize:
coordinates:
long_name:
units:
valid_min:
-----VARIABLE-----:
dtype:
shape:
chunksize:
comment:
coordinates:
long_name:
valid_min:
-----VARIABLE-----:
dtype:
shape:
chunksize:
_FillValue:
comment:
coordinates:
long_name:
units:
-----
Total number of shared items:
Total number of non-shared items:

```

Done.

END of Notebook.