Aquaplanet_Ozone_Revision

April 12, 2018

1 Aquaplanet Ozone dataset revision

Email form Yoko Tsushima informed me that the high-top ozone dataset (DOI: 10.5065/D64X5653) was not zonally symmetric.

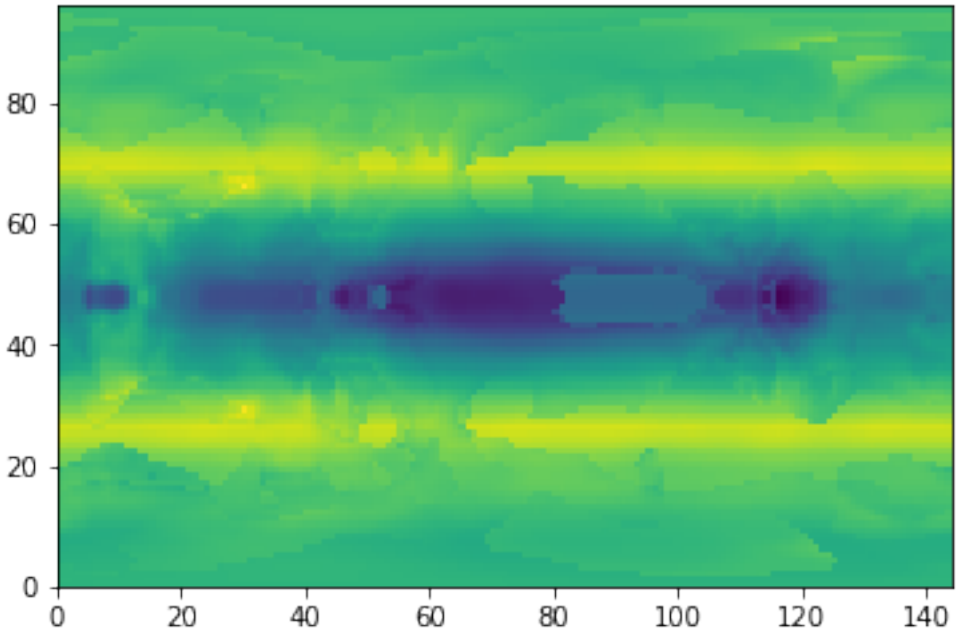
Here I simply confirm that is true. Then we take the zonal average and save an updated dataset.

The original file was made with an NCL script. The zonal asymmetry was present because I forgot to replace the OZONE array with its zonal average. This notebook just does that final step.

```
In [1]: import xarray as xr
        import matplotlib.pyplot as plt
        import datetime

In [2]: # ORIGINAL DATA
        F = xr.open_dataset('/Users/brianpm/Tub/aquaplanet_ozone_hightop_c160920.nc')

In [3]: F

Out[3]: <xarray.Dataset>
        Dimensions:  (lat: 96, lev: 69, lon: 144, time: 12)
        Coordinates:
          * time     (time) float64 4.382e+04 4.384e+04 4.388e+04 4.390e+04 ...
          * lev      (lev) float32 5e-06 1e-05 1.5e-05 2.5e-05 4.5e-05 7e-05 1e-04 ...
          * lat      (lat) float64 -90.0 -88.11 -86.21 -84.32 -82.42 -80.53 -78.63 ...
          * lon      (lon) float64 0.0 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 22.5 ...
        Data variables:
            OZONE    (time, lev, lat, lon) float64 ...
            P0       float64 ...
            date     (time) int32 ...
            datesec  (time) int32 ...
        Attributes:
            title:        Aquaplanet ozone data set
            institution:  NCAR
            source:       Brian Medeiros <brianpm@ucar.edu>
            comment:      Blended data based on APE ozone (from AMIP II) and WACCM cl...
            history:      Thu Sep 22 13:17:56 2016: ncatted -O -a units,OZONE,m,c,FRA...
            NCO:          "4.5.5"
```

In [7]:
```
# JUST PLOT A MAP TO SEE THE ZONAL ASYMMETRY
plt.pcolormesh(F['OZONE'].isel(time=1).sel(lev=1000, method='nearest'))
```

Out[7]:
```
<matplotlib.collections.QuadMesh at 0x1215da3c8>
```



In [8]:
```
# APPLY ZONAL AVERAGE
ozone_zonal_average = F['OZONE'].mean(dim='lon')
```

In [9]:
```
ozone_zonal_average
```

Out[9]:
```
<xarray.DataArray 'OZONE' (time: 12, lev: 69, lat: 96)>
array([[[5.327674e-13, 5.154311e-13, ..., 5.154311e-13, 5.327674e-13],
        [1.624036e-11, 1.638772e-11, ..., 1.638772e-11, 1.624036e-11],
        ...,
        [2.391247e-08, 2.390994e-08, ..., 2.337224e-08, 2.337057e-08],
        [2.260400e-08, 2.262803e-08, ..., 2.377535e-08, 2.347257e-08]],

       [[5.327674e-13, 5.154311e-13, ..., 5.154311e-13, 5.327674e-13],
        [1.624036e-11, 1.638772e-11, ..., 1.638772e-11, 1.624036e-11],
        ...,
        [2.391247e-08, 2.390994e-08, ..., 2.337224e-08, 2.337057e-08],
        [2.260400e-08, 2.262803e-08, ..., 2.377535e-08, 2.347257e-08]],

       ...,

       [[5.327674e-13, 5.154311e-13, ..., 5.154311e-13, 5.327674e-13],
```

```
                [1.624036e-11, 1.638772e-11, ..., 1.638772e-11, 1.624036e-11],
                ...,
                [2.391247e-08, 2.390994e-08, ..., 2.337224e-08, 2.337057e-08],
                [2.260400e-08, 2.262803e-08, ..., 2.377535e-08, 2.347257e-08]],

               [[5.327674e-13, 5.154311e-13, ..., 5.154311e-13, 5.327674e-13],
                [1.624036e-11, 1.638772e-11, ..., 1.638772e-11, 1.624036e-11],
                ...,
                [2.391247e-08, 2.390994e-08, ..., 2.337224e-08, 2.337057e-08],
                [2.260400e-08, 2.262803e-08, ..., 2.377535e-08, 2.347257e-08]]])
        Coordinates:
          * time     (time) float64 4.382e+04 4.384e+04 4.388e+04 4.390e+04 ...
          * lev      (lev) float32 5e-06 1e-05 1.5e-05 2.5e-05 4.5e-05 7e-05 1e-04 ...
          * lat      (lat) float64 -90.0 -88.11 -86.21 -84.32 -82.42 -80.53 -78.63 ...
```

```
In [10]: # BROADCAST ZONAL AVERAGE TO FULL ARRAY SIZE
         ozone1, ozone_za = xr.broadcast(F['OZONE'], ozone_zonal_average)
```

```
In [39]: # CONFIRM THAT ARBITRARY LONGITUDES ARE EQUAL
         (ozone_za[:,:,:,1] == ozone_za[:,:,:,99]).all().values
```

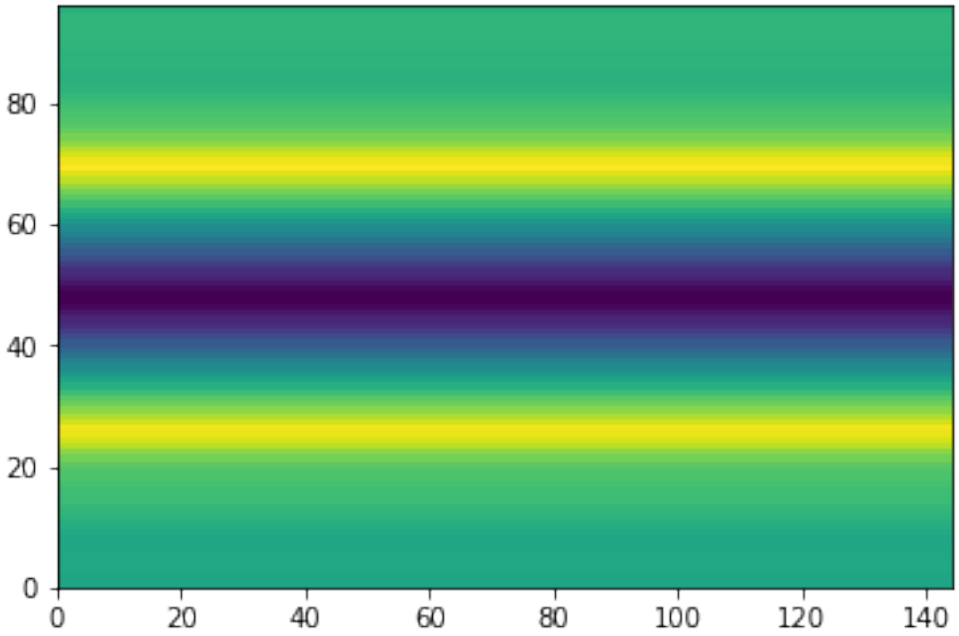
```
Out[39]: array(True)
```

```
In [14]: # A NEW OBJECT THAT IS THE SAME AS OUR INPUT DATA
         # NOTE: This is an unnecessary step, as this just makes a new reference to F.
         out_ds = F
```

```
In [15]: # INSERT ZONAL AVERAGE OZONE
         out_ds['OZONE'] = ozone_za
```

```
In [33]: # CONFIRM ZONAL SYMMETRY IN OUTPUT DATASET
         plt.pcolormesh(out_ds['OZONE'].isel(time=1).sel(lev=1000, method='nearest'))
```

```
Out[33]: <matplotlib.collections.QuadMesh at 0x12fd561d0>
```




```
In [25]: # APPEND A STATEMENT TO THE HISTORY ATTRIBUTE
         out_ds.attrs['history'] += f"{str(datetime.date.today())}: Replaced OZONE with zonal_a

In [27]: out_ds.attrs['history']

Out[27]: 'Thu Sep 22 13:17:56 2016: ncatted -O -a units,OZONE,m,c,FRACTION aquaplanet_ozone_hig

In [34]: # SAVE THE REVISED DATASET TO A NEW FILE
         out_ds.to_netcdf(f'/Users/brianpm/Tub/aquaplanet_ozone_hightop_c{datetime.date.today()
```

This notebook was written by Brian Medeiros (brianpm@ucar.edu) on 12 April 2018. The revised data set will be published to earthsystemgrid.org pending instructions on how to publish a change.