In [1]:
```
import numpy as np
import cdms2 as cd
import vcs, cdutil, genutil
import matplotlib.pyplot as plt
from eofs.cdms import Eof
```

In [2]:
```
canvas = vcs.init()
```

In [3]:
```
file = cd.open("/Users/bengoldman/HadISST_sst.nc")
```

In [4]:
```
sst = file("sst")
```

```
/opt/anaconda3/envs/cdat81/lib/python3.6/site-packages/cdms2/axis.py:
1685: UserWarning:
Your first bounds[0,0] -180.000000000000000 will be corrected to -180
.000000000000000
Your bounds bounds[-1,1] 180.000000000000000 will be corrected to 180
.000000000000000
  warnings.warn(msg, UserWarning)
```

In [5]:
```
nino34 = cdutil.region.domain(longitude = (360-170, 360-120), latitude
```

In [6]:
```
nino = file("sst", nino34)
```

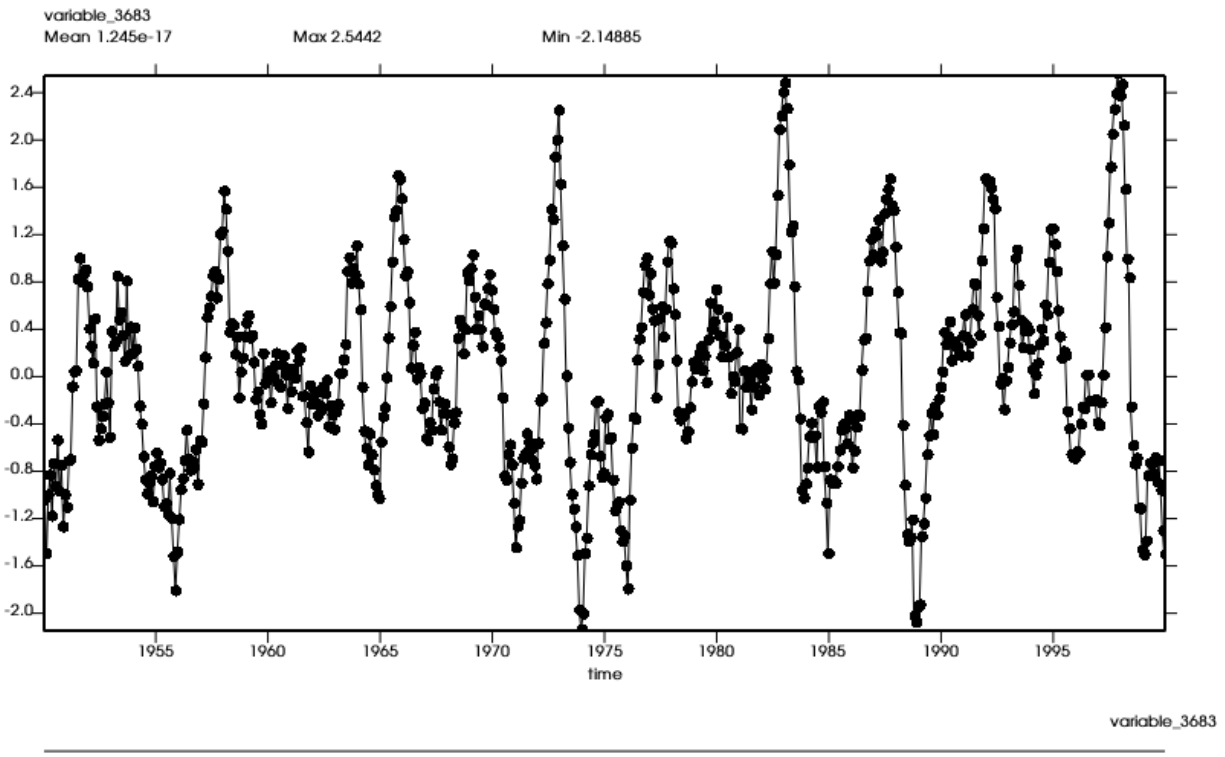
In [7]:
```
cdutil.setTimeBoundsMonthly(nino)
```

In [8]:
```
nino_plt = cdutil.averager(cdutil.ANNUALCYCLE.departures(nino(time = (
```

In [9]:
```
canvas = vcs.init()
```

In [10]:
```
canvas.plot(nino_plt)
```

Out[10]:



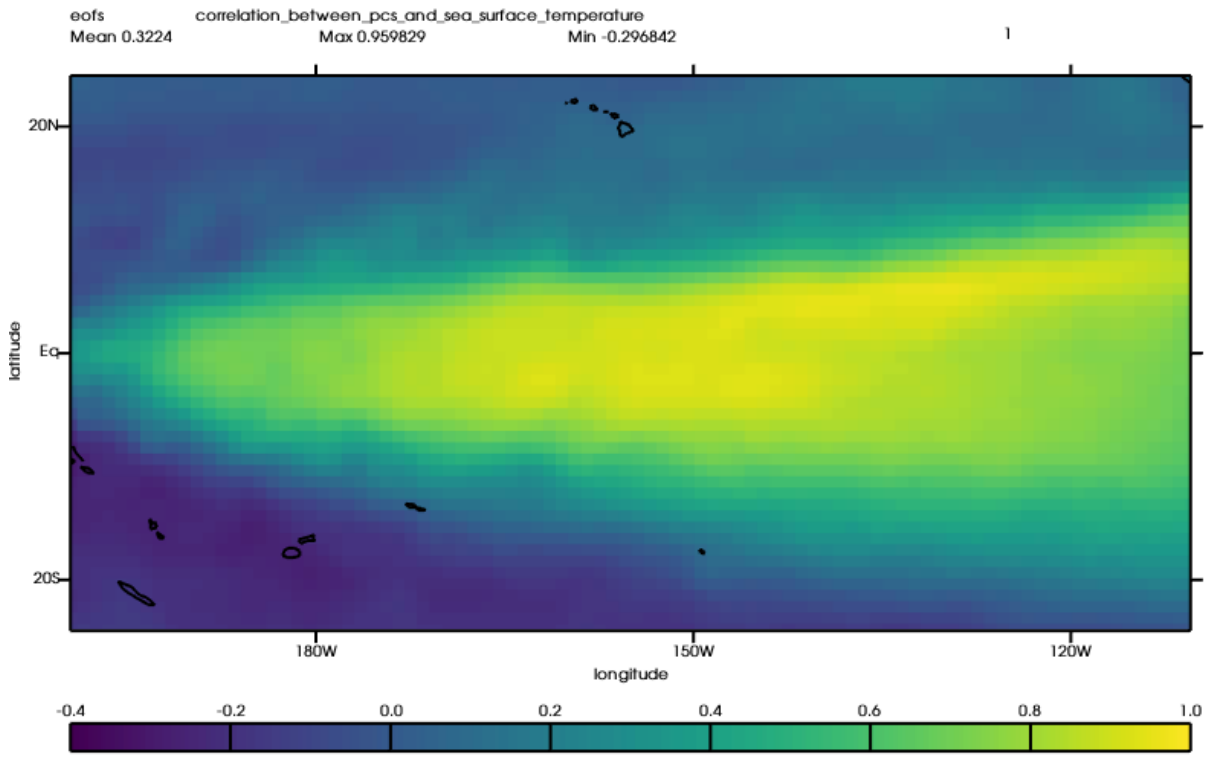
In [11]:
```
canvas.close()
```

In [12]:
```
solver = Eof(sst(lat = (-25,25), lon = (160, 360-110), time = ("1950-0
```

In [13]:
```
nino_eof = solver.eofsAsCorrelation(neofs = 2)
```

In [14]:
```
canvas.plot(nino_eof(eof = 1))
```

Out[14]:

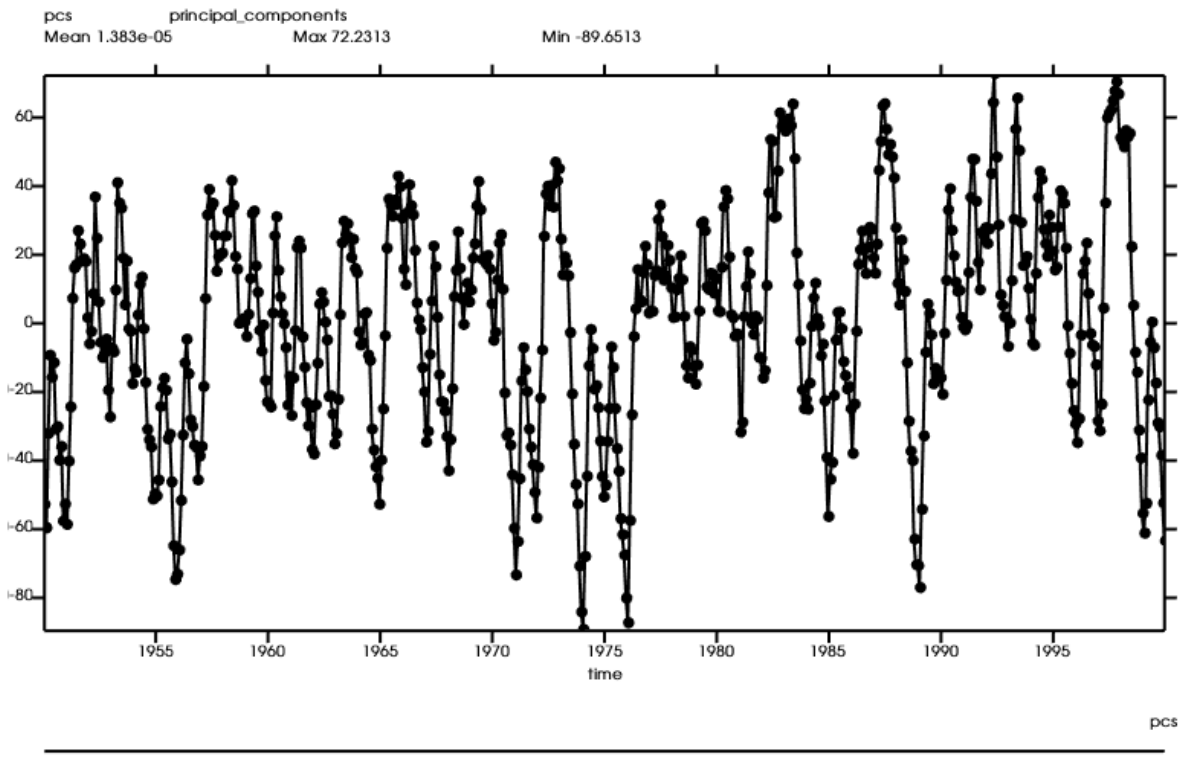


In [15]:
```
canvas.close()
```

In [16]:
```
nino_pc = solver.pcs(npcs = 2)
```

In [17]:
```
canvas.plot(nino_pc[...,1])
```

Out[17]:



In [18]:
```
canvas.close()
```

In [19]:
```
genutil.statistics.correlation(nino_pc, nino_plt)
```

Out[19]:
```
correlation
masked_array(data=[-0.0023489692372385936, 0.8579975823746138],
             mask=[False, False],
       fill_value=1e+20)
```

In [20]:
```
fig = plt.figure(figsize = (10,10))
plt.xlabel("Principal Component")
plt.ylabel("Nino 3.4 temperature anomaly")
plt.title("Methods of Measuring El Niño")
plt.figsize = (10,10)
plt.text(-80,2, "Correlation coefficient = 0.875")

plt.scatter(nino_pc[...,1], nino_plt, color = "k", marker = "x")
```

Out[20]: <matplotlib.collections.PathCollection at 0x143f88c50>