Plot some time series of Speedy results

In [1]:
```
import numpy as np
import xarray as xr
from matplotlib import pyplot as plt
plt.rcParams['figure.figsize'] = (12, 6)
%config InlineBackend.figure_format = 'retina'
%xmode Minimal

import warnings
warnings.filterwarnings('ignore')
```

```
Exception reporting mode: Minimal
```

In [2]:
```
run='Climate_Ocean_Land'
runn=run+'_0002'
data_file = '/Users/vidale/SpeedyWeather/run_'+runn+'/output.nc'
#data_file = '/Users/vidale/SpeedyWeather/output_run'+runn+'.nc'

#open data using x_array
data = xr.open_dataset(data_file)

#slice the data from
#data = data.sel(time=slice('1950','2023')).drop_vars('time_bnds')
data
```

Out[2]: xarray.Dataset

▶ Dimensions: (**time**: 292001, **lon**: 64, **lat**: 32, **layer**: 8, **soil_layer**: 2)

▼ Coordinates:

time	(time)	datetime64[ns]	2000-01-01 ... 2...
lon	(lon)	float64	0.0 5.625 11.25 ....
lat	(lat)	float64	85.76 80.27 74.7...
layer	(layer)	float32	0.0625 0.1875 ......
soil_layer	(soil_layer)	int64	1 2

▶ Data variables: (28)

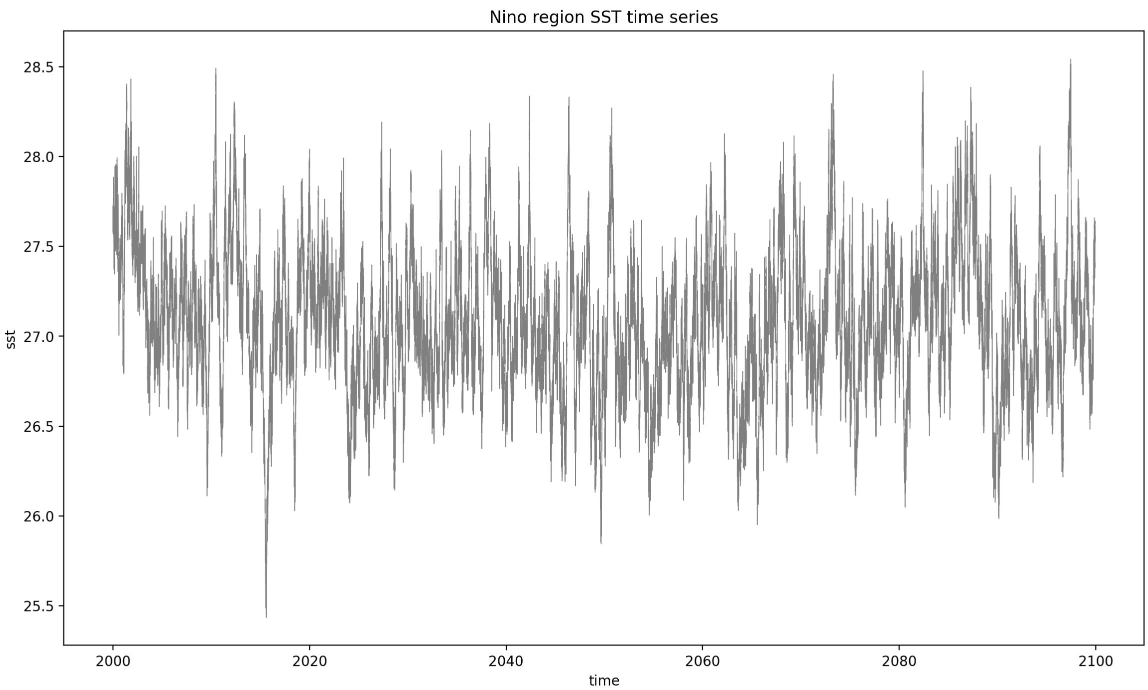
▶ Indexes: (5)

▶ Attributes: (0)

In [3]:
```
#nino_region
nino_region = data.sel(lon=slice(190, 240), lat=slice(6,-6))
```

In [4]:
```
#the mean over the entire area (spatially)
nino_region_mean = nino_region.mean(dim=('lat','lon'))

#the spatial and temporal mean for the entire area
nino_region_mean_climate = nino_region_mean.sel(time=slice('2000-01

#build the anomoly dataset
nino_anom = (
    nino_region_mean['sst'].sel(time=slice('2000-01-01', '2099-12-0
    nino_region_mean_climate['sst']
)
```

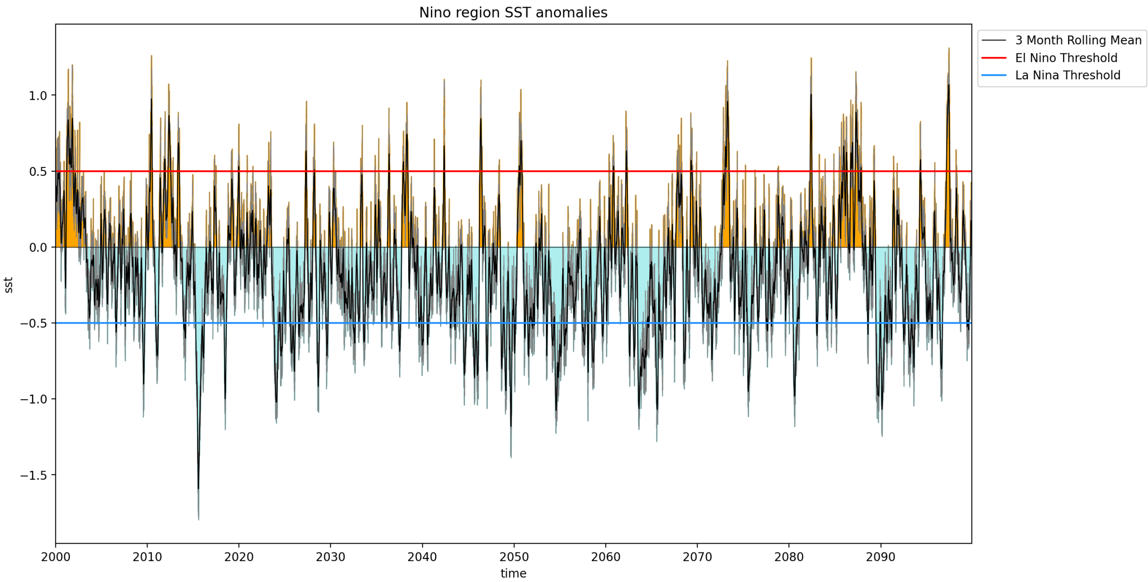
In [5]:
```
#plot the means
fig=plt.figure(figsize=(14,8))
nino_region_mean.sst.plot(linewidth=0.5, color='grey')
plt.title("Nino region SST time series")
#show plot
plt.show()
fig.savefig("NinoSST_run_"+runn+".png")
```



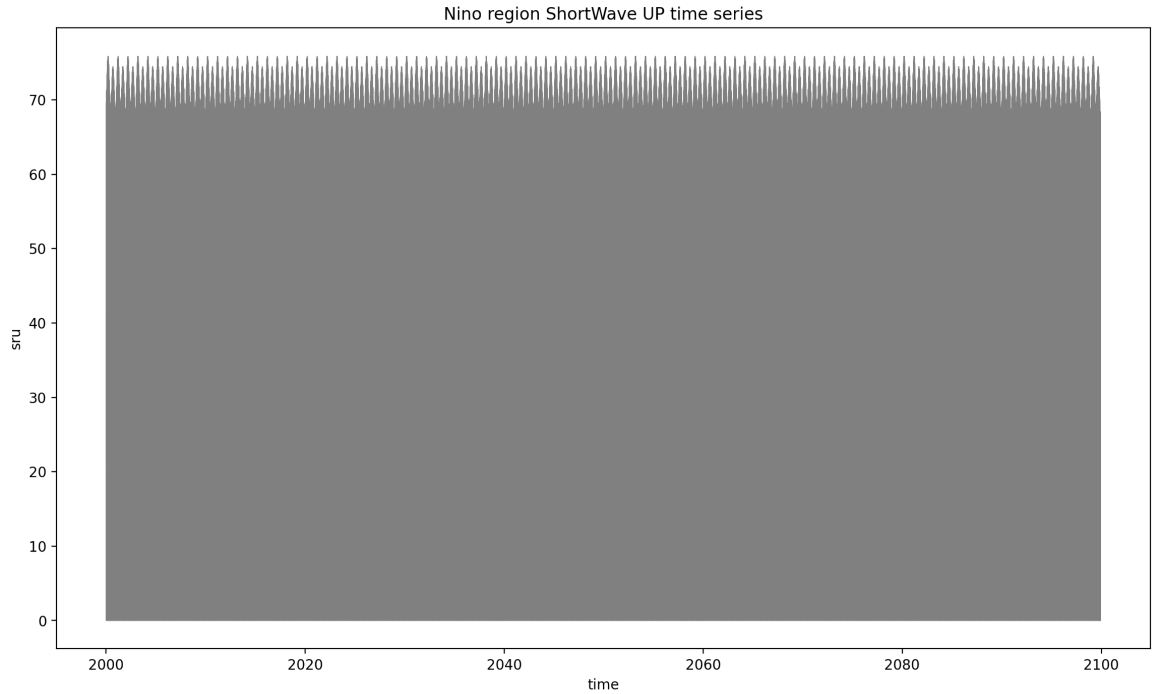
In [6]:
```
#create a rolling 3 month mean dataset
#rolling_mean = nino_anom.rolling(time=3, center=True).mean()
rolling_mean = nino_anom.rolling(time=360, center=True).mean()
#define mask for positive and negative anomoly values
positive = nino_anom.where(nino_anom > 0)
negative = nino_anom.where(nino_anom < 0)
```

In [7]:
```
fig=plt.figure(figsize=(14,8))

#plot the anomalies
nino_anom.plot(linewidth=0.5, color='grey')

#fill the spaces between the 0 line and the anomaly values
plt.fill_between(nino_anom.time, 0, positive, color='orange')
plt.fill_between(nino_anom.time, 0, negative, color='paleturquoise'
```

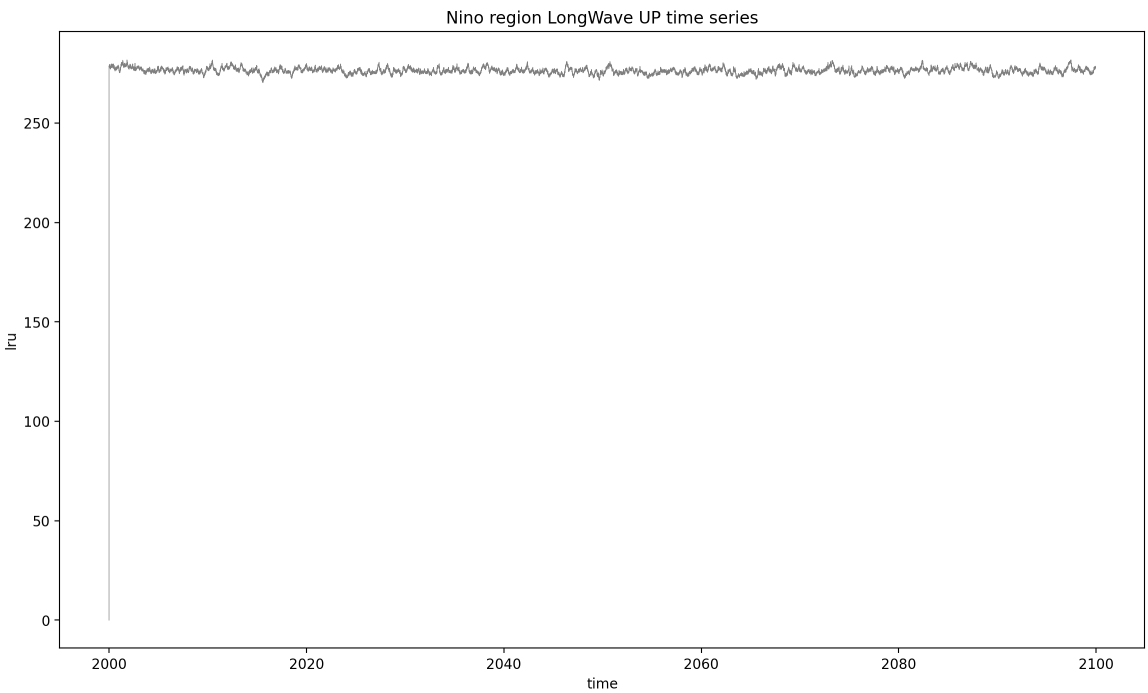
```
#plot the rolling mean
rolling_mean.plot(color='k', linewidth=0.8, label='3 Month Rolling 

#create horizonal lines to demark 0, el nino and la nina thresholds
plt.axhline(0, linewidth=0.5, color='black')
plt.axhline(0.5, color='red', label='El Nino Threshold')
plt.axhline(-0.5, color='dodgerblue', label='La Nina Threshold')

#set the limits of the x axis
plt.xlim(nino_anom.time.min(), nino_anom.time.max())

#create a legend and place it outside of plot
plt.legend(bbox_to_anchor=(1,1))
plt.title("Nino region SST anomalies")

#show plot
plt.show()
fig.savefig("NinoSSTAnomalies_run_"+runn+".png")
```



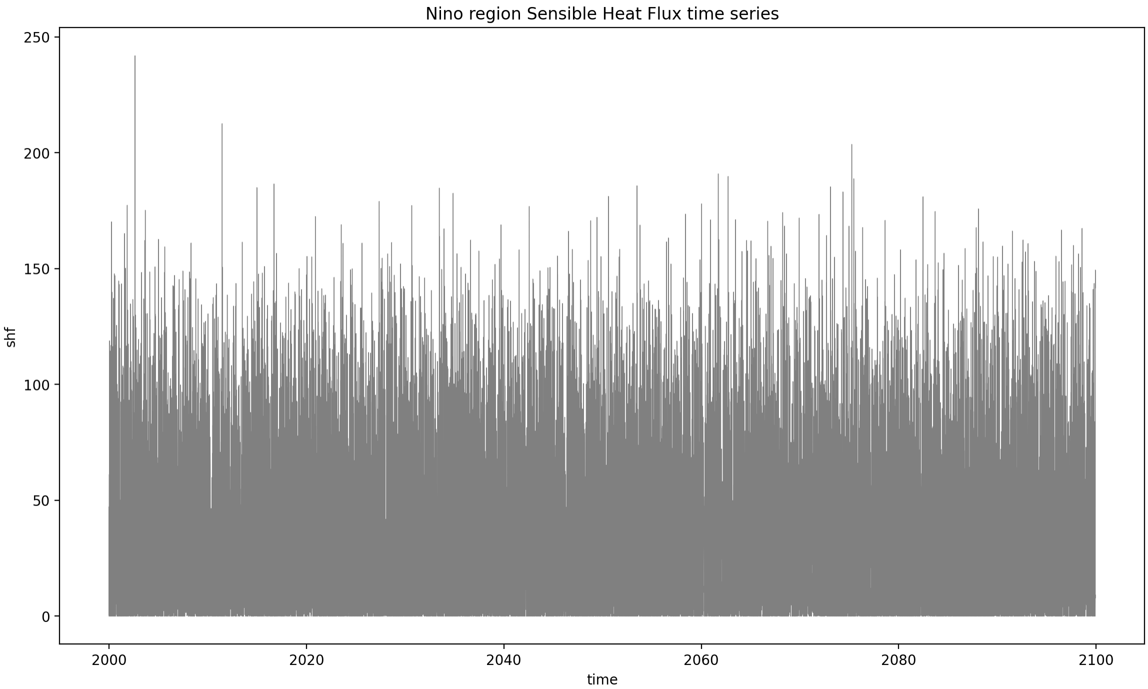
In [8]:
```
#plot the means
fig=plt.figure(figsize=(14,8))
nino_region_mean.sru.plot(linewidth=0.5, color='grey')
plt.title("Nino region ShortWave UP time series")
#show plot
plt.show()
fig.savefig("SRU_run_"+runn+".png")
```



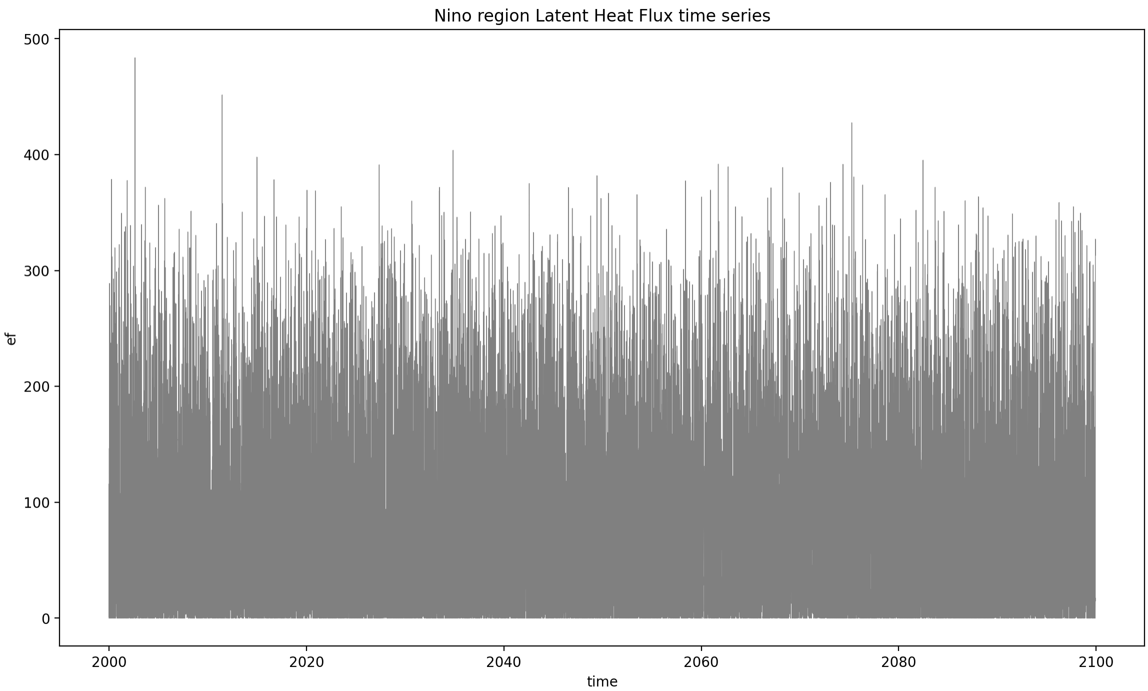
In [9]:
```
#plot the means
fig=plt.figure(figsize=(14,8))
nino_region_mean.lru.plot(linewidth=0.5, color='grey')
plt.title("Nino region LongWave UP time series")
#show plot
plt.show()
fig.savefig("LRU_run_"+runn+".png")
```



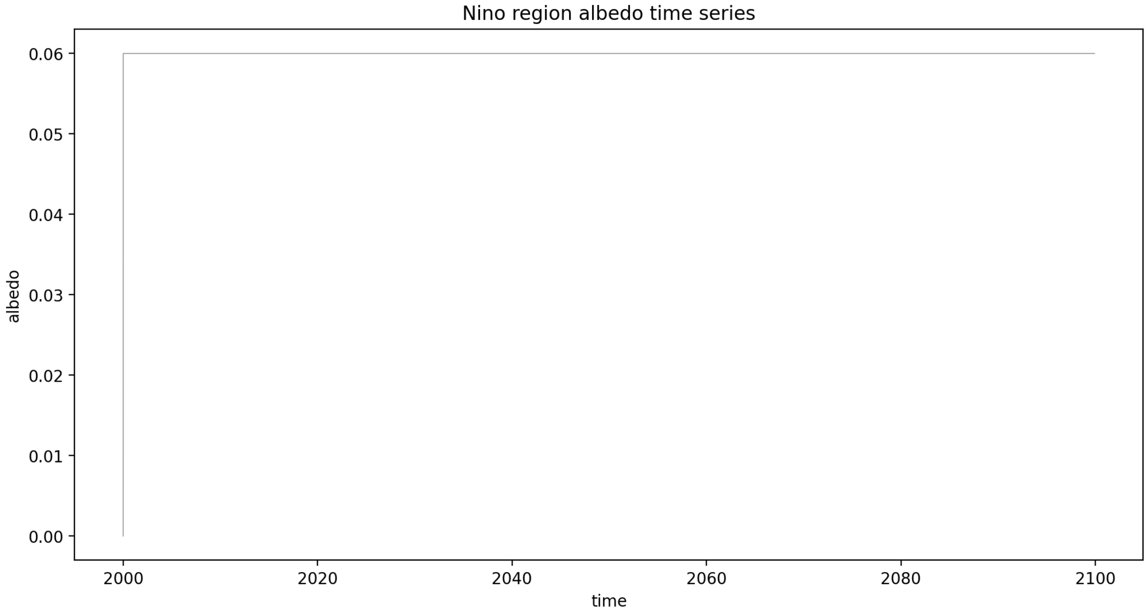
In [10]:
```
#plot the means
fig=plt.figure(figsize=(14,8))
nino_region_mean.shf.plot(linewidth=0.5, color='grey')
plt.title("Nino region Sensible Heat Flux time series")
#show plot
plt.show()
fig.savefig("SHF_run_"+runn+".png")
```



In [11]:
```
#plot the means
fig=plt.figure(figsize=(14,8))
lhf=2.5E6*nino_region_mean.ef
lhf.plot(linewidth=0.5, color='grey')
plt.title("Nino region Latent Heat Flux time series")
#show plot
plt.show()
fig.savefig("LHF_run_"+runn+".png")
```



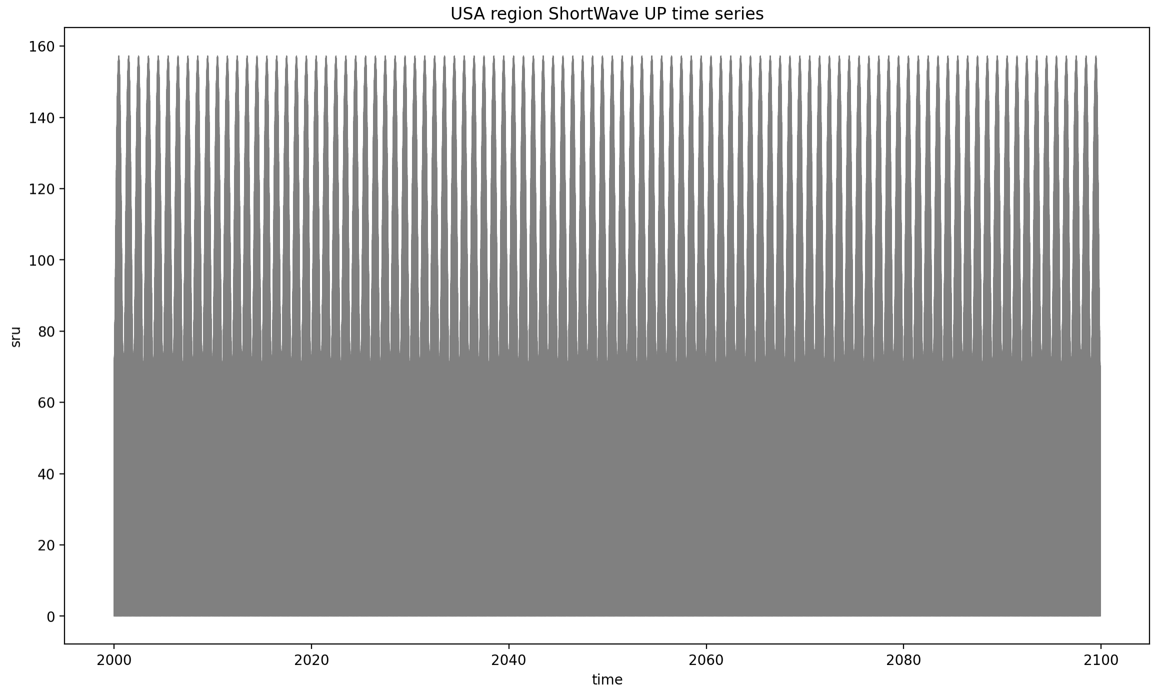
In [12]:
```
#plot the means
nino_region_mean.albedo.plot(linewidth=0.5, color='grey')
plt.title("Nino region albedo time series")
#show plot
plt.show()
```



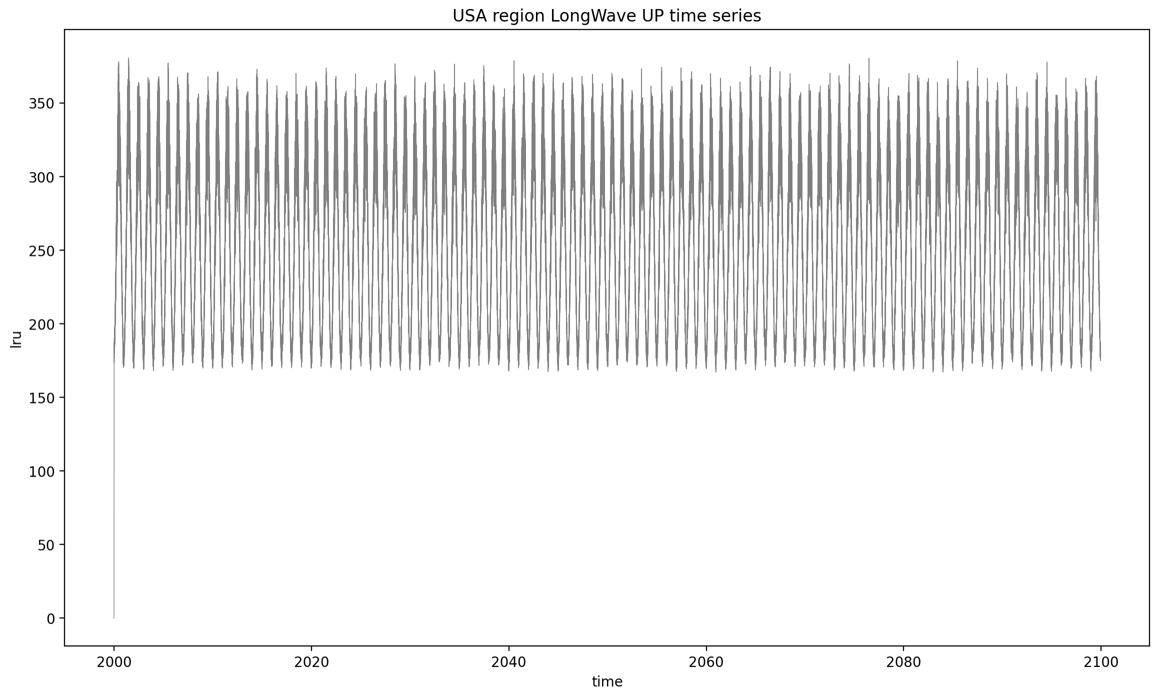
In [13]:
```
USA_region = data.sel(lon=slice(236, 294), lat=slice(50, 25))
#USA_region
```

In [14]:
```
#the mean over the entire area (spatially)
USA_region_mean = USA_region.mean(dim=('lat','lon'))

#the spatial and temporal mean for the entire area
USA_region_mean_climate = USA_region_mean.mean()

#build the anomoly dataset
#USA_anom = USA_month_mean - nino_region_mean
```

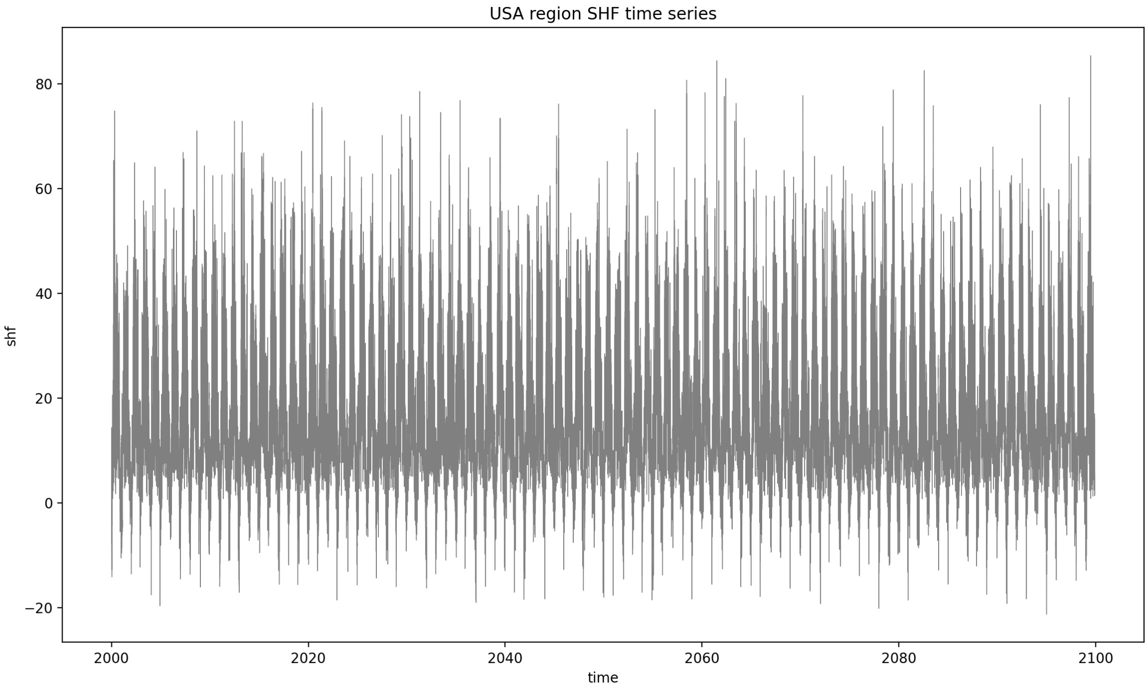
In [15]:
```
#plot the means
fig=plt.figure(figsize=(14,8))
USA_region_mean.sru.plot(linewidth=0.5, color='grey')
plt.title("USA region ShortWave UP time series")
#show plot
plt.show()
fig.savefig("SRU_run_USA_"+runn+".png")
```



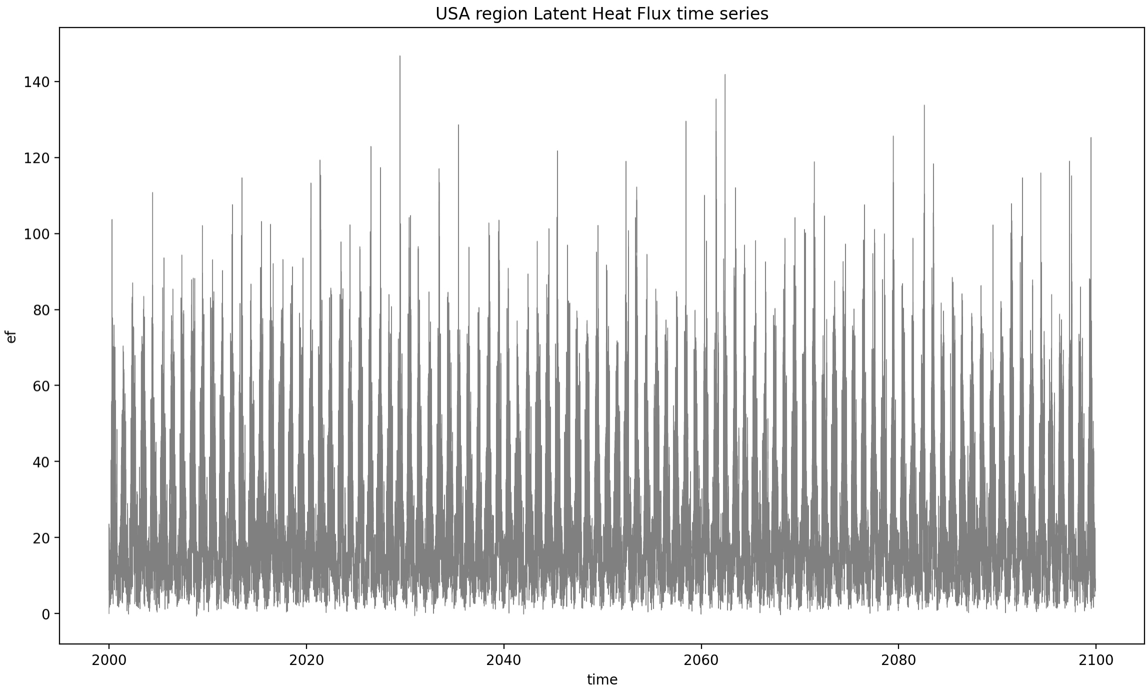
In [16]:
```
#plot the means
fig=plt.figure(figsize=(14,8))
USA_region_mean.lru.plot(linewidth=0.5, color='grey')
plt.title("USA region LongWave UP time series")
#show plot
plt.show()
fig.savefig("LRU_run_USA_"+runn+".png")
```



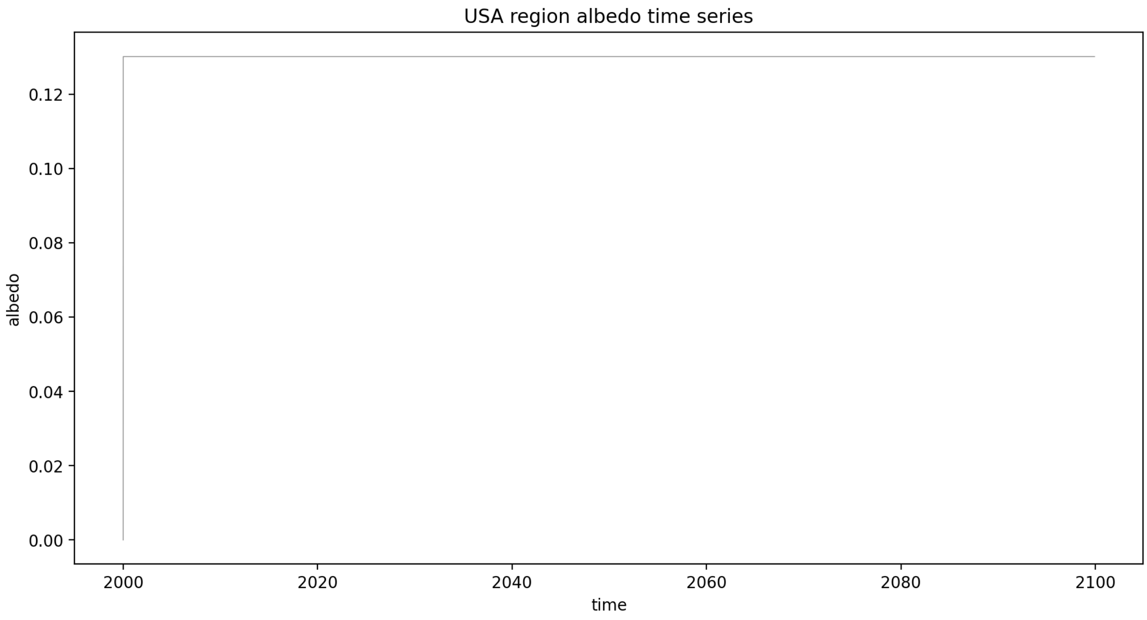
In [17]:
```
#plot the means
fig=plt.figure(figsize=(14,8))
USA_region_mean.shf.plot(linewidth=0.5, color='grey')
plt.title("USA region SHF time series")
#show plot
plt.show()
fig.savefig("SHF_run_USA_"+runn+".png")
```



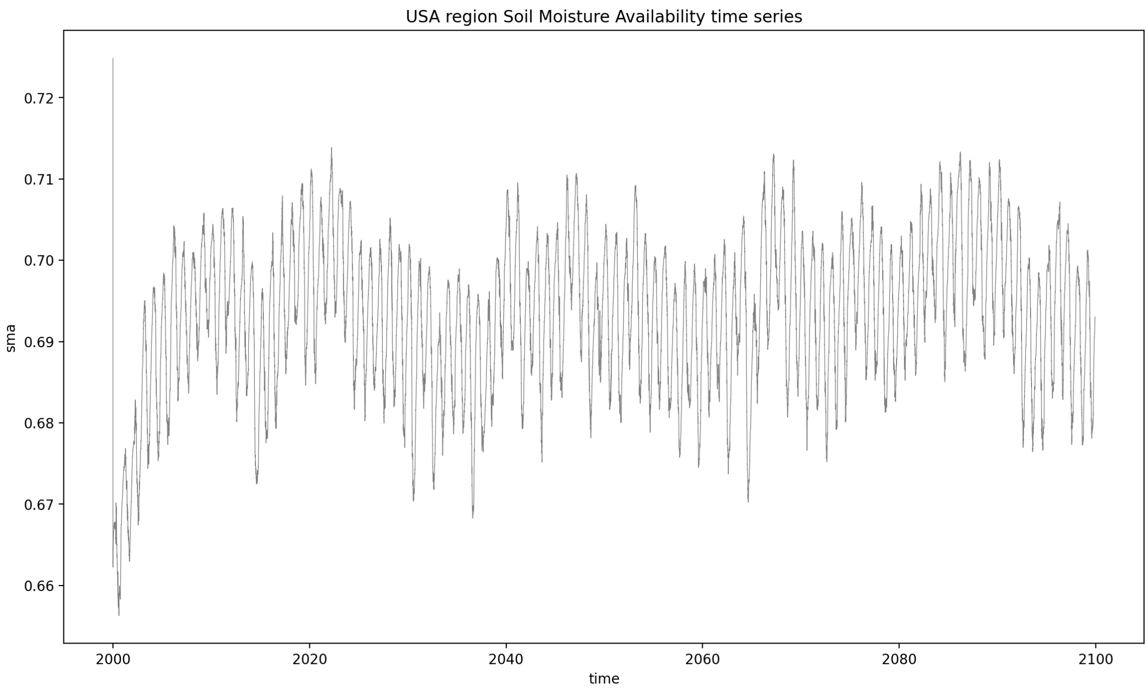
In [18]:
```
#plot the means
fig=plt.figure(figsize=(14,8))
lhf=2.5E6*USA_region_mean.ef
lhf.plot(linewidth=0.5, color='grey')
plt.title("USA region Latent Heat Flux time series")
#show plot
plt.show()
fig.savefig("LHF_run_USA_"+runn+".png")
```



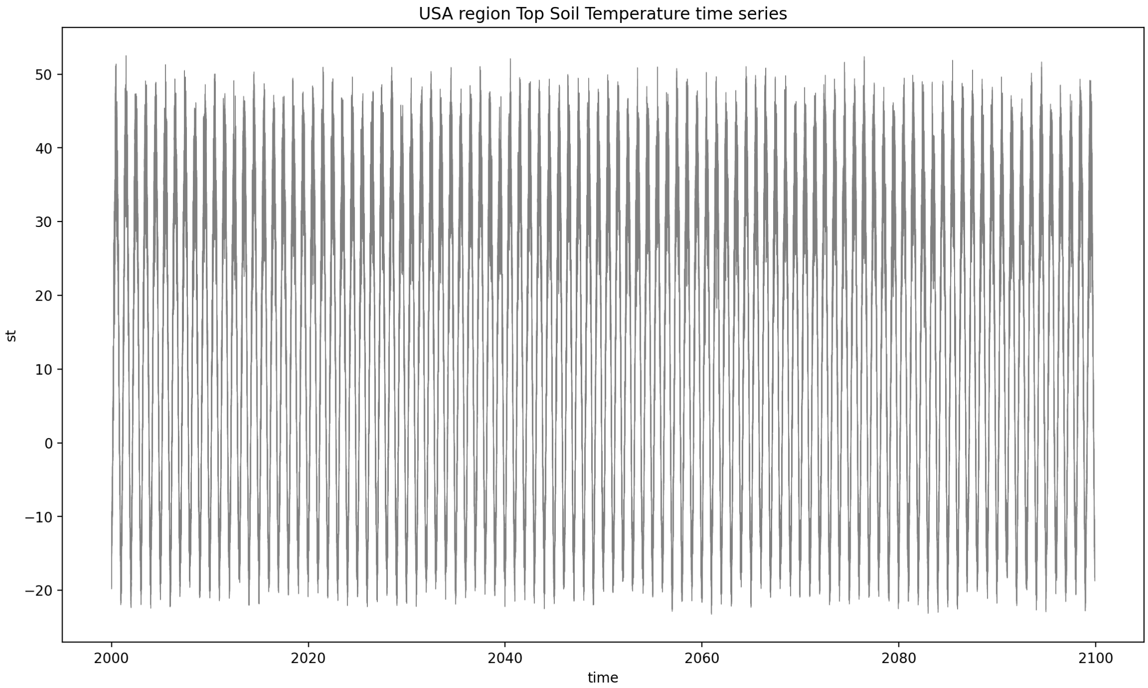
In [19]:
```
#plot the means
USA_region_mean.albedo.plot(linewidth=0.5, color='grey')
plt.title("USA region albedo time series")
#show plot
plt.show()
```



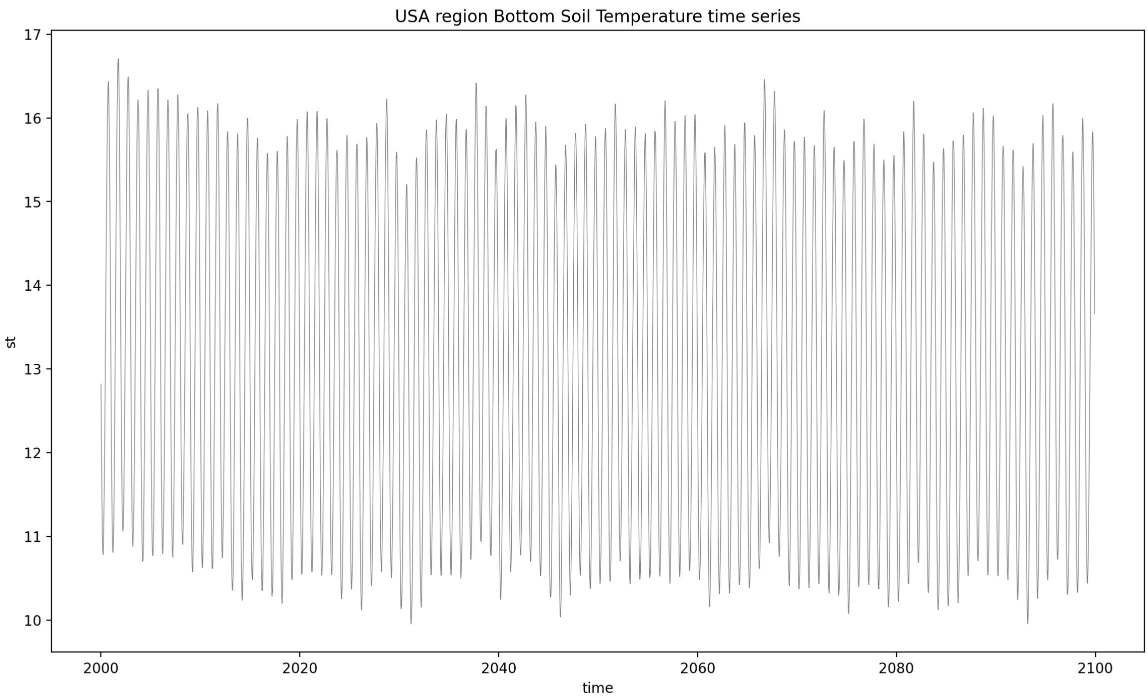
In [20]:
```
fig=plt.figure(figsize=(14,8))
USA_region_mean.sma.plot(linewidth=0.5, color='grey')
plt.title("USA region Soil Moisture Availability time series")
#show plot
plt.show()
fig.savefig("SMA_run_USA_"+runn+".png")
```



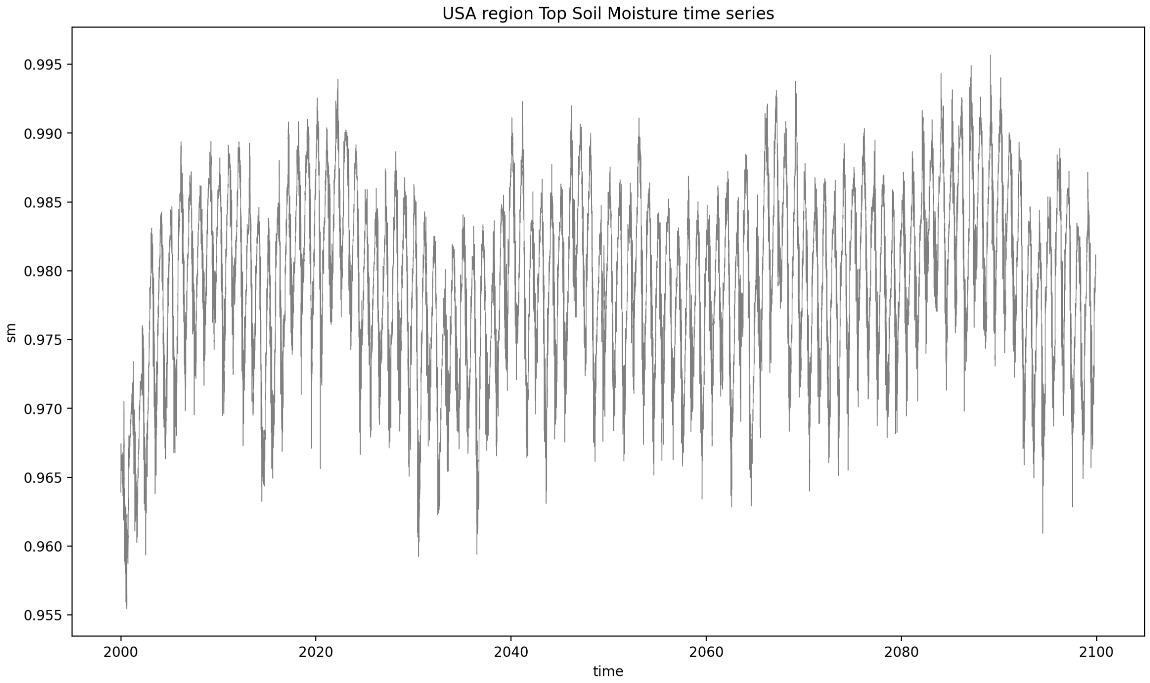
In [21]:
```
fig=plt.figure(figsize=(14,8))
st1=USA_region_mean.st[:,0]
st1.plot(linewidth=0.5, color='grey')
plt.title("USA region Top Soil Temperature time series")
#show plot
plt.show()
fig.savefig("ST1_run_USA_"+runn+".png")
```



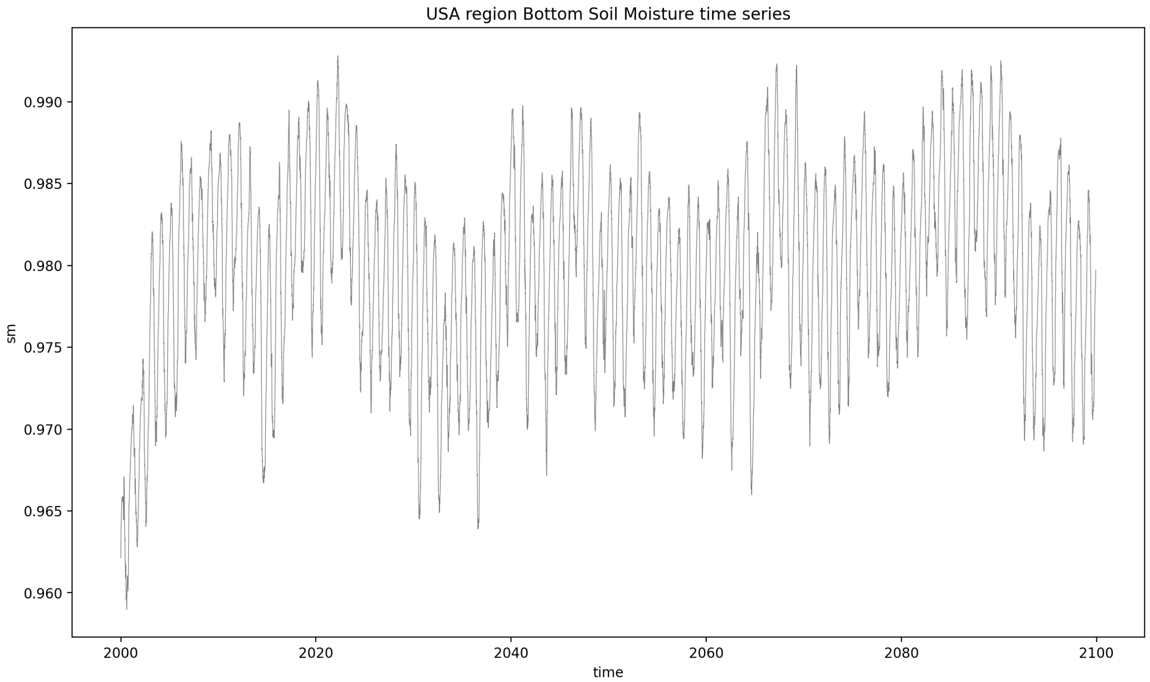
In [22]:
```
fig=plt.figure(figsize=(14,8))
st2=USA_region_mean.st[:,1]
st2.plot(linewidth=0.5, color='grey')
plt.title("USA region Bottom Soil Temperature time series")
#show plot
plt.show()
fig.savefig("ST2_run_USA_"+runn+".png")
```



In [23]:
```
fig=plt.figure(figsize=(14,8))
sm1=USA_region_mean.sm[:,0]
sm1.plot(linewidth=0.5, color='grey')
plt.title("USA region Top Soil Moisture time series")
#show plot
plt.show()
fig.savefig("SM1_run_USA_"+runn+".png")
```



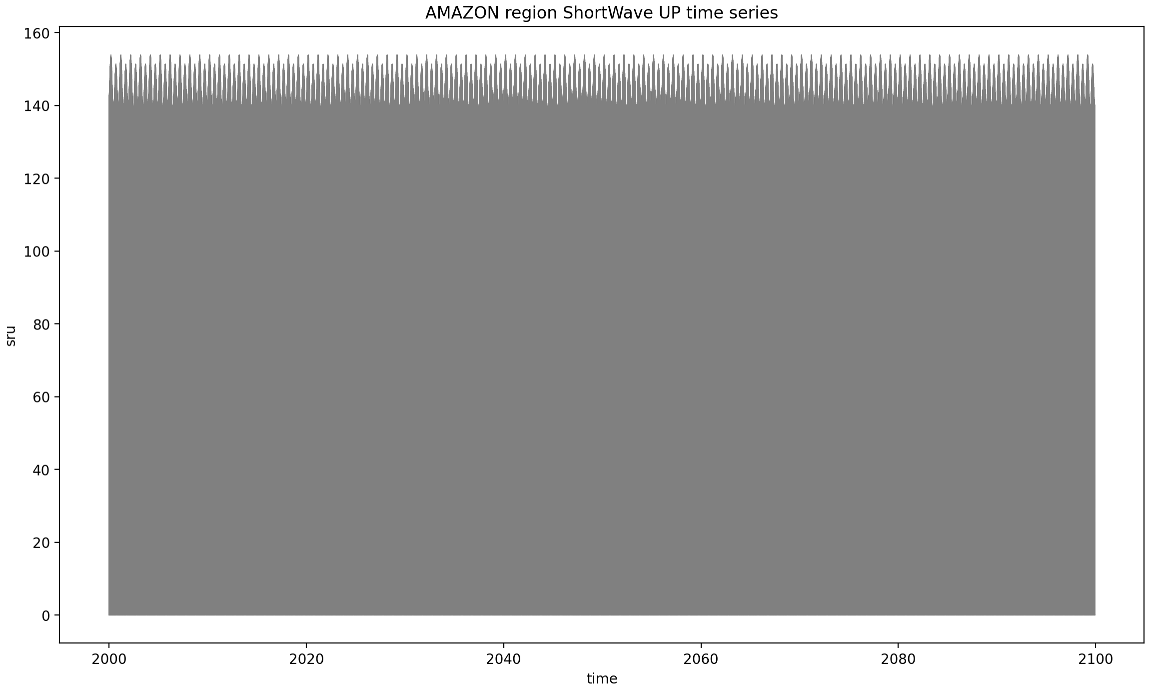
In [24]:
```
fig=plt.figure(figsize=(14,8))
sm2=USA_region_mean.sm[:,1]
sm2.plot(linewidth=0.5, color='grey')
plt.title("USA region Bottom Soil Moisture time series")
#show plot
plt.show()
fig.savefig("SM2_run_USA_"+runn+".png")
```



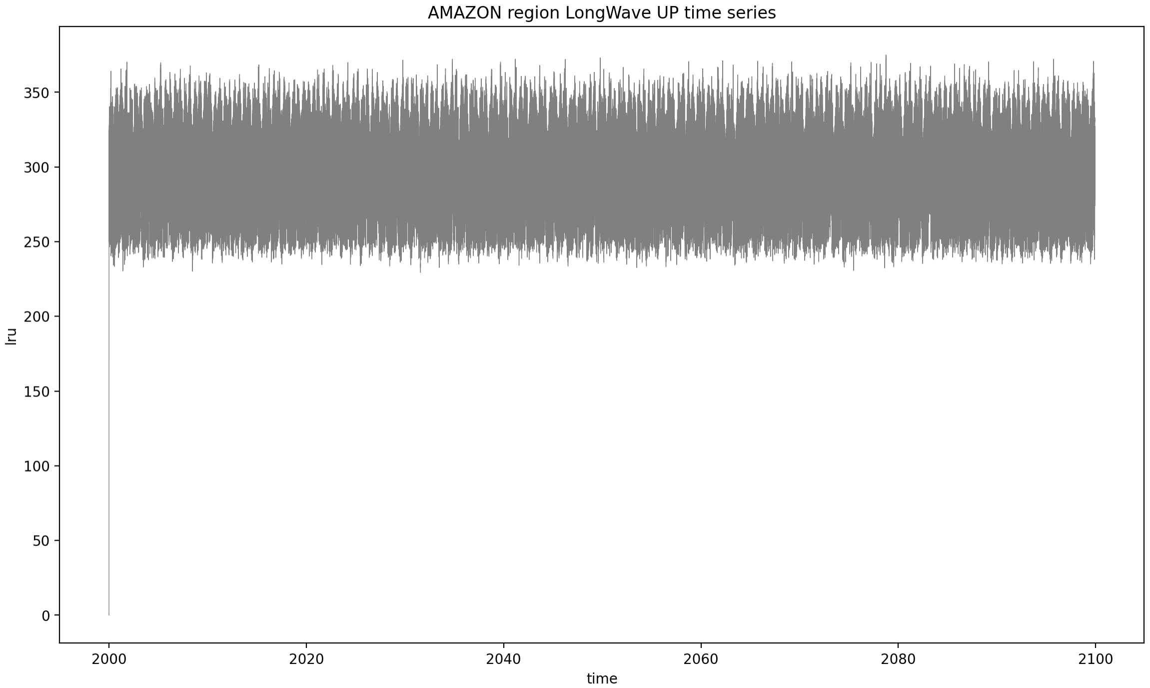
In [25]:
```
AMAZON_region = data.sel(lon=slice(285, 315), lat=slice(10, -10))
#AMAZON_region
```

In [26]:
```
#the mean over the entire area (spatially)
AMAZON_region_mean = AMAZON_region.mean(dim=('lat','lon'))

#the spatial and temporal mean for the entire area
AMAZON_region_mean_climate = AMAZON_region_mean.mean()
```

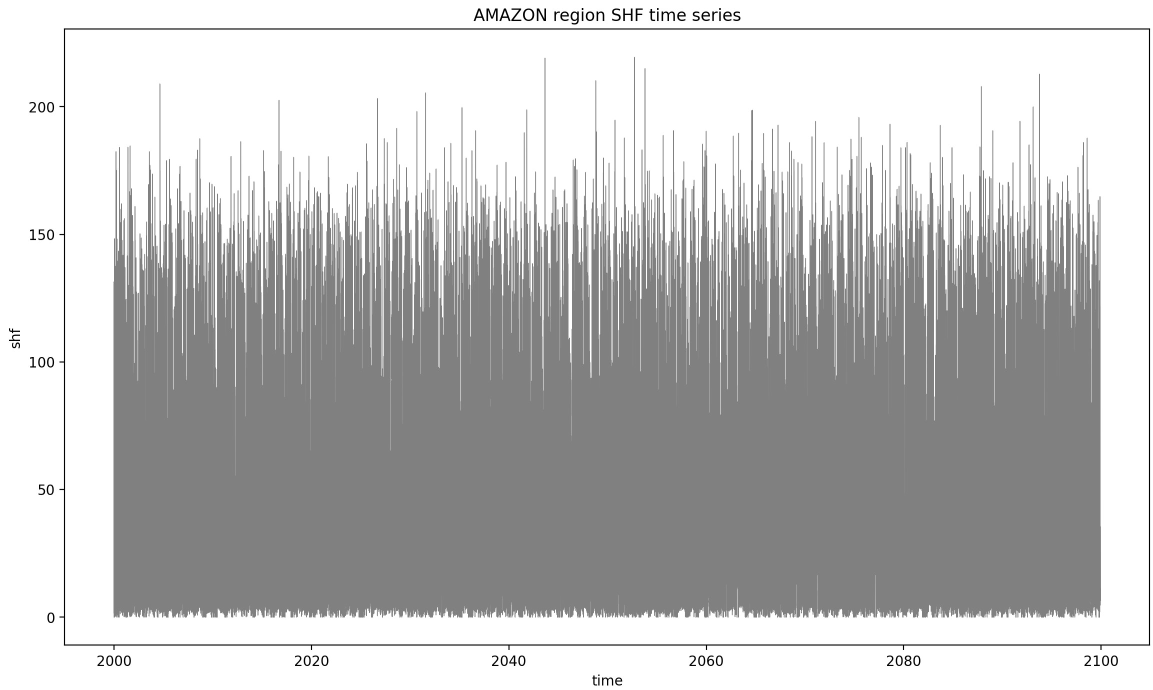
In [27]:
```
#plot the means
fig=plt.figure(figsize=(14,8))
AMAZON_region_mean.sru.plot(linewidth=0.5, color='grey')
plt.title("AMAZON region ShortWave UP time series")
#show plot
plt.show()
fig.savefig("SRU_run_AMAZON_"+runn+".png")
```



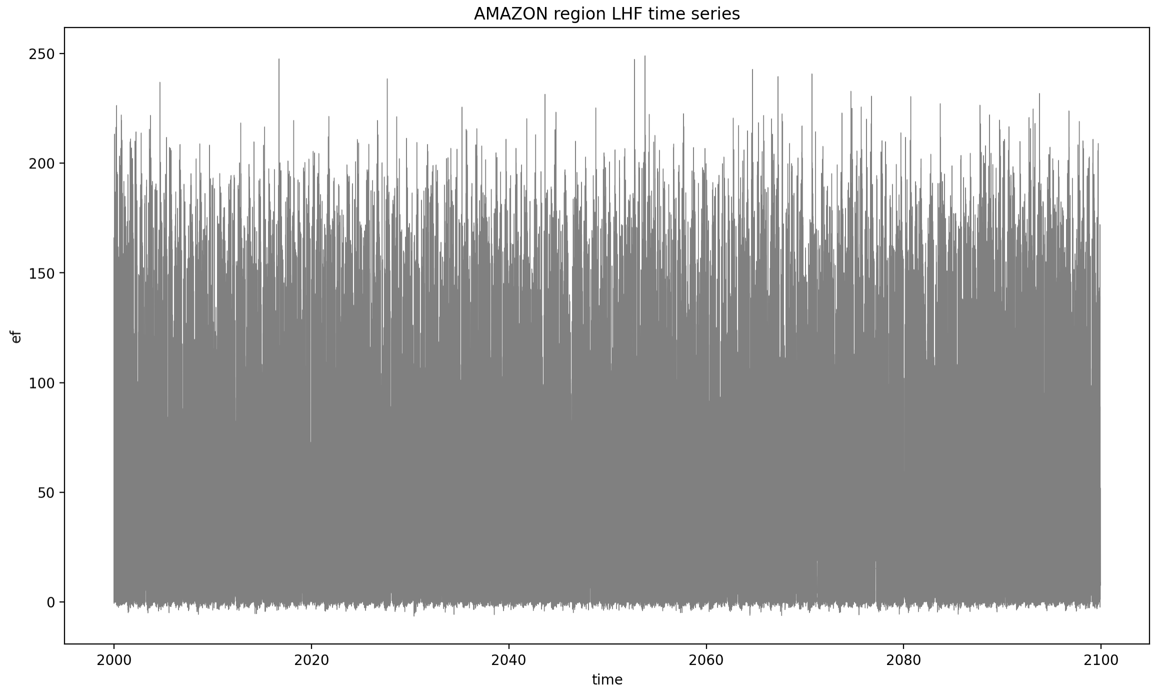
In [28]:
```
#plot the means
fig=plt.figure(figsize=(14,8))
AMAZON_region_mean.lru.plot(linewidth=0.5, color='grey')
plt.title("AMAZON region LongWave UP time series")
#show plot
plt.show()
fig.savefig("LRU_run_AMAZON_"+runn+".png")
```



In [29]:
```
#plot the means
fig=plt.figure(figsize=(14,8))
AMAZON_region_mean.shf.plot(linewidth=0.5, color='grey')
plt.title("AMAZON region SHF time series")
#show plot
plt.show()
fig.savefig("SHF_run_AMAZON_"+runn+".png")
```

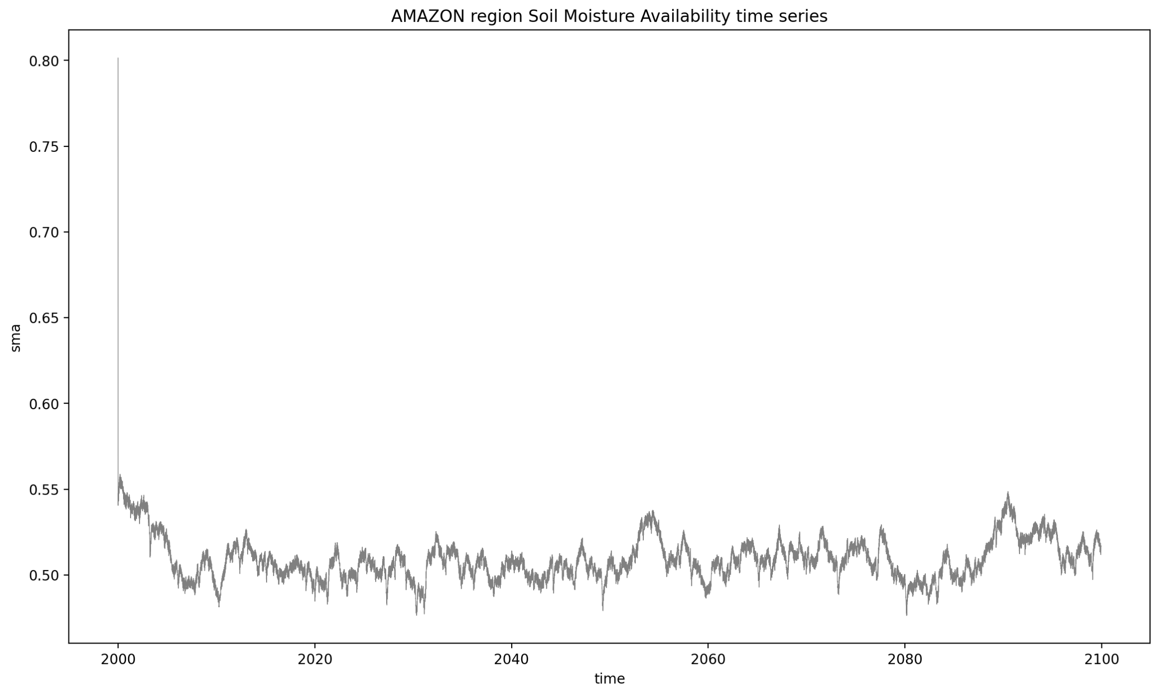


In [30]:
```
#plot the means
fig=plt.figure(figsize=(14,8))
lhf=2.5E6*AMAZON_region_mean.ef
lhf.plot(linewidth=0.5, color='grey')
plt.title("AMAZON region LHF time series")
#show plot
plt.show()
fig.savefig("LHF_run_AMAZON_"+runn+".png")
```



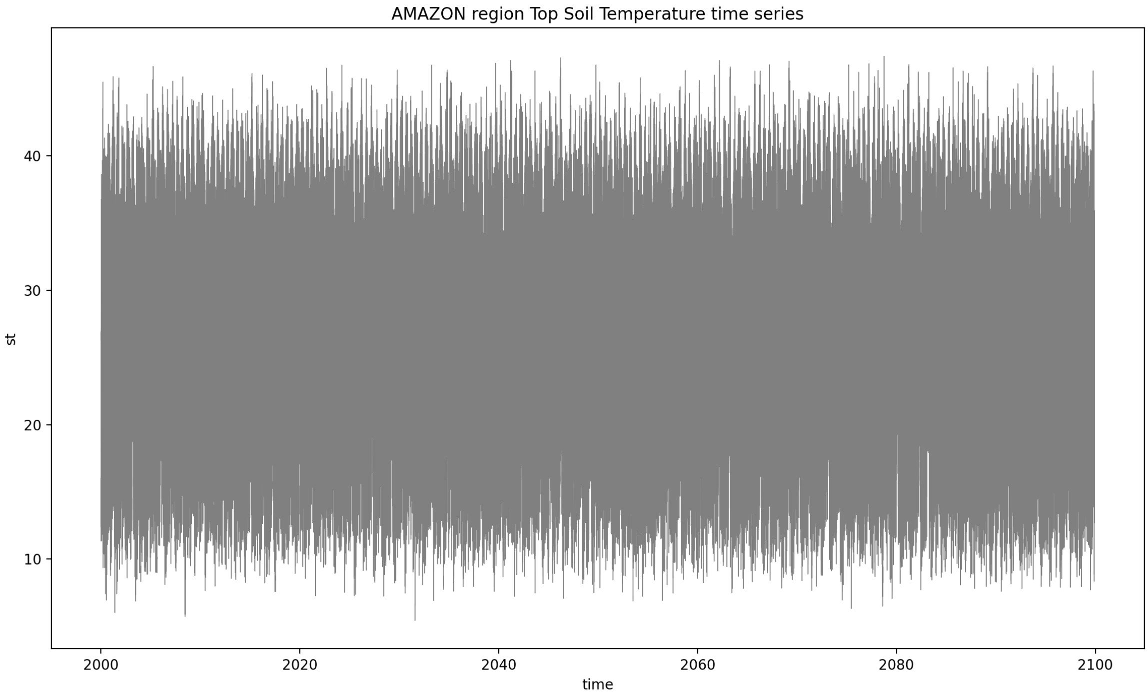
In [31]:

```
fig=plt.figure(figsize=(14,8))
AMAZON_region_mean.sma.plot(linewidth=0.5, color='grey')
plt.title("AMAZON region Soil Moisture Availability time series")
#show plot
plt.show()
fig.savefig("SMA_run_AMAZON_"+runn+".png")
```

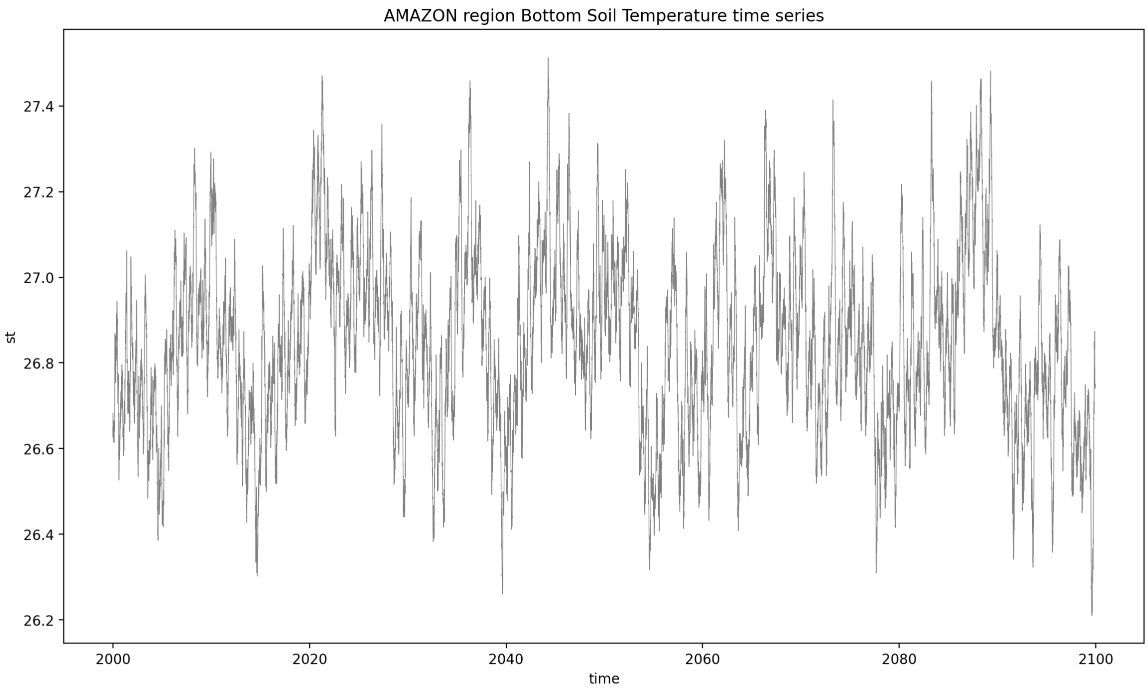


In [32]:

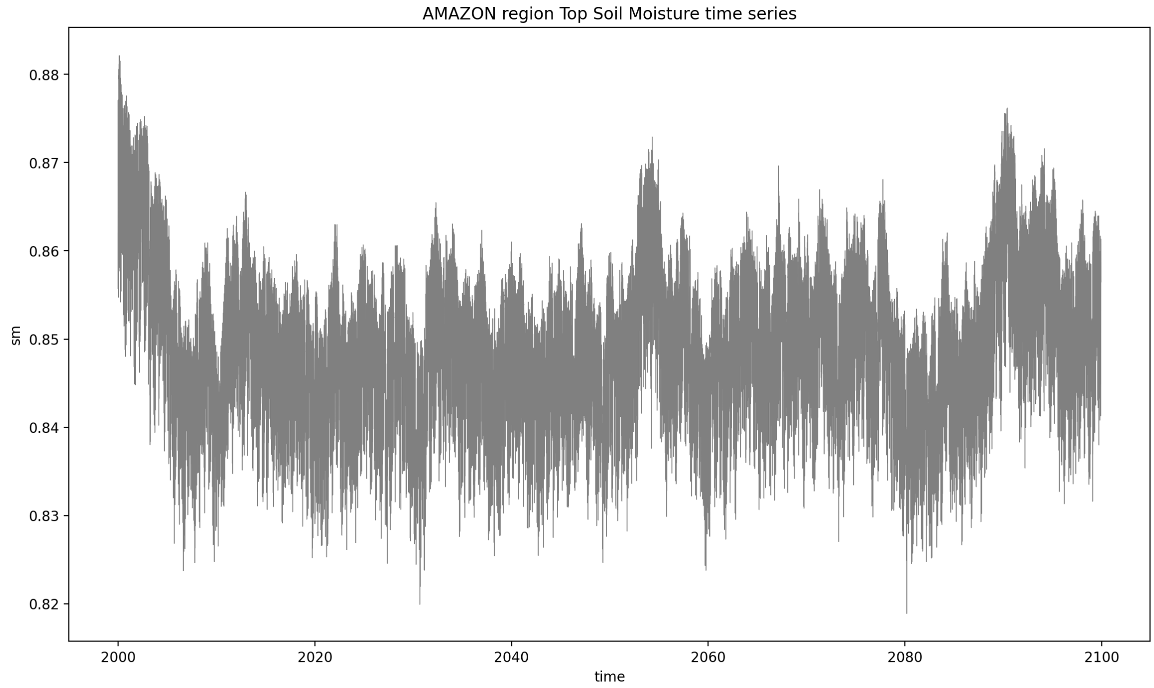
```
fig=plt.figure(figsize=(14,8))
st1=AMAZON_region_mean.st[:,0]
st1.plot(linewidth=0.5, color='grey')
plt.title("AMAZON region Top Soil Temperature time series")
#show plot
plt.show()
fig.savefig("ST1_run_AMAZON_"+runn+".png")
```



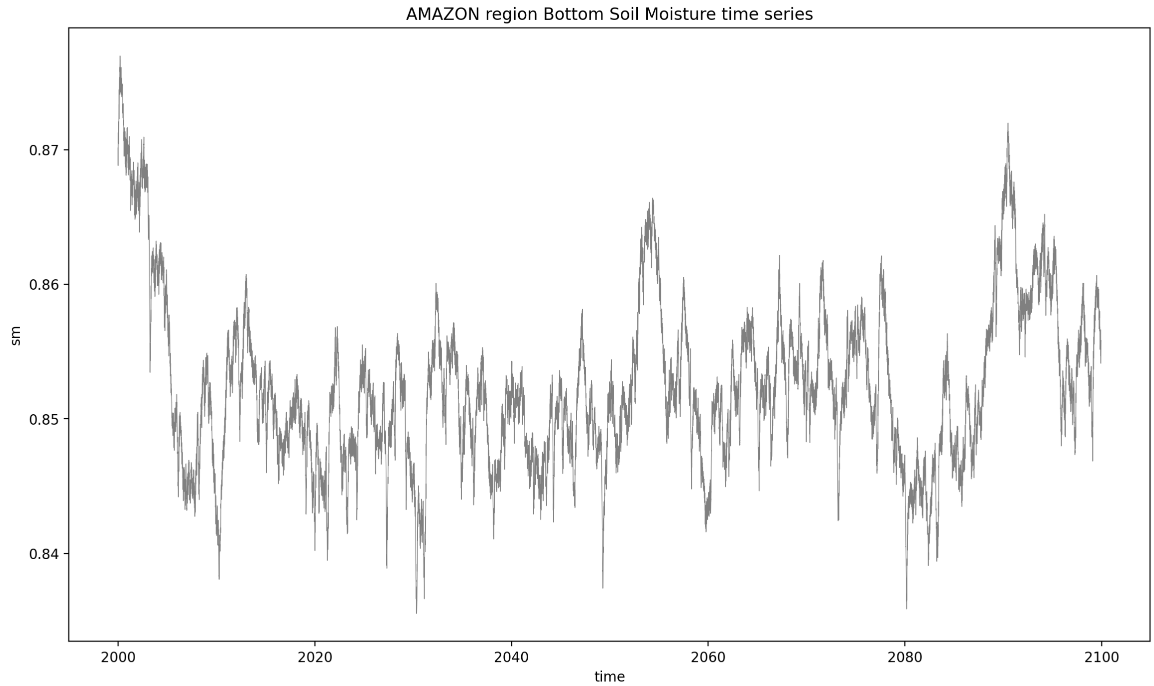
In [33]:
```
fig=plt.figure(figsize=(14,8))
st2=AMAZON_region_mean.st[:,1]
st2.plot(linewidth=0.5, color='grey')
plt.title("AMAZON region Bottom Soil Temperature time series")
#show plot
plt.show()
fig.savefig("ST2_run_AMAZON_"+runn+".png")
```



In [34]:
```
fig=plt.figure(figsize=(14,8))
sm1=AMAZON_region_mean.sm[:,0]
sm1.plot(linewidth=0.5, color='grey')
plt.title("AMAZON region Top Soil Moisture time series")
#show plot
plt.show()
fig.savefig("SM1_run_AMAZON_"+runn+".png")
```



In [35]:
```
fig=plt.figure(figsize=(14,8))
sm2=AMAZON_region_mean.sm[:,1]
sm2.plot(linewidth=0.5, color='grey')
plt.title("AMAZON region Bottom Soil Moisture time series")
#show plot
plt.show()
fig.savefig("SM2_run_AMAZON_"+runn+".png")
```



In [ ]: