

In [1]:

```
import boto3
import re
from sagemaker import get_execution_role
from sagemaker.amazon.amazon_estimator import get_image_uri

role = get_execution_role()

bucket='solarflares' # customize to your bucket
```

In [3]:

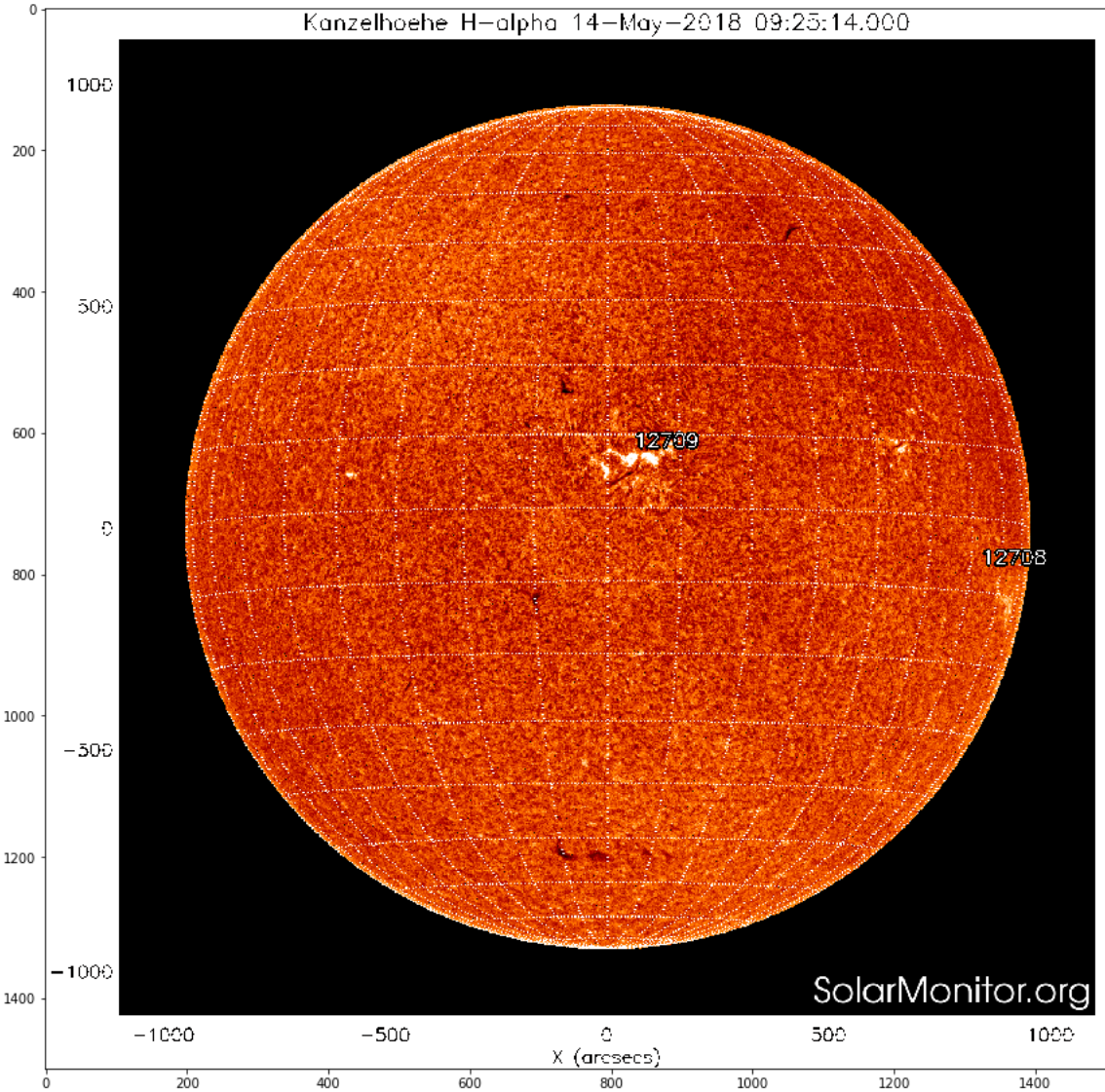
```
import matplotlib.image as mpimg
import wget
import os
import warnings
warnings.filterwarnings("ignore")
import matplotlib.pyplot as plt
import os
import urllib.request
import boto3

def download(url):
    filename = url.split("/")[-1]
    if not os.path.exists(filename):
        urllib.request.urlretrieve(url, filename)

def upload_to_s3(channel, file):
    s3 = boto3.resource('s3')
    data = open(file, "rb")
    key = channel + '/' + file
    s3.Bucket(bucket).put_object(Key=key, Body=data)

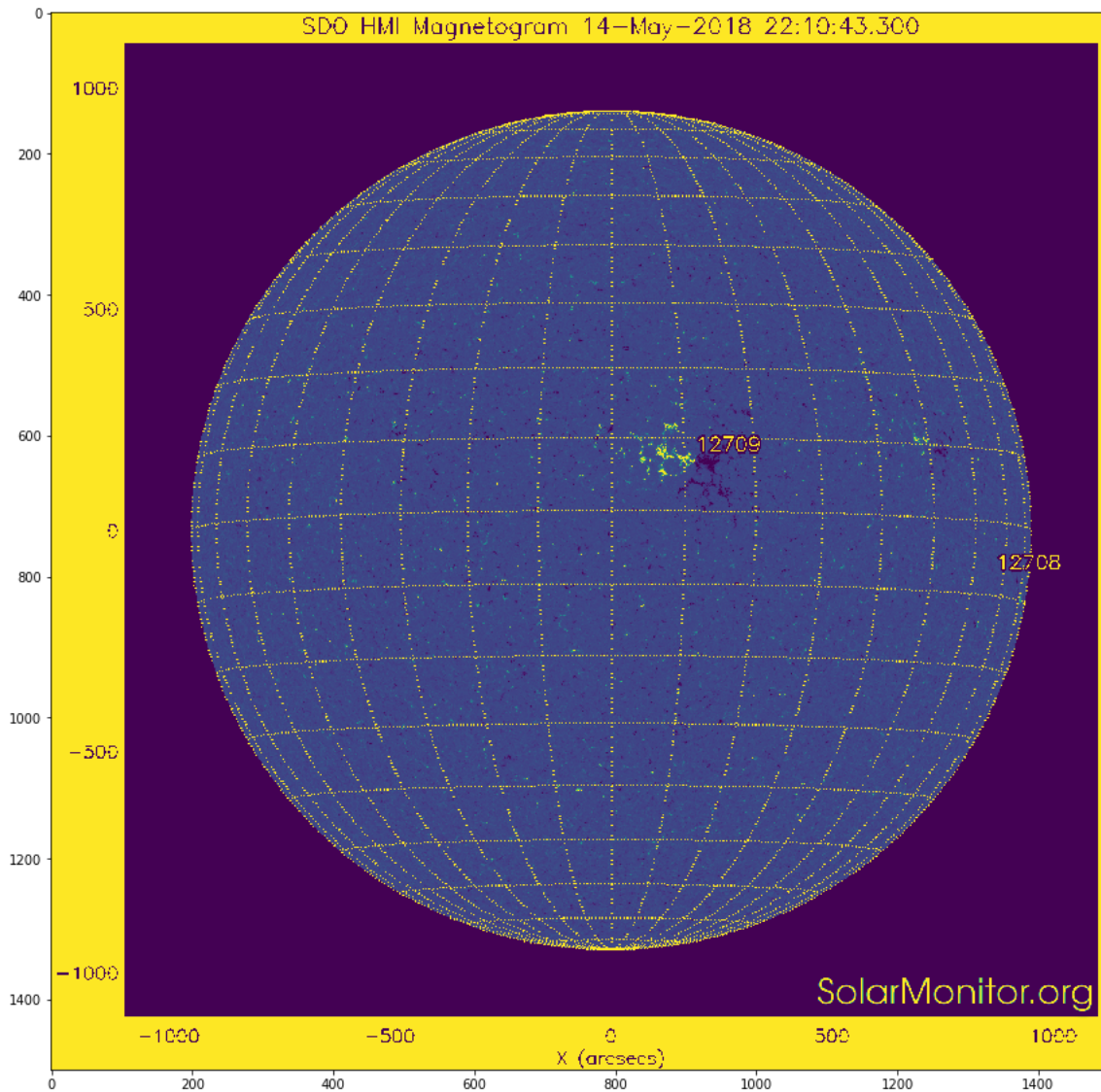
s3_key = "sunimages/img"
s3_t = 's3://{}/{}/'.format(bucket, s3_key)

download('https://solarmonitor.org/data/2018/05/14/pngs/bbso/bbso_half_fd_20180514_092514.png')
upload_to_s3(s3_key, 'bbso_half_fd_20180514_092514.png')
img = mpimg.imread('bbso_half_fd_20180514_092514.png')
plt.figure(figsize=(15,15))
imgplot=plt.imshow(img)
```



In [4]:

```
download('https://solarmonitor.org/data/2018/05/14/pngs/shmi/shmi_maglc_fd_20180514_221043.png')
upload_to_s3(s3_key, 'shmi_maglc_fd_20180514_221043.png')
img = mpimg.imread('shmi_maglc_fd_20180514_221043.png')
plt.figure(figsize=(15,15))
imgplot=plt.imshow(img)
```



In [7]:

```
from datetime import timedelta
import numpy as np
import pandas as pd
import datetime
import sunpy
from sunpy.time import TimeRange
from sunpy.instr import goes
```

In [8]:

```
time_range = TimeRange('2010/01/01 00:10', '2018/12/31 00:20')
#time_range = TimeRange(t_start,t_end)
goes_events = goes.get_goes_event_list(time_range, 'C1')
goes_events = pd.DataFrame(goes_events)
goes_events['noaa_active_region'] = goes_events['noaa_active_region'].replace(0,np.nan)
goes_events.dropna(inplace=True)
goes_events.drop(['goes_location', 'event_date', 'end_time', 'peak_time'], axis=1, inplace=True)
goes_events.start_time = goes_events.start_time.astype('datetime64[ns]')
```

In [9]:

```
goes_events.sort_values(by = 'start_time').tail(10)
```

Out[9]:

	goes_class	noaa_active_region	start_time
8640	C8.1	12699.0	2018-02-07 13:31:00
8641	C1.7	12699.0	2018-02-07 14:35:00
8642	C4.6	12699.0	2018-02-10 13:02:00
8643	C1.5	12699.0	2018-02-12 00:15:00
8644	C1.9	12700.0	2018-03-02 10:56:00
8645	C4.6	12703.0	2018-03-30 07:57:00
8646	C2.0	12712.0	2018-05-23 18:03:00
8647	C2.7	12712.0	2018-05-28 17:04:00
8648	C1.0	12712.0	2018-06-06 10:44:00
8649	C2.1	12715.0	2018-06-21 01:09:00

In [10]:

```
s3_key1 = "data"
s3_t1 = 's3://{}/{}/{}'.format(bucket, s3_key1)
#download mapper NOAA
num_mapper = pd.read_csv('http://jsoc.stanford.edu/doc/data/hmi/harpnum_to_noaa/all_harps_with_noaa_ars.txt', sep=' ')
#num_mapper.to_csv(os.path.join(s3_t1, 'all_harps_with_noaa_ars.txt'), sep=' ')
download('http://jsoc.stanford.edu/doc/data/hmi/harpnum_to_noaa/all_harps_with_noaa_ars.txt')
upload_to_s3(s3_key1, 'all_harps_with_noaa_ars.txt')
num_mapper.to_csv('all_harps_with_noaa_ars.txt', sep=' ')
```

In [11]:

```
num_mapper.tail()
```

Out[11]:

	HARPNUM	NOAA_ARS
1323	7326	12730
1324	7327	12731
1325	7331	12732
1326	7334	12733
1327	7348	12734

In [12]:

```
def convert_noaa_to_harpnum(noaa_ar):
    """
    Converts from a NOAA Active Region to a HARPNUM
    Returns harpnum if present, else None if there are no matching harpnums

    Args:
    """
    idx = num_mapper[num_mapper['NOAA_ARS'].str.contains(str(int(noaa_ar)))]
    return None if idx.empty else int(idx.HARPNUM.values[0])
goes_events['harp_number'] = goes_events['noaa_active_region'].apply(convert_noaa_to_harpnum)
goes_events.dropna(inplace=True)
```

In [13]:

```
#Goes class flares better convert to flux value. It could be done with method flareclass_to_flux from goes
goes_events['flux'] = goes_events['goes_class'].apply(lambda x: 1e06*goes.flareclass_to_flux(x).value)
goes_events.head()
```

Out[13]:

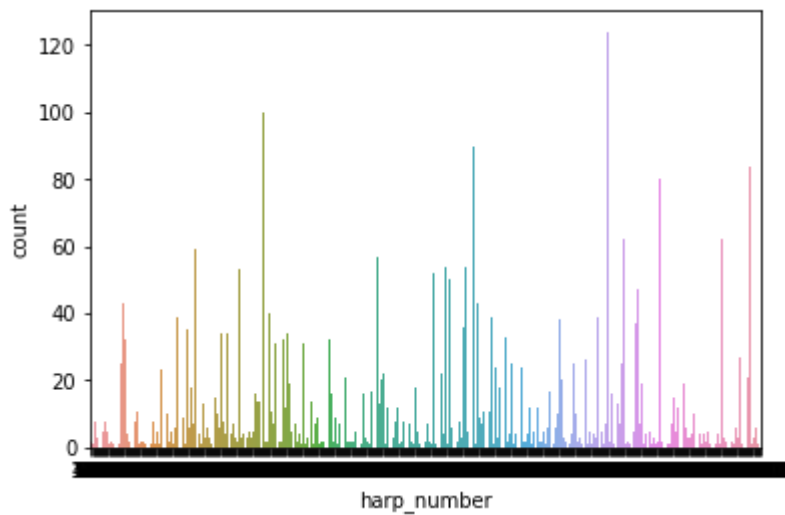
	goes_class	noaa_active_region	start_time	harp_number	flux
96	C2.2	11067.0	2010-04-30 19:28:00	1.0	2.2
97	C5.7	11067.0	2010-05-01 01:34:00	1.0	5.7
98	C3.6	11069.0	2010-05-04 16:15:00	8.0	3.6
99	C2.3	11069.0	2010-05-05 07:09:00	8.0	2.3
100	C8.8	11069.0	2010-05-05 11:37:00	8.0	8.8

In [24]:

```
import seaborn as sns
sns.countplot(x='harp_number', data = goes_events)
```

Out[24]:

<matplotlib.axes._subplots.AxesSubplot at 0x7fcfef59a518>



In [15]:

```
from io import StringIO, BytesIO
```

In [33]:

```

import boto3
from io import StringIO
#here list of keywords we want to download. Keywords computed for harp regions.
#Here we walk through the all harp regions, download features and save them to disk (it
is very time consuming)
import drms
c = drms.Client()
list_keywords = ['T_REC,CRVAL1,CRLN_OBS,USFLUX,MEANGBT,MEANJZH,MEANPOT,SHRGT45,TOTUSJH,
MEANGBH,MEANALP,MEANGAM,MEANGBZ,MEANJZD,TOTUSJZ,SAVNCPP,TOTPOT,MEANSHR,AREA_ACR,R_VALU
E,ABSNJZH']
harp_list = pd.unique(goes_events.harp_number)
N=len(harp_list)
k=0
s3_key2 = "data/keys_regions"
s3_t2 = 's3://{}/{}'.format(bucket, s3_key2)
for harp in harp_list:
    str_query = f'hmi.sharp_cea_720s[{str(int(harp))}]'

    if os.path.isfile(os.path.join(s3_t2+'/keys_regions',str_query+'.csv')):
        #print(f'Harp number {harp} already exist\n')
        k=k+1
    else:
        '''def upload_too_s3(channel,file):
            s3 = boto3.resource('s3')
            #data = open(file, "w")
            key = channel + '/' + file
            s3.Bucket(bucket).put_object(Key=key, Body=c.query(str_query,key=list_keywo
            rds))'''

DESTINATION = 'solarflares'

def write_dataframe_to_csv_on_s3(dataframe, filename):
    """ Write a dataframe to a CSV on S3 """
    print("Writing {} records to {}".format(len(dataframe), filename))
    # Create buffer
    csv_buffer = StringIO()
    # Write dataframe to buffer
    dataframe.to_csv(csv_buffer, sep=",", index=False)
    # Create S3 object
    s3_resource = boto3.resource("s3")
    # Write buffer to S3 object
    s3_resource.Object(DESTINATION, filename).put(Body=csv_buffer.getvalue())
    #keys = StringIO()
    #k.to_csv(csv_buffer)
    #s3_resource.Object(bucket_name, 'df.csv').put(Body=csv_buffer.getvalue())
    print(f'load region with Harp number {harp}')
    keys = c.query(str_query, key=list_keywords)
    write_dataframe_to_csv_on_s3(keys, 'data/keys_regions/'+str_query+'.csv')
    #keys.to_csv(upload_too_s3(s3_key2,str_query+'.csv'))

```



```
load region with Harp number 1.0
Writing 1247 records to data/keys_regions/hmi.sharp_cea_720s[1].csv
load region with Harp number 8.0
Writing 728 records to data/keys_regions/hmi.sharp_cea_720s[8].csv
load region with Harp number 54.0
Writing 439 records to data/keys_regions/hmi.sharp_cea_720s[54].csv
load region with Harp number 51.0
Writing 424 records to data/keys_regions/hmi.sharp_cea_720s[51].csv
load region with Harp number 49.0
Writing 589 records to data/keys_regions/hmi.sharp_cea_720s[49].csv
load region with Harp number 86.0
Writing 1479 records to data/keys_regions/hmi.sharp_cea_720s[86].csv
load region with Harp number 92.0
Writing 1553 records to data/keys_regions/hmi.sharp_cea_720s[92].csv
load region with Harp number 104.0
Writing 1604 records to data/keys_regions/hmi.sharp_cea_720s[104].csv
load region with Harp number 115.0
Writing 1652 records to data/keys_regions/hmi.sharp_cea_720s[115].csv
load region with Harp number 156.0
Writing 772 records to data/keys_regions/hmi.sharp_cea_720s[156].csv
load region with Harp number 185.0
Writing 1415 records to data/keys_regions/hmi.sharp_cea_720s[185].csv
load region with Harp number 187.0
Writing 1456 records to data/keys_regions/hmi.sharp_cea_720s[187].csv
load region with Harp number 190.0
Writing 1069 records to data/keys_regions/hmi.sharp_cea_720s[190].csv
load region with Harp number 211.0
Writing 1480 records to data/keys_regions/hmi.sharp_cea_720s[211].csv
load region with Harp number 226.0
Writing 1620 records to data/keys_regions/hmi.sharp_cea_720s[226].csv
load region with Harp number 224.0
Writing 1123 records to data/keys_regions/hmi.sharp_cea_720s[224].csv
load region with Harp number 245.0
Writing 1482 records to data/keys_regions/hmi.sharp_cea_720s[245].csv
load region with Harp number 252.0
Writing 1312 records to data/keys_regions/hmi.sharp_cea_720s[252].csv
load region with Harp number 274.0
Writing 946 records to data/keys_regions/hmi.sharp_cea_720s[274].csv
load region with Harp number 284.0
Writing 1556 records to data/keys_regions/hmi.sharp_cea_720s[284].csv
load region with Harp number 297.0
Writing 1353 records to data/keys_regions/hmi.sharp_cea_720s[297].csv
load region with Harp number 318.0
Writing 780 records to data/keys_regions/hmi.sharp_cea_720s[318].csv
load region with Harp number 327.0
Writing 1123 records to data/keys_regions/hmi.sharp_cea_720s[327].csv
load region with Harp number 325.0
Writing 736 records to data/keys_regions/hmi.sharp_cea_720s[325].csv
load region with Harp number 345.0
Writing 1489 records to data/keys_regions/hmi.sharp_cea_720s[345].csv
load region with Harp number 362.0
Writing 888 records to data/keys_regions/hmi.sharp_cea_720s[362].csv
load region with Harp number 371.0
Writing 918 records to data/keys_regions/hmi.sharp_cea_720s[371].csv
load region with Harp number 384.0
Writing 1476 records to data/keys_regions/hmi.sharp_cea_720s[384].csv
load region with Harp number 377.0
Writing 1247 records to data/keys_regions/hmi.sharp_cea_720s[377].csv
load region with Harp number 392.0
Writing 1316 records to data/keys_regions/hmi.sharp_cea_720s[392].csv
load region with Harp number 393.0
```

Writing 1558 records to data/keys_regions/hmi.sharp_cea_720s[393].csv
load region with Harp number 394.0
Writing 1334 records to data/keys_regions/hmi.sharp_cea_720s[394].csv
load region with Harp number 407.0
Writing 1445 records to data/keys_regions/hmi.sharp_cea_720s[407].csv
load region with Harp number 401.0
Writing 1580 records to data/keys_regions/hmi.sharp_cea_720s[401].csv
load region with Harp number 415.0
Writing 1247 records to data/keys_regions/hmi.sharp_cea_720s[415].csv
load region with Harp number 414.0
Writing 399 records to data/keys_regions/hmi.sharp_cea_720s[414].csv
load region with Harp number 421.0
Writing 1526 records to data/keys_regions/hmi.sharp_cea_720s[421].csv
load region with Harp number 437.0
Writing 1539 records to data/keys_regions/hmi.sharp_cea_720s[437].csv
load region with Harp number 443.0
Writing 1291 records to data/keys_regions/hmi.sharp_cea_720s[443].csv
load region with Harp number 451.0
Writing 1419 records to data/keys_regions/hmi.sharp_cea_720s[451].csv
load region with Harp number 466.0
Writing 1220 records to data/keys_regions/hmi.sharp_cea_720s[466].csv
load region with Harp number 495.0
Writing 1505 records to data/keys_regions/hmi.sharp_cea_720s[495].csv
load region with Harp number 504.0
Writing 1636 records to data/keys_regions/hmi.sharp_cea_720s[504].csv
load region with Harp number 480.0
Writing 1493 records to data/keys_regions/hmi.sharp_cea_720s[480].csv
load region with Harp number 514.0
Writing 1587 records to data/keys_regions/hmi.sharp_cea_720s[514].csv
load region with Harp number 532.0
Writing 1382 records to data/keys_regions/hmi.sharp_cea_720s[532].csv
load region with Harp number 540.0
Writing 786 records to data/keys_regions/hmi.sharp_cea_720s[540].csv
load region with Harp number 556.0
Writing 1628 records to data/keys_regions/hmi.sharp_cea_720s[556].csv
load region with Harp number 580.0
Writing 1314 records to data/keys_regions/hmi.sharp_cea_720s[580].csv
load region with Harp number 587.0
Writing 1345 records to data/keys_regions/hmi.sharp_cea_720s[587].csv
load region with Harp number 610.0
Writing 1213 records to data/keys_regions/hmi.sharp_cea_720s[610].csv
load region with Harp number 625.0
Writing 1056 records to data/keys_regions/hmi.sharp_cea_720s[625].csv
load region with Harp number 637.0
Writing 1670 records to data/keys_regions/hmi.sharp_cea_720s[637].csv
load region with Harp number 605.0
Writing 1580 records to data/keys_regions/hmi.sharp_cea_720s[605].csv
load region with Harp number 622.0
Writing 1182 records to data/keys_regions/hmi.sharp_cea_720s[622].csv
load region with Harp number 639.0
Writing 1448 records to data/keys_regions/hmi.sharp_cea_720s[639].csv
load region with Harp number 650.0
Writing 1401 records to data/keys_regions/hmi.sharp_cea_720s[650].csv
load region with Harp number 661.0
Writing 1432 records to data/keys_regions/hmi.sharp_cea_720s[661].csv
load region with Harp number 667.0
Writing 1599 records to data/keys_regions/hmi.sharp_cea_720s[667].csv
load region with Harp number 674.0
Writing 1565 records to data/keys_regions/hmi.sharp_cea_720s[674].csv
load region with Harp number 684.0
Writing 1288 records to data/keys_regions/hmi.sharp_cea_720s[684].csv

```
load region with Harp number 685.0
Writing 1491 records to data/keys_regions/hmi.sharp_cea_720s[685].csv
load region with Harp number 695.0
Writing 1178 records to data/keys_regions/hmi.sharp_cea_720s[695].csv
load region with Harp number 702.0
Writing 946 records to data/keys_regions/hmi.sharp_cea_720s[702].csv
load region with Harp number 725.0
Writing 1432 records to data/keys_regions/hmi.sharp_cea_720s[725].csv
load region with Harp number 746.0
Writing 1544 records to data/keys_regions/hmi.sharp_cea_720s[746].csv
load region with Harp number 744.0
Writing 1039 records to data/keys_regions/hmi.sharp_cea_720s[744].csv
load region with Harp number 750.0
Writing 1575 records to data/keys_regions/hmi.sharp_cea_720s[750].csv
load region with Harp number 753.0
Writing 1700 records to data/keys_regions/hmi.sharp_cea_720s[753].csv
load region with Harp number 748.0
Writing 1093 records to data/keys_regions/hmi.sharp_cea_720s[748].csv
load region with Harp number 764.0
Writing 963 records to data/keys_regions/hmi.sharp_cea_720s[764].csv
load region with Harp number 794.0
Writing 1631 records to data/keys_regions/hmi.sharp_cea_720s[794].csv
load region with Harp number 798.0
Writing 1382 records to data/keys_regions/hmi.sharp_cea_720s[798].csv
load region with Harp number 803.0
Writing 1500 records to data/keys_regions/hmi.sharp_cea_720s[803].csv
load region with Harp number 824.0
Writing 1396 records to data/keys_regions/hmi.sharp_cea_720s[824].csv
load region with Harp number 833.0
Writing 1600 records to data/keys_regions/hmi.sharp_cea_720s[833].csv
load region with Harp number 814.0
Writing 1569 records to data/keys_regions/hmi.sharp_cea_720s[814].csv
load region with Harp number 843.0
Writing 1509 records to data/keys_regions/hmi.sharp_cea_720s[843].csv
load region with Harp number 847.0
Writing 1635 records to data/keys_regions/hmi.sharp_cea_720s[847].csv
load region with Harp number 853.0
Writing 1213 records to data/keys_regions/hmi.sharp_cea_720s[853].csv
load region with Harp number 856.0
Writing 1581 records to data/keys_regions/hmi.sharp_cea_720s[856].csv
load region with Harp number 869.0
Writing 469 records to data/keys_regions/hmi.sharp_cea_720s[869].csv
load region with Harp number 850.0
Writing 1132 records to data/keys_regions/hmi.sharp_cea_720s[850].csv
load region with Harp number 878.0
Writing 1499 records to data/keys_regions/hmi.sharp_cea_720s[878].csv
load region with Harp number 892.0
Writing 1562 records to data/keys_regions/hmi.sharp_cea_720s[892].csv
load region with Harp number 899.0
Writing 286 records to data/keys_regions/hmi.sharp_cea_720s[899].csv
load region with Harp number 902.0
Writing 1437 records to data/keys_regions/hmi.sharp_cea_720s[902].csv
load region with Harp number 909.0
Writing 1367 records to data/keys_regions/hmi.sharp_cea_720s[909].csv
load region with Harp number 932.0
Writing 1482 records to data/keys_regions/hmi.sharp_cea_720s[932].csv
load region with Harp number 918.0
Writing 1594 records to data/keys_regions/hmi.sharp_cea_720s[918].csv
load region with Harp number 940.0
Writing 1666 records to data/keys_regions/hmi.sharp_cea_720s[940].csv
load region with Harp number 950.0
```

Writing 1269 records to data/keys_regions/hmi.sharp_cea_720s[950].csv
load region with Harp number 956.0
Writing 889 records to data/keys_regions/hmi.sharp_cea_720s[956].csv
load region with Harp number 948.0
Writing 1498 records to data/keys_regions/hmi.sharp_cea_720s[948].csv
load region with Harp number 976.0
Writing 1647 records to data/keys_regions/hmi.sharp_cea_720s[976].csv
load region with Harp number 997.0
Writing 1634 records to data/keys_regions/hmi.sharp_cea_720s[997].csv
load region with Harp number 1021.0
Writing 1087 records to data/keys_regions/hmi.sharp_cea_720s[1021].csv
load region with Harp number 1026.0
Writing 1781 records to data/keys_regions/hmi.sharp_cea_720s[1026].csv
load region with Harp number 1028.0
Writing 1862 records to data/keys_regions/hmi.sharp_cea_720s[1028].csv
load region with Harp number 1041.0
Writing 1631 records to data/keys_regions/hmi.sharp_cea_720s[1041].csv
load region with Harp number 1075.0
Writing 968 records to data/keys_regions/hmi.sharp_cea_720s[1075].csv
load region with Harp number 1066.0
Writing 1510 records to data/keys_regions/hmi.sharp_cea_720s[1066].csv
load region with Harp number 1089.0
Writing 1558 records to data/keys_regions/hmi.sharp_cea_720s[1089].csv
load region with Harp number 1092.0
Writing 1463 records to data/keys_regions/hmi.sharp_cea_720s[1092].csv
load region with Harp number 1093.0
Writing 1844 records to data/keys_regions/hmi.sharp_cea_720s[1093].csv
load region with Harp number 1080.0
Writing 1370 records to data/keys_regions/hmi.sharp_cea_720s[1080].csv
load region with Harp number 1113.0
Writing 1534 records to data/keys_regions/hmi.sharp_cea_720s[1113].csv
load region with Harp number 1090.0
Writing 1395 records to data/keys_regions/hmi.sharp_cea_720s[1090].csv
load region with Harp number 1119.0
Writing 1288 records to data/keys_regions/hmi.sharp_cea_720s[1119].csv
load region with Harp number 1120.0
Writing 1466 records to data/keys_regions/hmi.sharp_cea_720s[1120].csv
load region with Harp number 1124.0
Writing 1610 records to data/keys_regions/hmi.sharp_cea_720s[1124].csv
load region with Harp number 1126.0
Writing 1957 records to data/keys_regions/hmi.sharp_cea_720s[1126].csv
load region with Harp number 1149.0
Writing 1277 records to data/keys_regions/hmi.sharp_cea_720s[1149].csv
load region with Harp number 1164.0
Writing 853 records to data/keys_regions/hmi.sharp_cea_720s[1164].csv
load region with Harp number 1171.0
Writing 1424 records to data/keys_regions/hmi.sharp_cea_720s[1171].csv
load region with Harp number 1168.0
Writing 1600 records to data/keys_regions/hmi.sharp_cea_720s[1168].csv
load region with Harp number 1183.0
Writing 1570 records to data/keys_regions/hmi.sharp_cea_720s[1183].csv
load region with Harp number 1210.0
Writing 1353 records to data/keys_regions/hmi.sharp_cea_720s[1210].csv
load region with Harp number 1221.0
Writing 1642 records to data/keys_regions/hmi.sharp_cea_720s[1221].csv
load region with Harp number 1237.0
Writing 1624 records to data/keys_regions/hmi.sharp_cea_720s[1237].csv
load region with Harp number 1209.0
Writing 1642 records to data/keys_regions/hmi.sharp_cea_720s[1209].csv
load region with Harp number 1256.0
Writing 1749 records to data/keys_regions/hmi.sharp_cea_720s[1256].csv

```
load region with Harp number 1271.0
Writing 1372 records to data/keys_regions/hmi.sharp_cea_720s[1271].csv
load region with Harp number 1249.0
Writing 1466 records to data/keys_regions/hmi.sharp_cea_720s[1249].csv
load region with Harp number 1275.0
Writing 1257 records to data/keys_regions/hmi.sharp_cea_720s[1275].csv
load region with Harp number 1278.0
Writing 1544 records to data/keys_regions/hmi.sharp_cea_720s[1278].csv
load region with Harp number 1300.0
Writing 1342 records to data/keys_regions/hmi.sharp_cea_720s[1300].csv
load region with Harp number 1309.0
Writing 981 records to data/keys_regions/hmi.sharp_cea_720s[1309].csv
load region with Harp number 1321.0
Writing 1564 records to data/keys_regions/hmi.sharp_cea_720s[1321].csv
load region with Harp number 1350.0
Writing 1615 records to data/keys_regions/hmi.sharp_cea_720s[1350].csv
load region with Harp number 1338.0
Writing 1518 records to data/keys_regions/hmi.sharp_cea_720s[1338].csv
load region with Harp number 1367.0
Writing 1379 records to data/keys_regions/hmi.sharp_cea_720s[1367].csv
load region with Harp number 1389.0
Writing 1060 records to data/keys_regions/hmi.sharp_cea_720s[1389].csv
load region with Harp number 1396.0
Writing 1182 records to data/keys_regions/hmi.sharp_cea_720s[1396].csv
load region with Harp number 1405.0
Writing 980 records to data/keys_regions/hmi.sharp_cea_720s[1405].csv
load region with Harp number 1410.0
Writing 829 records to data/keys_regions/hmi.sharp_cea_720s[1410].csv
load region with Harp number 1422.0
Writing 1196 records to data/keys_regions/hmi.sharp_cea_720s[1422].csv
load region with Harp number 1449.0
Writing 1519 records to data/keys_regions/hmi.sharp_cea_720s[1449].csv
load region with Harp number 1425.0
Writing 1153 records to data/keys_regions/hmi.sharp_cea_720s[1425].csv
load region with Harp number 1447.0
Writing 1391 records to data/keys_regions/hmi.sharp_cea_720s[1447].csv
load region with Harp number 1461.0
Writing 1395 records to data/keys_regions/hmi.sharp_cea_720s[1461].csv
load region with Harp number 1465.0
Writing 1389 records to data/keys_regions/hmi.sharp_cea_720s[1465].csv
load region with Harp number 1464.0
Writing 1374 records to data/keys_regions/hmi.sharp_cea_720s[1464].csv
load region with Harp number 1484.0
Writing 853 records to data/keys_regions/hmi.sharp_cea_720s[1484].csv
load region with Harp number 1500.0
Writing 1521 records to data/keys_regions/hmi.sharp_cea_720s[1500].csv
load region with Harp number 1492.0
Writing 1394 records to data/keys_regions/hmi.sharp_cea_720s[1492].csv
load region with Harp number 1527.0
Writing 1483 records to data/keys_regions/hmi.sharp_cea_720s[1527].csv
load region with Harp number 1495.0
Writing 835 records to data/keys_regions/hmi.sharp_cea_720s[1495].csv
load region with Harp number 1528.0
Writing 1226 records to data/keys_regions/hmi.sharp_cea_720s[1528].csv
load region with Harp number 1582.0
Writing 1272 records to data/keys_regions/hmi.sharp_cea_720s[1582].csv
load region with Harp number 1558.0
Writing 1443 records to data/keys_regions/hmi.sharp_cea_720s[1558].csv
load region with Harp number 1578.0
Writing 1290 records to data/keys_regions/hmi.sharp_cea_720s[1578].csv
load region with Harp number 1573.0
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Writing 1235 records to data/keys_regions/hmi.sharp_cea_720s[1573].csv
load region with Harp number 1596.0
Writing 1300 records to data/keys_regions/hmi.sharp_cea_720s[1596].csv
load region with Harp number 1574.0
Writing 1592 records to data/keys_regions/hmi.sharp_cea_720s[1574].csv
load region with Harp number 1611.0
Writing 1448 records to data/keys_regions/hmi.sharp_cea_720s[1611].csv
load region with Harp number 1613.0
Writing 1300 records to data/keys_regions/hmi.sharp_cea_720s[1613].csv
load region with Harp number 1603.0
Writing 1262 records to data/keys_regions/hmi.sharp_cea_720s[1603].csv
load region with Harp number 1621.0
Writing 1473 records to data/keys_regions/hmi.sharp_cea_720s[1621].csv
load region with Harp number 1634.0
Writing 1114 records to data/keys_regions/hmi.sharp_cea_720s[1634].csv
load region with Harp number 1632.0
Writing 1214 records to data/keys_regions/hmi.sharp_cea_720s[1632].csv
load region with Harp number 1638.0
Writing 1477 records to data/keys_regions/hmi.sharp_cea_720s[1638].csv
load region with Harp number 1658.0
Writing 1462 records to data/keys_regions/hmi.sharp_cea_720s[1658].csv
load region with Harp number 1662.0
Writing 1592 records to data/keys_regions/hmi.sharp_cea_720s[1662].csv
load region with Harp number 1653.0
Writing 1635 records to data/keys_regions/hmi.sharp_cea_720s[1653].csv
load region with Harp number 1688.0
Writing 1385 records to data/keys_regions/hmi.sharp_cea_720s[1688].csv
load region with Harp number 1705.0
Writing 1560 records to data/keys_regions/hmi.sharp_cea_720s[1705].csv
load region with Harp number 1724.0
Writing 1519 records to data/keys_regions/hmi.sharp_cea_720s[1724].csv
load region with Harp number 1722.0
Writing 1554 records to data/keys_regions/hmi.sharp_cea_720s[1722].csv
load region with Harp number 1750.0
Writing 1500 records to data/keys_regions/hmi.sharp_cea_720s[1750].csv
load region with Harp number 1744.0
Writing 1411 records to data/keys_regions/hmi.sharp_cea_720s[1744].csv
load region with Harp number 1756.0
Writing 1329 records to data/keys_regions/hmi.sharp_cea_720s[1756].csv
load region with Harp number 1795.0
Writing 1502 records to data/keys_regions/hmi.sharp_cea_720s[1795].csv
load region with Harp number 1806.0
Writing 1624 records to data/keys_regions/hmi.sharp_cea_720s[1806].csv
load region with Harp number 1807.0
Writing 1668 records to data/keys_regions/hmi.sharp_cea_720s[1807].csv
load region with Harp number 1834.0
Writing 1789 records to data/keys_regions/hmi.sharp_cea_720s[1834].csv
load region with Harp number 1844.0
Writing 250 records to data/keys_regions/hmi.sharp_cea_720s[1844].csv
load region with Harp number 1866.0
Writing 1372 records to data/keys_regions/hmi.sharp_cea_720s[1866].csv
load region with Harp number 1873.0
Writing 1370 records to data/keys_regions/hmi.sharp_cea_720s[1873].csv
load region with Harp number 1877.0
Writing 1509 records to data/keys_regions/hmi.sharp_cea_720s[1877].csv
load region with Harp number 1879.0
Writing 1851 records to data/keys_regions/hmi.sharp_cea_720s[1879].csv
load region with Harp number 1886.0
Writing 448 records to data/keys_regions/hmi.sharp_cea_720s[1886].csv
load region with Harp number 1903.0
Writing 1610 records to data/keys_regions/hmi.sharp_cea_720s[1903].csv

```
load region with Harp number 1907.0
Writing 1688 records to data/keys_regions/hmi.sharp_cea_720s[1907].csv
load region with Harp number 1930.0
Writing 1250 records to data/keys_regions/hmi.sharp_cea_720s[1930].csv
load region with Harp number 1931.0
Writing 1546 records to data/keys_regions/hmi.sharp_cea_720s[1931].csv
load region with Harp number 1946.0
Writing 1464 records to data/keys_regions/hmi.sharp_cea_720s[1946].csv
load region with Harp number 1962.0
Writing 1208 records to data/keys_regions/hmi.sharp_cea_720s[1962].csv
load region with Harp number 1996.0
Writing 1134 records to data/keys_regions/hmi.sharp_cea_720s[1996].csv
load region with Harp number 1959.0
Writing 1514 records to data/keys_regions/hmi.sharp_cea_720s[1959].csv
load region with Harp number 1993.0
Writing 1066 records to data/keys_regions/hmi.sharp_cea_720s[1993].csv
load region with Harp number 1999.0
Writing 1394 records to data/keys_regions/hmi.sharp_cea_720s[1999].csv
load region with Harp number 1990.0
Writing 1367 records to data/keys_regions/hmi.sharp_cea_720s[1990].csv
load region with Harp number 2007.0
Writing 807 records to data/keys_regions/hmi.sharp_cea_720s[2007].csv
load region with Harp number 2017.0
Writing 836 records to data/keys_regions/hmi.sharp_cea_720s[2017].csv
load region with Harp number 2021.0
Writing 1122 records to data/keys_regions/hmi.sharp_cea_720s[2021].csv
load region with Harp number 2026.0
Writing 1249 records to data/keys_regions/hmi.sharp_cea_720s[2026].csv
load region with Harp number 2040.0
Writing 1824 records to data/keys_regions/hmi.sharp_cea_720s[2040].csv
load region with Harp number 2044.0
Writing 1282 records to data/keys_regions/hmi.sharp_cea_720s[2044].csv
load region with Harp number 2039.0
Writing 512 records to data/keys_regions/hmi.sharp_cea_720s[2039].csv
load region with Harp number 2047.0
Writing 1235 records to data/keys_regions/hmi.sharp_cea_720s[2047].csv
load region with Harp number 2061.0
Writing 1267 records to data/keys_regions/hmi.sharp_cea_720s[2061].csv
load region with Harp number 2037.0
Writing 1307 records to data/keys_regions/hmi.sharp_cea_720s[2037].csv
load region with Harp number 2069.0
Writing 1495 records to data/keys_regions/hmi.sharp_cea_720s[2069].csv
load region with Harp number 2059.0
Writing 1490 records to data/keys_regions/hmi.sharp_cea_720s[2059].csv
load region with Harp number 2109.0
Writing 826 records to data/keys_regions/hmi.sharp_cea_720s[2109].csv
load region with Harp number 2110.0
Writing 196 records to data/keys_regions/hmi.sharp_cea_720s[2110].csv
load region with Harp number 2098.0
Writing 1325 records to data/keys_regions/hmi.sharp_cea_720s[2098].csv
load region with Harp number 2112.0
Writing 634 records to data/keys_regions/hmi.sharp_cea_720s[2112].csv
load region with Harp number 2121.0
Writing 849 records to data/keys_regions/hmi.sharp_cea_720s[2121].csv
load region with Harp number 2117.0
Writing 1140 records to data/keys_regions/hmi.sharp_cea_720s[2117].csv
load region with Harp number 2123.0
Writing 988 records to data/keys_regions/hmi.sharp_cea_720s[2123].csv
load region with Harp number 2130.0
Writing 1441 records to data/keys_regions/hmi.sharp_cea_720s[2130].csv
load region with Harp number 2137.0
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Writing 1474 records to data/keys_regions/hmi.sharp_cea_720s[2137].csv
load region with Harp number 2186.0
Writing 1458 records to data/keys_regions/hmi.sharp_cea_720s[2186].csv
load region with Harp number 2173.0
Writing 1179 records to data/keys_regions/hmi.sharp_cea_720s[2173].csv
load region with Harp number 2177.0
Writing 1159 records to data/keys_regions/hmi.sharp_cea_720s[2177].csv
load region with Harp number 2178.0
Writing 519 records to data/keys_regions/hmi.sharp_cea_720s[2178].csv
load region with Harp number 2193.0
Writing 1349 records to data/keys_regions/hmi.sharp_cea_720s[2193].csv
load region with Harp number 2181.0
Writing 1357 records to data/keys_regions/hmi.sharp_cea_720s[2181].csv
load region with Harp number 2191.0
Writing 1446 records to data/keys_regions/hmi.sharp_cea_720s[2191].csv
load region with Harp number 2220.0
Writing 1287 records to data/keys_regions/hmi.sharp_cea_720s[2220].csv
load region with Harp number 2203.0
Writing 1313 records to data/keys_regions/hmi.sharp_cea_720s[2203].csv
load region with Harp number 2227.0
Writing 1302 records to data/keys_regions/hmi.sharp_cea_720s[2227].csv
load region with Harp number 2245.0
Writing 1448 records to data/keys_regions/hmi.sharp_cea_720s[2245].csv
load region with Harp number 2262.0
Writing 1611 records to data/keys_regions/hmi.sharp_cea_720s[2262].csv
load region with Harp number 2240.0
Writing 1329 records to data/keys_regions/hmi.sharp_cea_720s[2240].csv
load region with Harp number 2270.0
Writing 1028 records to data/keys_regions/hmi.sharp_cea_720s[2270].csv
load region with Harp number 2291.0
Writing 878 records to data/keys_regions/hmi.sharp_cea_720s[2291].csv
load region with Harp number 2306.0
Writing 1573 records to data/keys_regions/hmi.sharp_cea_720s[2306].csv
load region with Harp number 2314.0
Writing 1479 records to data/keys_regions/hmi.sharp_cea_720s[2314].csv
load region with Harp number 2331.0
Writing 1576 records to data/keys_regions/hmi.sharp_cea_720s[2331].csv
load region with Harp number 2337.0
Writing 1191 records to data/keys_regions/hmi.sharp_cea_720s[2337].csv
load region with Harp number 2329.0
Writing 1293 records to data/keys_regions/hmi.sharp_cea_720s[2329].csv
load region with Harp number 2360.0
Writing 1378 records to data/keys_regions/hmi.sharp_cea_720s[2360].csv
load region with Harp number 2362.0
Writing 1411 records to data/keys_regions/hmi.sharp_cea_720s[2362].csv
load region with Harp number 2353.0
Writing 736 records to data/keys_regions/hmi.sharp_cea_720s[2353].csv
load region with Harp number 2366.0
Writing 1111 records to data/keys_regions/hmi.sharp_cea_720s[2366].csv
load region with Harp number 2372.0
Writing 1529 records to data/keys_regions/hmi.sharp_cea_720s[2372].csv
load region with Harp number 2344.0
Writing 1322 records to data/keys_regions/hmi.sharp_cea_720s[2344].csv
load region with Harp number 2338.0
Writing 1220 records to data/keys_regions/hmi.sharp_cea_720s[2338].csv
load region with Harp number 2371.0
Writing 876 records to data/keys_regions/hmi.sharp_cea_720s[2371].csv
load region with Harp number 2400.0
Writing 1198 records to data/keys_regions/hmi.sharp_cea_720s[2400].csv
load region with Harp number 2420.0
Writing 1135 records to data/keys_regions/hmi.sharp_cea_720s[2420].csv


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load region with Harp number 2433.0
Writing 1545 records to data/keys_regions/hmi.sharp_cea_720s[2433].csv
load region with Harp number 2450.0
Writing 1519 records to data/keys_regions/hmi.sharp_cea_720s[2450].csv
load region with Harp number 2460.0
Writing 1274 records to data/keys_regions/hmi.sharp_cea_720s[2460].csv
load region with Harp number 2491.0
Writing 1211 records to data/keys_regions/hmi.sharp_cea_720s[2491].csv
load region with Harp number 2469.0
Writing 1764 records to data/keys_regions/hmi.sharp_cea_720s[2469].csv
load region with Harp number 2520.0
Writing 1526 records to data/keys_regions/hmi.sharp_cea_720s[2520].csv
load region with Harp number 2519.0
Writing 858 records to data/keys_regions/hmi.sharp_cea_720s[2519].csv
load region with Harp number 2557.0
Writing 1436 records to data/keys_regions/hmi.sharp_cea_720s[2557].csv
load region with Harp number 2533.0
Writing 1253 records to data/keys_regions/hmi.sharp_cea_720s[2533].csv
load region with Harp number 2546.0
Writing 1539 records to data/keys_regions/hmi.sharp_cea_720s[2546].csv
load region with Harp number 2522.0
Writing 1467 records to data/keys_regions/hmi.sharp_cea_720s[2522].csv
load region with Harp number 2560.0
Writing 1205 records to data/keys_regions/hmi.sharp_cea_720s[2560].csv
load region with Harp number 2541.0
Writing 1339 records to data/keys_regions/hmi.sharp_cea_720s[2541].csv
load region with Harp number 2543.0
Writing 1328 records to data/keys_regions/hmi.sharp_cea_720s[2543].csv
load region with Harp number 2605.0
Writing 1601 records to data/keys_regions/hmi.sharp_cea_720s[2605].csv
load region with Harp number 2597.0
Writing 1661 records to data/keys_regions/hmi.sharp_cea_720s[2597].csv
load region with Harp number 2635.0
Writing 1531 records to data/keys_regions/hmi.sharp_cea_720s[2635].csv
load region with Harp number 2634.0
Writing 970 records to data/keys_regions/hmi.sharp_cea_720s[2634].csv
load region with Harp number 2636.0
Writing 1226 records to data/keys_regions/hmi.sharp_cea_720s[2636].csv
load region with Harp number 2626.0
Writing 539 records to data/keys_regions/hmi.sharp_cea_720s[2626].csv
load region with Harp number 2619.0
Writing 1484 records to data/keys_regions/hmi.sharp_cea_720s[2619].csv
load region with Harp number 2651.0
Writing 1407 records to data/keys_regions/hmi.sharp_cea_720s[2651].csv
load region with Harp number 2661.0
Writing 1354 records to data/keys_regions/hmi.sharp_cea_720s[2661].csv
load region with Harp number 2663.0
Writing 1287 records to data/keys_regions/hmi.sharp_cea_720s[2663].csv
load region with Harp number 2673.0
Writing 904 records to data/keys_regions/hmi.sharp_cea_720s[2673].csv
load region with Harp number 2693.0
Writing 1414 records to data/keys_regions/hmi.sharp_cea_720s[2693].csv
load region with Harp number 2696.0
Writing 1846 records to data/keys_regions/hmi.sharp_cea_720s[2696].csv
load region with Harp number 2677.0
Writing 1381 records to data/keys_regions/hmi.sharp_cea_720s[2677].csv
load region with Harp number 2691.0
Writing 1147 records to data/keys_regions/hmi.sharp_cea_720s[2691].csv
load region with Harp number 2716.0
Writing 1400 records to data/keys_regions/hmi.sharp_cea_720s[2716].csv
load region with Harp number 2718.0
```

Writing 1345 records to data/keys_regions/hmi.sharp_cea_720s[2718].csv
load region with Harp number 2727.0
Writing 1421 records to data/keys_regions/hmi.sharp_cea_720s[2727].csv
load region with Harp number 2710.0
Writing 364 records to data/keys_regions/hmi.sharp_cea_720s[2710].csv
load region with Harp number 2735.0
Writing 1496 records to data/keys_regions/hmi.sharp_cea_720s[2735].csv
load region with Harp number 2733.0
Writing 1380 records to data/keys_regions/hmi.sharp_cea_720s[2733].csv
load region with Harp number 2739.0
Writing 1585 records to data/keys_regions/hmi.sharp_cea_720s[2739].csv
load region with Harp number 2737.0
Writing 1652 records to data/keys_regions/hmi.sharp_cea_720s[2737].csv
load region with Harp number 2748.0
Writing 1542 records to data/keys_regions/hmi.sharp_cea_720s[2748].csv
load region with Harp number 2754.0
Writing 472 records to data/keys_regions/hmi.sharp_cea_720s[2754].csv
load region with Harp number 2750.0
Writing 808 records to data/keys_regions/hmi.sharp_cea_720s[2750].csv
load region with Harp number 2760.0
Writing 1625 records to data/keys_regions/hmi.sharp_cea_720s[2760].csv
load region with Harp number 2758.0
Writing 1662 records to data/keys_regions/hmi.sharp_cea_720s[2758].csv
load region with Harp number 2779.0
Writing 1374 records to data/keys_regions/hmi.sharp_cea_720s[2779].csv
load region with Harp number 2809.0
Writing 1156 records to data/keys_regions/hmi.sharp_cea_720s[2809].csv
load region with Harp number 2790.0
Writing 1599 records to data/keys_regions/hmi.sharp_cea_720s[2790].csv
load region with Harp number 2825.0
Writing 1100 records to data/keys_regions/hmi.sharp_cea_720s[2825].csv
load region with Harp number 2852.0
Writing 1864 records to data/keys_regions/hmi.sharp_cea_720s[2852].csv
load region with Harp number 2875.0
Writing 907 records to data/keys_regions/hmi.sharp_cea_720s[2875].csv
load region with Harp number 2861.0
Writing 1408 records to data/keys_regions/hmi.sharp_cea_720s[2861].csv
load region with Harp number 2878.0
Writing 1576 records to data/keys_regions/hmi.sharp_cea_720s[2878].csv
load region with Harp number 2887.0
Writing 1515 records to data/keys_regions/hmi.sharp_cea_720s[2887].csv
load region with Harp number 2912.0
Writing 859 records to data/keys_regions/hmi.sharp_cea_720s[2912].csv
load region with Harp number 2920.0
Writing 1606 records to data/keys_regions/hmi.sharp_cea_720s[2920].csv
load region with Harp number 2922.0
Writing 1112 records to data/keys_regions/hmi.sharp_cea_720s[2922].csv
load region with Harp number 2952.0
Writing 1342 records to data/keys_regions/hmi.sharp_cea_720s[2952].csv
load region with Harp number 2954.0
Writing 1305 records to data/keys_regions/hmi.sharp_cea_720s[2954].csv
load region with Harp number 2968.0
Writing 1556 records to data/keys_regions/hmi.sharp_cea_720s[2968].csv
load region with Harp number 2981.0
Writing 1691 records to data/keys_regions/hmi.sharp_cea_720s[2981].csv
load region with Harp number 2999.0
Writing 1552 records to data/keys_regions/hmi.sharp_cea_720s[2999].csv
load region with Harp number 3028.0
Writing 1681 records to data/keys_regions/hmi.sharp_cea_720s[3028].csv
load region with Harp number 3056.0
Writing 1513 records to data/keys_regions/hmi.sharp_cea_720s[3056].csv

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load region with Harp number 3048.0
Writing 1593 records to data/keys_regions/hmi.sharp_cea_720s[3048].csv
load region with Harp number 3068.0
Writing 1455 records to data/keys_regions/hmi.sharp_cea_720s[3068].csv
load region with Harp number 3082.0
Writing 1534 records to data/keys_regions/hmi.sharp_cea_720s[3082].csv
load region with Harp number 3113.0
Writing 313 records to data/keys_regions/hmi.sharp_cea_720s[3113].csv
load region with Harp number 3103.0
Writing 1487 records to data/keys_regions/hmi.sharp_cea_720s[3103].csv
load region with Harp number 3097.0
Writing 597 records to data/keys_regions/hmi.sharp_cea_720s[3097].csv
load region with Harp number 3066.0
Writing 1612 records to data/keys_regions/hmi.sharp_cea_720s[3066].csv
load region with Harp number 3098.0
Writing 1429 records to data/keys_regions/hmi.sharp_cea_720s[3098].csv
load region with Harp number 3129.0
Writing 1545 records to data/keys_regions/hmi.sharp_cea_720s[3129].csv
load region with Harp number 3119.0
Writing 1570 records to data/keys_regions/hmi.sharp_cea_720s[3119].csv
load region with Harp number 3149.0
Writing 933 records to data/keys_regions/hmi.sharp_cea_720s[3149].csv
load region with Harp number 3194.0
Writing 1483 records to data/keys_regions/hmi.sharp_cea_720s[3194].csv
load region with Harp number 3199.0
Writing 1545 records to data/keys_regions/hmi.sharp_cea_720s[3199].csv
load region with Harp number 3188.0
Writing 1202 records to data/keys_regions/hmi.sharp_cea_720s[3188].csv
load region with Harp number 3247.0
Writing 1463 records to data/keys_regions/hmi.sharp_cea_720s[3247].csv
load region with Harp number 3248.0
Writing 1353 records to data/keys_regions/hmi.sharp_cea_720s[3248].csv
load region with Harp number 3258.0
Writing 1613 records to data/keys_regions/hmi.sharp_cea_720s[3258].csv
load region with Harp number 3263.0
Writing 1529 records to data/keys_regions/hmi.sharp_cea_720s[3263].csv
load region with Harp number 3273.0
Writing 1487 records to data/keys_regions/hmi.sharp_cea_720s[3273].csv
load region with Harp number 3267.0
Writing 1099 records to data/keys_regions/hmi.sharp_cea_720s[3267].csv
load region with Harp number 3291.0
Writing 1574 records to data/keys_regions/hmi.sharp_cea_720s[3291].csv
load region with Harp number 3288.0
Writing 1509 records to data/keys_regions/hmi.sharp_cea_720s[3288].csv
load region with Harp number 3295.0
Writing 1661 records to data/keys_regions/hmi.sharp_cea_720s[3295].csv
load region with Harp number 3311.0
Writing 1514 records to data/keys_regions/hmi.sharp_cea_720s[3311].csv
load region with Harp number 3321.0
Writing 1571 records to data/keys_regions/hmi.sharp_cea_720s[3321].csv
load region with Harp number 3336.0
Writing 1027 records to data/keys_regions/hmi.sharp_cea_720s[3336].csv
load region with Harp number 3341.0
Writing 1622 records to data/keys_regions/hmi.sharp_cea_720s[3341].csv
load region with Harp number 3344.0
Writing 1006 records to data/keys_regions/hmi.sharp_cea_720s[3344].csv
load region with Harp number 3330.0
Writing 1457 records to data/keys_regions/hmi.sharp_cea_720s[3330].csv
load region with Harp number 3364.0
Writing 1604 records to data/keys_regions/hmi.sharp_cea_720s[3364].csv
load region with Harp number 3366.0
```

Writing 1610 records to data/keys_regions/hmi.sharp_cea_720s[3366].csv
load region with Harp number 3362.0
Writing 328 records to data/keys_regions/hmi.sharp_cea_720s[3362].csv
load region with Harp number 3376.0
Writing 1624 records to data/keys_regions/hmi.sharp_cea_720s[3376].csv
load region with Harp number 3420.0
Writing 1529 records to data/keys_regions/hmi.sharp_cea_720s[3420].csv
load region with Harp number 3415.0
Writing 1644 records to data/keys_regions/hmi.sharp_cea_720s[3415].csv
load region with Harp number 3432.0
Writing 1367 records to data/keys_regions/hmi.sharp_cea_720s[3432].csv
load region with Harp number 3437.0
Writing 1536 records to data/keys_regions/hmi.sharp_cea_720s[3437].csv
load region with Harp number 3457.0
Writing 1554 records to data/keys_regions/hmi.sharp_cea_720s[3457].csv
load region with Harp number 3448.0
Writing 1540 records to data/keys_regions/hmi.sharp_cea_720s[3448].csv
load region with Harp number 3473.0
Writing 1717 records to data/keys_regions/hmi.sharp_cea_720s[3473].csv
load region with Harp number 3483.0
Writing 1629 records to data/keys_regions/hmi.sharp_cea_720s[3483].csv
load region with Harp number 3497.0
Writing 1636 records to data/keys_regions/hmi.sharp_cea_720s[3497].csv
load region with Harp number 3515.0
Writing 1300 records to data/keys_regions/hmi.sharp_cea_720s[3515].csv
load region with Harp number 3520.0
Writing 1783 records to data/keys_regions/hmi.sharp_cea_720s[3520].csv
load region with Harp number 3535.0
Writing 1629 records to data/keys_regions/hmi.sharp_cea_720s[3535].csv
load region with Harp number 3542.0
Writing 1639 records to data/keys_regions/hmi.sharp_cea_720s[3542].csv
load region with Harp number 3563.0
Writing 1822 records to data/keys_regions/hmi.sharp_cea_720s[3563].csv
load region with Harp number 3580.0
Writing 1196 records to data/keys_regions/hmi.sharp_cea_720s[3580].csv
load region with Harp number 3587.0
Writing 344 records to data/keys_regions/hmi.sharp_cea_720s[3587].csv
load region with Harp number 3604.0
Writing 1223 records to data/keys_regions/hmi.sharp_cea_720s[3604].csv
load region with Harp number 3608.0
Writing 1263 records to data/keys_regions/hmi.sharp_cea_720s[3608].csv
load region with Harp number 3647.0
Writing 1795 records to data/keys_regions/hmi.sharp_cea_720s[3647].csv
load region with Harp number 3631.0
Writing 1656 records to data/keys_regions/hmi.sharp_cea_720s[3631].csv
load region with Harp number 3686.0
Writing 1704 records to data/keys_regions/hmi.sharp_cea_720s[3686].csv
load region with Harp number 3688.0
Writing 1657 records to data/keys_regions/hmi.sharp_cea_720s[3688].csv
load region with Harp number 3730.0
Writing 1594 records to data/keys_regions/hmi.sharp_cea_720s[3730].csv
load region with Harp number 3721.0
Writing 1688 records to data/keys_regions/hmi.sharp_cea_720s[3721].csv
load region with Harp number 3719.0
Writing 1507 records to data/keys_regions/hmi.sharp_cea_720s[3719].csv
load region with Harp number 3740.0
Writing 1541 records to data/keys_regions/hmi.sharp_cea_720s[3740].csv
load region with Harp number 3711.0
Writing 1385 records to data/keys_regions/hmi.sharp_cea_720s[3711].csv
load region with Harp number 3766.0
Writing 1580 records to data/keys_regions/hmi.sharp_cea_720s[3766].csv

```
load region with Harp number 3784.0
Writing 1952 records to data/keys_regions/hmi.sharp_cea_720s[3784].csv
load region with Harp number 3793.0
Writing 1535 records to data/keys_regions/hmi.sharp_cea_720s[3793].csv
load region with Harp number 3779.0
Writing 1471 records to data/keys_regions/hmi.sharp_cea_720s[3779].csv
load region with Harp number 3804.0
Writing 1521 records to data/keys_regions/hmi.sharp_cea_720s[3804].csv
load region with Harp number 3813.0
Writing 1318 records to data/keys_regions/hmi.sharp_cea_720s[3813].csv
load region with Harp number 3836.0
Writing 1340 records to data/keys_regions/hmi.sharp_cea_720s[3836].csv
load region with Harp number 3845.0
Writing 765 records to data/keys_regions/hmi.sharp_cea_720s[3845].csv
load region with Harp number 3824.0
Writing 1309 records to data/keys_regions/hmi.sharp_cea_720s[3824].csv
load region with Harp number 3848.0
Writing 1435 records to data/keys_regions/hmi.sharp_cea_720s[3848].csv
load region with Harp number 3856.0
Writing 1786 records to data/keys_regions/hmi.sharp_cea_720s[3856].csv
load region with Harp number 3879.0
Writing 1556 records to data/keys_regions/hmi.sharp_cea_720s[3879].csv
load region with Harp number 3874.0
Writing 1315 records to data/keys_regions/hmi.sharp_cea_720s[3874].csv
load region with Harp number 3877.0
Writing 649 records to data/keys_regions/hmi.sharp_cea_720s[3877].csv
load region with Harp number 3894.0
Writing 1383 records to data/keys_regions/hmi.sharp_cea_720s[3894].csv
load region with Harp number 3907.0
Writing 1267 records to data/keys_regions/hmi.sharp_cea_720s[3907].csv
load region with Harp number 3942.0
Writing 1479 records to data/keys_regions/hmi.sharp_cea_720s[3942].csv
load region with Harp number 3926.0
Writing 1299 records to data/keys_regions/hmi.sharp_cea_720s[3926].csv
load region with Harp number 3957.0
Writing 973 records to data/keys_regions/hmi.sharp_cea_720s[3957].csv
load region with Harp number 3941.0
Writing 1530 records to data/keys_regions/hmi.sharp_cea_720s[3941].csv
load region with Harp number 3912.0
Writing 1639 records to data/keys_regions/hmi.sharp_cea_720s[3912].csv
load region with Harp number 4000.0
Writing 1876 records to data/keys_regions/hmi.sharp_cea_720s[4000].csv
load region with Harp number 3999.0
Writing 1445 records to data/keys_regions/hmi.sharp_cea_720s[3999].csv
load region with Harp number 4025.0
Writing 1500 records to data/keys_regions/hmi.sharp_cea_720s[4025].csv
load region with Harp number 3996.0
Writing 1546 records to data/keys_regions/hmi.sharp_cea_720s[3996].csv
load region with Harp number 4040.0
Writing 1313 records to data/keys_regions/hmi.sharp_cea_720s[4040].csv
load region with Harp number 3985.0
Writing 1615 records to data/keys_regions/hmi.sharp_cea_720s[3985].csv
load region with Harp number 4042.0
Writing 1634 records to data/keys_regions/hmi.sharp_cea_720s[4042].csv
load region with Harp number 4065.0
Writing 645 records to data/keys_regions/hmi.sharp_cea_720s[4065].csv
load region with Harp number 4075.0
Writing 1320 records to data/keys_regions/hmi.sharp_cea_720s[4075].csv
load region with Harp number 4073.0
Writing 1589 records to data/keys_regions/hmi.sharp_cea_720s[4073].csv
load region with Harp number 4071.0
```

Writing 1402 records to data/keys_regions/hmi.sharp_cea_720s[4071].csv
load region with Harp number 4088.0
Writing 1292 records to data/keys_regions/hmi.sharp_cea_720s[4088].csv
load region with Harp number 4092.0
Writing 1107 records to data/keys_regions/hmi.sharp_cea_720s[4092].csv
load region with Harp number 4097.0
Writing 1680 records to data/keys_regions/hmi.sharp_cea_720s[4097].csv
load region with Harp number 4111.0
Writing 1606 records to data/keys_regions/hmi.sharp_cea_720s[4111].csv
load region with Harp number 4133.0
Writing 1019 records to data/keys_regions/hmi.sharp_cea_720s[4133].csv
load region with Harp number 4131.0
Writing 1185 records to data/keys_regions/hmi.sharp_cea_720s[4131].csv
load region with Harp number 4156.0
Writing 1556 records to data/keys_regions/hmi.sharp_cea_720s[4156].csv
load region with Harp number 4138.0
Writing 1615 records to data/keys_regions/hmi.sharp_cea_720s[4138].csv
load region with Harp number 4190.0
Writing 1563 records to data/keys_regions/hmi.sharp_cea_720s[4190].csv
load region with Harp number 4186.0
Writing 1485 records to data/keys_regions/hmi.sharp_cea_720s[4186].csv
load region with Harp number 4197.0
Writing 1614 records to data/keys_regions/hmi.sharp_cea_720s[4197].csv
load region with Harp number 4179.0
Writing 1086 records to data/keys_regions/hmi.sharp_cea_720s[4179].csv
load region with Harp number 4225.0
Writing 1693 records to data/keys_regions/hmi.sharp_cea_720s[4225].csv
load region with Harp number 4231.0
Writing 1081 records to data/keys_regions/hmi.sharp_cea_720s[4231].csv
load region with Harp number 4205.0
Writing 1402 records to data/keys_regions/hmi.sharp_cea_720s[4205].csv
load region with Harp number 4252.0
Writing 1465 records to data/keys_regions/hmi.sharp_cea_720s[4252].csv
load region with Harp number 4265.0
Writing 305 records to data/keys_regions/hmi.sharp_cea_720s[4265].csv
load region with Harp number 4272.0
Writing 1337 records to data/keys_regions/hmi.sharp_cea_720s[4272].csv
load region with Harp number 4288.0
Writing 1461 records to data/keys_regions/hmi.sharp_cea_720s[4288].csv
load region with Harp number 4296.0
Writing 1694 records to data/keys_regions/hmi.sharp_cea_720s[4296].csv
load region with Harp number 4294.0
Writing 1746 records to data/keys_regions/hmi.sharp_cea_720s[4294].csv
load region with Harp number 4321.0
Writing 1557 records to data/keys_regions/hmi.sharp_cea_720s[4321].csv
load region with Harp number 4351.0
Writing 1342 records to data/keys_regions/hmi.sharp_cea_720s[4351].csv
load region with Harp number 4344.0
Writing 1464 records to data/keys_regions/hmi.sharp_cea_720s[4344].csv
load region with Harp number 4379.0
Writing 1513 records to data/keys_regions/hmi.sharp_cea_720s[4379].csv
load region with Harp number 4390.0
Writing 1558 records to data/keys_regions/hmi.sharp_cea_720s[4390].csv
load region with Harp number 4383.0
Writing 1439 records to data/keys_regions/hmi.sharp_cea_720s[4383].csv
load region with Harp number 4396.0
Writing 1922 records to data/keys_regions/hmi.sharp_cea_720s[4396].csv
load region with Harp number 4424.0
Writing 1678 records to data/keys_regions/hmi.sharp_cea_720s[4424].csv
load region with Harp number 4422.0
Writing 913 records to data/keys_regions/hmi.sharp_cea_720s[4422].csv

```
load region with Harp number 4610.0
Writing 1479 records to data/keys_regions/hmi.sharp_cea_720s[4610].csv
load region with Harp number 4616.0
Writing 1476 records to data/keys_regions/hmi.sharp_cea_720s[4616].csv
load region with Harp number 4639.0
Writing 1518 records to data/keys_regions/hmi.sharp_cea_720s[4639].csv
load region with Harp number 4678.0
Writing 1571 records to data/keys_regions/hmi.sharp_cea_720s[4678].csv
load region with Harp number 4698.0
Writing 1693 records to data/keys_regions/hmi.sharp_cea_720s[4698].csv
load region with Harp number 4711.0
Writing 1098 records to data/keys_regions/hmi.sharp_cea_720s[4711].csv
load region with Harp number 4760.0
Writing 1368 records to data/keys_regions/hmi.sharp_cea_720s[4760].csv
load region with Harp number 4781.0
Writing 1549 records to data/keys_regions/hmi.sharp_cea_720s[4781].csv
load region with Harp number 4764.0
Writing 1130 records to data/keys_regions/hmi.sharp_cea_720s[4764].csv
load region with Harp number 4800.0
Writing 1641 records to data/keys_regions/hmi.sharp_cea_720s[4800].csv
load region with Harp number 4810.0
Writing 1183 records to data/keys_regions/hmi.sharp_cea_720s[4810].csv
load region with Harp number 4817.0
Writing 1689 records to data/keys_regions/hmi.sharp_cea_720s[4817].csv
load region with Harp number 4851.0
Writing 1580 records to data/keys_regions/hmi.sharp_cea_720s[4851].csv
load region with Harp number 4862.0
Writing 1685 records to data/keys_regions/hmi.sharp_cea_720s[4862].csv
load region with Harp number 4868.0
Writing 1003 records to data/keys_regions/hmi.sharp_cea_720s[4868].csv
load region with Harp number 4874.0
Writing 1551 records to data/keys_regions/hmi.sharp_cea_720s[4874].csv
load region with Harp number 4872.0
Writing 1480 records to data/keys_regions/hmi.sharp_cea_720s[4872].csv
load region with Harp number 4879.0
Writing 590 records to data/keys_regions/hmi.sharp_cea_720s[4879].csv
load region with Harp number 4888.0
Writing 1559 records to data/keys_regions/hmi.sharp_cea_720s[4888].csv
load region with Harp number 4900.0
Writing 1559 records to data/keys_regions/hmi.sharp_cea_720s[4900].csv
load region with Harp number 4932.0
Writing 1598 records to data/keys_regions/hmi.sharp_cea_720s[4932].csv
load region with Harp number 4921.0
Writing 1072 records to data/keys_regions/hmi.sharp_cea_720s[4921].csv
load region with Harp number 4908.0
Writing 1388 records to data/keys_regions/hmi.sharp_cea_720s[4908].csv
load region with Harp number 4920.0
Writing 1829 records to data/keys_regions/hmi.sharp_cea_720s[4920].csv
load region with Harp number 4941.0
Writing 1557 records to data/keys_regions/hmi.sharp_cea_720s[4941].csv
load region with Harp number 4942.0
Writing 1212 records to data/keys_regions/hmi.sharp_cea_720s[4942].csv
load region with Harp number 4963.0
Writing 1240 records to data/keys_regions/hmi.sharp_cea_720s[4963].csv
load region with Harp number 4969.0
Writing 1357 records to data/keys_regions/hmi.sharp_cea_720s[4969].csv
load region with Harp number 4978.0
Writing 1741 records to data/keys_regions/hmi.sharp_cea_720s[4978].csv
load region with Harp number 4955.0
Writing 1542 records to data/keys_regions/hmi.sharp_cea_720s[4955].csv
load region with Harp number 5002.0
```

Writing 1524 records to data/keys_regions/hmi.sharp_cea_720s[5002].csv
load region with Harp number 4995.0
Writing 739 records to data/keys_regions/hmi.sharp_cea_720s[4995].csv
load region with Harp number 5011.0
Writing 1564 records to data/keys_regions/hmi.sharp_cea_720s[5011].csv
load region with Harp number 5005.0
Writing 1065 records to data/keys_regions/hmi.sharp_cea_720s[5005].csv
load region with Harp number 5026.0
Writing 1252 records to data/keys_regions/hmi.sharp_cea_720s[5026].csv
load region with Harp number 5039.0
Writing 1701 records to data/keys_regions/hmi.sharp_cea_720s[5039].csv
load region with Harp number 5036.0
Writing 1464 records to data/keys_regions/hmi.sharp_cea_720s[5036].csv
load region with Harp number 5022.0
Writing 1657 records to data/keys_regions/hmi.sharp_cea_720s[5022].csv
load region with Harp number 5051.0
Writing 1035 records to data/keys_regions/hmi.sharp_cea_720s[5051].csv
load region with Harp number 5028.0
Writing 1346 records to data/keys_regions/hmi.sharp_cea_720s[5028].csv
load region with Harp number 5075.0
Writing 1321 records to data/keys_regions/hmi.sharp_cea_720s[5075].csv
load region with Harp number 5107.0
Writing 1616 records to data/keys_regions/hmi.sharp_cea_720s[5107].csv
load region with Harp number 5111.0
Writing 1087 records to data/keys_regions/hmi.sharp_cea_720s[5111].csv
load region with Harp number 5118.0
Writing 848 records to data/keys_regions/hmi.sharp_cea_720s[5118].csv
load region with Harp number 5127.0
Writing 1666 records to data/keys_regions/hmi.sharp_cea_720s[5127].csv
load region with Harp number 5113.0
Writing 1386 records to data/keys_regions/hmi.sharp_cea_720s[5113].csv
load region with Harp number 5112.0
Writing 784 records to data/keys_regions/hmi.sharp_cea_720s[5112].csv
load region with Harp number 5144.0
Writing 1410 records to data/keys_regions/hmi.sharp_cea_720s[5144].csv
load region with Harp number 5151.0
Writing 1403 records to data/keys_regions/hmi.sharp_cea_720s[5151].csv
load region with Harp number 5186.0
Writing 1565 records to data/keys_regions/hmi.sharp_cea_720s[5186].csv
load region with Harp number 5183.0
Writing 1555 records to data/keys_regions/hmi.sharp_cea_720s[5183].csv
load region with Harp number 5198.0
Writing 1344 records to data/keys_regions/hmi.sharp_cea_720s[5198].csv
load region with Harp number 5233.0
Writing 1396 records to data/keys_regions/hmi.sharp_cea_720s[5233].csv
load region with Harp number 5246.0
Writing 1259 records to data/keys_regions/hmi.sharp_cea_720s[5246].csv
load region with Harp number 5249.0
Writing 1376 records to data/keys_regions/hmi.sharp_cea_720s[5249].csv
load region with Harp number 5298.0
Writing 1568 records to data/keys_regions/hmi.sharp_cea_720s[5298].csv
load region with Harp number 5326.0
Writing 916 records to data/keys_regions/hmi.sharp_cea_720s[5326].csv
load region with Harp number 5315.0
Writing 1129 records to data/keys_regions/hmi.sharp_cea_720s[5315].csv
load region with Harp number 5354.0
Writing 1526 records to data/keys_regions/hmi.sharp_cea_720s[5354].csv
load region with Harp number 5342.0
Writing 1590 records to data/keys_regions/hmi.sharp_cea_720s[5342].csv
load region with Harp number 5366.0
Writing 1430 records to data/keys_regions/hmi.sharp_cea_720s[5366].csv


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load region with Harp number 5375.0
Writing 1140 records to data/keys_regions/hmi.sharp_cea_720s[5375].csv
load region with Harp number 5422.0
Writing 1336 records to data/keys_regions/hmi.sharp_cea_720s[5422].csv
load region with Harp number 5415.0
Writing 1574 records to data/keys_regions/hmi.sharp_cea_720s[5415].csv
load region with Harp number 5447.0
Writing 1778 records to data/keys_regions/hmi.sharp_cea_720s[5447].csv
load region with Harp number 4376.0
Writing 341 records to data/keys_regions/hmi.sharp_cea_720s[4376].csv
load region with Harp number 5446.0
Writing 1376 records to data/keys_regions/hmi.sharp_cea_720s[5446].csv
load region with Harp number 5492.0
Writing 1287 records to data/keys_regions/hmi.sharp_cea_720s[5492].csv
load region with Harp number 5462.0
Writing 1593 records to data/keys_regions/hmi.sharp_cea_720s[5462].csv
load region with Harp number 5526.0
Writing 1528 records to data/keys_regions/hmi.sharp_cea_720s[5526].csv
load region with Harp number 5537.0
Writing 1262 records to data/keys_regions/hmi.sharp_cea_720s[5537].csv
load region with Harp number 5541.0
Writing 1636 records to data/keys_regions/hmi.sharp_cea_720s[5541].csv
load region with Harp number 5549.0
Writing 1543 records to data/keys_regions/hmi.sharp_cea_720s[5549].csv
load region with Harp number 5545.0
Writing 1452 records to data/keys_regions/hmi.sharp_cea_720s[5545].csv
load region with Harp number 5571.0
Writing 1530 records to data/keys_regions/hmi.sharp_cea_720s[5571].csv
load region with Harp number 5586.0
Writing 1371 records to data/keys_regions/hmi.sharp_cea_720s[5586].csv
load region with Harp number 5596.0
Writing 1008 records to data/keys_regions/hmi.sharp_cea_720s[5596].csv
load region with Harp number 5618.0
Writing 1624 records to data/keys_regions/hmi.sharp_cea_720s[5618].csv
load region with Harp number 5637.0
Writing 1611 records to data/keys_regions/hmi.sharp_cea_720s[5637].csv
load region with Harp number 5644.0
Writing 1644 records to data/keys_regions/hmi.sharp_cea_720s[5644].csv
load region with Harp number 5653.0
Writing 1532 records to data/keys_regions/hmi.sharp_cea_720s[5653].csv
load region with Harp number 5658.0
Writing 1238 records to data/keys_regions/hmi.sharp_cea_720s[5658].csv
load region with Harp number 5673.0
Writing 1556 records to data/keys_regions/hmi.sharp_cea_720s[5673].csv
load region with Harp number 5099.0
Writing 987 records to data/keys_regions/hmi.sharp_cea_720s[5099].csv
load region with Harp number 5675.0
Writing 529 records to data/keys_regions/hmi.sharp_cea_720s[5675].csv
load region with Harp number 5692.0
Writing 1602 records to data/keys_regions/hmi.sharp_cea_720s[5692].csv
load region with Harp number 5718.0
Writing 1630 records to data/keys_regions/hmi.sharp_cea_720s[5718].csv
load region with Harp number 5738.0
Writing 1410 records to data/keys_regions/hmi.sharp_cea_720s[5738].csv
load region with Harp number 5745.0
Writing 1453 records to data/keys_regions/hmi.sharp_cea_720s[5745].csv
load region with Harp number 5739.0
Writing 1371 records to data/keys_regions/hmi.sharp_cea_720s[5739].csv
load region with Harp number 5789.0
Writing 1411 records to data/keys_regions/hmi.sharp_cea_720s[5789].csv
load region with Harp number 5783.0
```

Writing 692 records to data/keys_regions/hmi.sharp_cea_720s[5783].csv
load region with Harp number 5808.0
Writing 1390 records to data/keys_regions/hmi.sharp_cea_720s[5808].csv
load region with Harp number 5807.0
Writing 1214 records to data/keys_regions/hmi.sharp_cea_720s[5807].csv
load region with Harp number 5848.0
Writing 1418 records to data/keys_regions/hmi.sharp_cea_720s[5848].csv
load region with Harp number 5831.0
Writing 1593 records to data/keys_regions/hmi.sharp_cea_720s[5831].csv
load region with Harp number 5880.0
Writing 1209 records to data/keys_regions/hmi.sharp_cea_720s[5880].csv
load region with Harp number 5885.0
Writing 1512 records to data/keys_regions/hmi.sharp_cea_720s[5885].csv
load region with Harp number 5916.0
Writing 1047 records to data/keys_regions/hmi.sharp_cea_720s[5916].csv
load region with Harp number 5894.0
Writing 1340 records to data/keys_regions/hmi.sharp_cea_720s[5894].csv
load region with Harp number 5944.0
Writing 1208 records to data/keys_regions/hmi.sharp_cea_720s[5944].csv
load region with Harp number 5956.0
Writing 1439 records to data/keys_regions/hmi.sharp_cea_720s[5956].csv
load region with Harp number 5963.0
Writing 1221 records to data/keys_regions/hmi.sharp_cea_720s[5963].csv
load region with Harp number 5974.0
Writing 1691 records to data/keys_regions/hmi.sharp_cea_720s[5974].csv
load region with Harp number 5983.0
Writing 1386 records to data/keys_regions/hmi.sharp_cea_720s[5983].csv
load region with Harp number 5976.0
Writing 1190 records to data/keys_regions/hmi.sharp_cea_720s[5976].csv
load region with Harp number 5982.0
Writing 893 records to data/keys_regions/hmi.sharp_cea_720s[5982].csv
load region with Harp number 5990.0
Writing 472 records to data/keys_regions/hmi.sharp_cea_720s[5990].csv
load region with Harp number 5991.0
Writing 1317 records to data/keys_regions/hmi.sharp_cea_720s[5991].csv
load region with Harp number 6015.0
Writing 1560 records to data/keys_regions/hmi.sharp_cea_720s[6015].csv
load region with Harp number 6026.0
Writing 1721 records to data/keys_regions/hmi.sharp_cea_720s[6026].csv
load region with Harp number 6027.0
Writing 1634 records to data/keys_regions/hmi.sharp_cea_720s[6027].csv
load region with Harp number 6063.0
Writing 1570 records to data/keys_regions/hmi.sharp_cea_720s[6063].csv
load region with Harp number 6054.0
Writing 814 records to data/keys_regions/hmi.sharp_cea_720s[6054].csv
load region with Harp number 6052.0
Writing 1729 records to data/keys_regions/hmi.sharp_cea_720s[6052].csv
load region with Harp number 6075.0
Writing 1559 records to data/keys_regions/hmi.sharp_cea_720s[6075].csv
load region with Harp number 6078.0
Writing 1418 records to data/keys_regions/hmi.sharp_cea_720s[6078].csv
load region with Harp number 6069.0
Writing 824 records to data/keys_regions/hmi.sharp_cea_720s[6069].csv
load region with Harp number 6084.0
Writing 1239 records to data/keys_regions/hmi.sharp_cea_720s[6084].csv
load region with Harp number 6100.0
Writing 1556 records to data/keys_regions/hmi.sharp_cea_720s[6100].csv
load region with Harp number 6124.0
Writing 1544 records to data/keys_regions/hmi.sharp_cea_720s[6124].csv
load region with Harp number 6136.0
Writing 1482 records to data/keys_regions/hmi.sharp_cea_720s[6136].csv

```
load region with Harp number 6155.0
Writing 1461 records to data/keys_regions/hmi.sharp_cea_720s[6155].csv
load region with Harp number 6154.0
Writing 1397 records to data/keys_regions/hmi.sharp_cea_720s[6154].csv
load region with Harp number 6164.0
Writing 1293 records to data/keys_regions/hmi.sharp_cea_720s[6164].csv
load region with Harp number 6167.0
Writing 1478 records to data/keys_regions/hmi.sharp_cea_720s[6167].csv
load region with Harp number 6172.0
Writing 1408 records to data/keys_regions/hmi.sharp_cea_720s[6172].csv
load region with Harp number 6178.0
Writing 1665 records to data/keys_regions/hmi.sharp_cea_720s[6178].csv
load region with Harp number 6205.0
Writing 1311 records to data/keys_regions/hmi.sharp_cea_720s[6205].csv
load region with Harp number 6206.0
Writing 1443 records to data/keys_regions/hmi.sharp_cea_720s[6206].csv
load region with Harp number 6242.0
Writing 1457 records to data/keys_regions/hmi.sharp_cea_720s[6242].csv
load region with Harp number 6258.0
Writing 1289 records to data/keys_regions/hmi.sharp_cea_720s[6258].csv
load region with Harp number 6281.0
Writing 1544 records to data/keys_regions/hmi.sharp_cea_720s[6281].csv
load region with Harp number 6289.0
Writing 1515 records to data/keys_regions/hmi.sharp_cea_720s[6289].csv
load region with Harp number 6301.0
Writing 1475 records to data/keys_regions/hmi.sharp_cea_720s[6301].csv
load region with Harp number 6317.0
Writing 1368 records to data/keys_regions/hmi.sharp_cea_720s[6317].csv
load region with Harp number 6319.0
Writing 476 records to data/keys_regions/hmi.sharp_cea_720s[6319].csv
load region with Harp number 6320.0
Writing 1116 records to data/keys_regions/hmi.sharp_cea_720s[6320].csv
load region with Harp number 6302.0
Writing 1626 records to data/keys_regions/hmi.sharp_cea_720s[6302].csv
load region with Harp number 6327.0
Writing 1651 records to data/keys_regions/hmi.sharp_cea_720s[6327].csv
load region with Harp number 6356.0
Writing 323 records to data/keys_regions/hmi.sharp_cea_720s[6356].csv
load region with Harp number 6353.0
Writing 1094 records to data/keys_regions/hmi.sharp_cea_720s[6353].csv
load region with Harp number 6359.0
Writing 1412 records to data/keys_regions/hmi.sharp_cea_720s[6359].csv
load region with Harp number 6383.0
Writing 1308 records to data/keys_regions/hmi.sharp_cea_720s[6383].csv
load region with Harp number 6398.0
Writing 1262 records to data/keys_regions/hmi.sharp_cea_720s[6398].csv
load region with Harp number 6418.0
Writing 1541 records to data/keys_regions/hmi.sharp_cea_720s[6418].csv
load region with Harp number 6403.0
Writing 1373 records to data/keys_regions/hmi.sharp_cea_720s[6403].csv
load region with Harp number 6424.0
Writing 930 records to data/keys_regions/hmi.sharp_cea_720s[6424].csv
load region with Harp number 6427.0
Writing 381 records to data/keys_regions/hmi.sharp_cea_720s[6427].csv
load region with Harp number 6437.0
Writing 1525 records to data/keys_regions/hmi.sharp_cea_720s[6437].csv
load region with Harp number 6483.0
Writing 1558 records to data/keys_regions/hmi.sharp_cea_720s[6483].csv
load region with Harp number 6507.0
Writing 1340 records to data/keys_regions/hmi.sharp_cea_720s[6507].csv
load region with Harp number 6523.0
```

Writing 1326 records to data/keys_regions/hmi.sharp_cea_720s[6523].csv
load region with Harp number 6537.0
Writing 1521 records to data/keys_regions/hmi.sharp_cea_720s[6537].csv
load region with Harp number 6532.0
Writing 1288 records to data/keys_regions/hmi.sharp_cea_720s[6532].csv
load region with Harp number 6544.0
Writing 1043 records to data/keys_regions/hmi.sharp_cea_720s[6544].csv
load region with Harp number 6550.0
Writing 1421 records to data/keys_regions/hmi.sharp_cea_720s[6550].csv
load region with Harp number 6558.0
Writing 1592 records to data/keys_regions/hmi.sharp_cea_720s[6558].csv
load region with Harp number 6566.0
Writing 1400 records to data/keys_regions/hmi.sharp_cea_720s[6566].csv
load region with Harp number 6591.0
Writing 503 records to data/keys_regions/hmi.sharp_cea_720s[6591].csv
load region with Harp number 6599.0
Writing 1303 records to data/keys_regions/hmi.sharp_cea_720s[6599].csv
load region with Harp number 6617.0
Writing 1418 records to data/keys_regions/hmi.sharp_cea_720s[6617].csv
load region with Harp number 6661.0
Writing 343 records to data/keys_regions/hmi.sharp_cea_720s[6661].csv
load region with Harp number 6666.0
Writing 1497 records to data/keys_regions/hmi.sharp_cea_720s[6666].csv
load region with Harp number 6670.0
Writing 1659 records to data/keys_regions/hmi.sharp_cea_720s[6670].csv
load region with Harp number 6688.0
Writing 766 records to data/keys_regions/hmi.sharp_cea_720s[6688].csv
load region with Harp number 6692.0
Writing 904 records to data/keys_regions/hmi.sharp_cea_720s[6692].csv
load region with Harp number 6699.0
Writing 1493 records to data/keys_regions/hmi.sharp_cea_720s[6699].csv
load region with Harp number 6711.0
Writing 1167 records to data/keys_regions/hmi.sharp_cea_720s[6711].csv
load region with Harp number 6716.0
Writing 1067 records to data/keys_regions/hmi.sharp_cea_720s[6716].csv
load region with Harp number 6731.0
Writing 1462 records to data/keys_regions/hmi.sharp_cea_720s[6731].csv
load region with Harp number 6764.0
Writing 904 records to data/keys_regions/hmi.sharp_cea_720s[6764].csv
load region with Harp number 6754.0
Writing 1305 records to data/keys_regions/hmi.sharp_cea_720s[6754].csv
load region with Harp number 6769.0
Writing 1389 records to data/keys_regions/hmi.sharp_cea_720s[6769].csv
load region with Harp number 6794.0
Writing 1594 records to data/keys_regions/hmi.sharp_cea_720s[6794].csv
load region with Harp number 6846.0
Writing 1268 records to data/keys_regions/hmi.sharp_cea_720s[6846].csv
load region with Harp number 6870.0
Writing 1346 records to data/keys_regions/hmi.sharp_cea_720s[6870].csv
load region with Harp number 6920.0
Writing 1286 records to data/keys_regions/hmi.sharp_cea_720s[6920].csv
load region with Harp number 6922.0
Writing 1060 records to data/keys_regions/hmi.sharp_cea_720s[6922].csv
load region with Harp number 6949.0
Writing 856 records to data/keys_regions/hmi.sharp_cea_720s[6949].csv
load region with Harp number 6952.0
Writing 1387 records to data/keys_regions/hmi.sharp_cea_720s[6952].csv
load region with Harp number 6972.0
Writing 1313 records to data/keys_regions/hmi.sharp_cea_720s[6972].csv
load region with Harp number 6975.0
Writing 1444 records to data/keys_regions/hmi.sharp_cea_720s[6975].csv

```
load region with Harp number 6982.0
Writing 1342 records to data/keys_regions/hmi.sharp_cea_720s[6982].csv
load region with Harp number 6986.0
Writing 1534 records to data/keys_regions/hmi.sharp_cea_720s[6986].csv
load region with Harp number 7022.0
Writing 1082 records to data/keys_regions/hmi.sharp_cea_720s[7022].csv
load region with Harp number 7034.0
Writing 1403 records to data/keys_regions/hmi.sharp_cea_720s[7034].csv
load region with Harp number 7075.0
Writing 1504 records to data/keys_regions/hmi.sharp_cea_720s[7075].csv
load region with Harp number 7107.0
Writing 1525 records to data/keys_regions/hmi.sharp_cea_720s[7107].csv
load region with Harp number 7110.0
Writing 1409 records to data/keys_regions/hmi.sharp_cea_720s[7110].csv
load region with Harp number 7117.0
Writing 1595 records to data/keys_regions/hmi.sharp_cea_720s[7117].csv
load region with Harp number 7115.0
Writing 1431 records to data/keys_regions/hmi.sharp_cea_720s[7115].csv
load region with Harp number 7122.0
Writing 1241 records to data/keys_regions/hmi.sharp_cea_720s[7122].csv
load region with Harp number 7131.0
Writing 1575 records to data/keys_regions/hmi.sharp_cea_720s[7131].csv
load region with Harp number 7148.0
Writing 1608 records to data/keys_regions/hmi.sharp_cea_720s[7148].csv
load region with Harp number 7169.0
Writing 1375 records to data/keys_regions/hmi.sharp_cea_720s[7169].csv
load region with Harp number 7237.0
Writing 1481 records to data/keys_regions/hmi.sharp_cea_720s[7237].csv
load region with Harp number 7240.0
Writing 477 records to data/keys_regions/hmi.sharp_cea_720s[7240].csv
load region with Harp number 7246.0
Writing 1019 records to data/keys_regions/hmi.sharp_cea_720s[7246].csv
load region with Harp number 7262.0
Writing 1548 records to data/keys_regions/hmi.sharp_cea_720s[7262].csv
load region with Harp number 7275.0
Writing 971 records to data/keys_regions/hmi.sharp_cea_720s[7275].csv
```

In [59]:

```

import s3fs
from smart_open import open
def plot_harp_features_flares(harp, goes_events = goes_events, feature_key = 'R_VALUE'):
    str_query = f'hmi.sharp_cea_720s[{str(int(harp))}]'
    df = pd.read_csv(open('s3://solarflares/data/keys_regions/'+str_query+'.csv'))
    df["T_REC"] = drms.to_datetime(df.T_REC)
    df.set_index('T_REC', inplace=True)
    first_date = df.index.get_values()[0]

    is_visible = abs(df['CRVAL1']-df['CRLN_OBS'])<60
    df = df[is_visible]

    flux = goes_events[goes_events['harp_number']==harp][['start_time','flux']].set_index('start_time')
    #plt.figure(figsize = (10,14))
    fig, ax1 = plt.subplots(figsize=(15,5))
    #ax1.figure(figsize = (10,14))
    first_date = flux.index.get_values()[0]
    first_date = df.index.get_values()[0]
    #t2 = flux.index.get_values()[0]
    #first_data = min(t1,t2)
    dates_to_show = pd.date_range(pd.Timestamp(first_date).strftime('%m/%d/%Y'), period
s=14, freq='d')
    labels = dates_to_show.strftime('%b %d')
    color = 'tab:green'
    ax1.plot(df.index, df[feature_key], color=color)
    ax2 = ax1.twinx()
    ax2.bar(flux.index, flux.flux, width=0.05, facecolor='indianred')
    plt.setp(ax1, xticks=dates_to_show, xticklabels=labels);
    #ax2.set_ylim(0,10)

```

In [60]:

```

harp = 6327
plot_harp_features_flares(harp, feature_key = 'R_VALUE')

```



In [63]:

```
#Features from CSV
'''Now we need to generate features from time series evolutions. It is believed that ac
tive region "prepared for giving a flare".
So we decided to take complexity features at the considered moment add aggregates from
the past'''
'''1. Features at the time moment, not all moments each 2 hours
2. Mean and range (max-min) for features at the last 2 hours
3. Mean and range (max-min) at the last 6 hours
4. Mean and range (max-min) at the last 12 hours
5. Mean and range (max-min) at the last 24 hours
6. Mean and range (max-min) at the last 48 hours'''
def extract_features_from_csv(harp, time_stamp = 2, delay_hours = [2,6,12,24,48], long=
70):
    """
    process downloaded csv files with time series features and create features from the
    m
    harp: harp number
    time_stamp: frequency
    delay_hour:
    return: data_frame with features
    """
    str_query = f'hmi.sharp_cea_720s[{str(int(harp))}]'
    df = pd.read_csv(open('s3://solarflares/data/keys_regions/'+str_query+'.csv'))
    df['T_REC'] = drms.to_datetime(df.T_REC)
    df.set_index('T_REC', inplace=True)
    is_visible = abs(df['CRVAL1']-df['CRLN_OBS'])<long
    df = df[is_visible].drop(['CRVAL1', 'CRLN_OBS'], axis=1)
    first_date = df.index.get_values()[0]
    last_date = df.index.get_values()[-1]
    first_date = first_date+np.timedelta64(1, 'D')
    #round to closet whole hour
    first_date = pd.to_datetime(first_date).replace(microsecond=0,second=0,minute=0)+ti
medelta(hours=1)

    t_range = pd.date_range(first_date, last_date, freq=str(time_stamp)+'H')
    df_orig = df.loc[t_range]
    df_list = []
    df_list.append(df_orig)
    for delay in delay_hours:
        columns_=[col+'_mean_'+str(delay) for col in df_orig.columns]
        df_delay = df.rolling(str(delay)+'h').mean()
        df_delay.columns = columns_
        df_delay = df_delay.loc[t_range]
        df_list.append(df_delay)
        columns_=[col+'_range_'+str(delay) for col in df_orig.columns]
        df_delay = df.rolling(str(delay)+'h').max() - df.rolling(str(delay)+'h').min()
        df_delay.columns = columns_
        df_delay = df_delay.loc[t_range]
        df_list.append(df_delay)
    full_df = pd.concat(df_list, axis=1)
    full_df.dropna(inplace=True)
    full_df['HARP']=harp
    return full_df
```

In [64]:

```
harp = harp_list[4]
full_df = extract_features_from_csv(harp)
full_df.head()
```

Out[64]:

	USFLUX	MEANGBT	MEANJZH	MEANPOT	SHRGT45	TOTUSJH	MEANGBH
2010-06-10 04:00:00	2.235606e+21	141.044	-0.002669	2297.217	1.901	144.397	54.265
2010-06-10 06:00:00	2.423397e+21	133.750	-0.002078	1929.119	1.861	145.473	49.236
2010-06-10 08:00:00	2.497526e+21	127.085	-0.001155	1903.451	1.742	157.283	46.487
2010-06-10 10:00:00	2.196429e+21	135.547	0.000110	1971.593	2.134	140.319	48.598
2010-06-10 12:00:00	2.175385e+21	134.130	0.000092	1736.382	1.776	128.176	46.337

5 rows × 199 columns

In [65]:

```
#Define target
'''At each active region (harp) at each moment targer will be the number of events wher
e flux exceed M1.0 level (or 10 in flux value) in any time in the next 24 hours and 0 w
hen there is not such events.
Actually I will predict only the fact of solar flares, but maybe in future this informa
tion will be usefull, especially on error analysis stage'''

def compute_target(full_df, goes_events=goes_events, horizont = 24, level = 10):
    harp = full_df['HARP'][0]
    big_events = goes_events[(goes_events['harp_number']==harp) &(goes_events.flux>leve
1)]
    target = pd.Series(full_df.index.map(lambda x: np.sum((x>big_events.start_time - np
.timedelta64(horizont,'h'))
& (x<big_events.start_time))))
    full_df['target'] = target.values
    return full_df
full_df=compute_target(full_df)
```


In [66]:

```
#Feature from goes history
def compute_prev_flux(full_df, goes_events=goes_events):
    harp = full_df['HARP'][0]

    goes_harp = goes_events[(goes_events['harp_number']==harp)]
    prev_flux = pd.Series(full_df.index.map(lambda x: goes_harp.loc[goes_harp.start_time<x].flux.sum()))
    full_df['prev_flux'] = prev_flux.values
    return full_df
full_df=compute_prev_flux(full_df)
```

In [67]:

```
full_df.head()
```

Out[67]:

	USFLUX	MEANGBT	MEANJZH	MEANPOT	SHRGT45	TOTUSJH	MEANGBH
2010-06-10 04:00:00	2.235606e+21	141.044	-0.002669	2297.217	1.901	144.397	54.265
2010-06-10 06:00:00	2.423397e+21	133.750	-0.002078	1929.119	1.861	145.473	49.236
2010-06-10 08:00:00	2.497526e+21	127.085	-0.001155	1903.451	1.742	157.283	46.487
2010-06-10 10:00:00	2.196429e+21	135.547	0.000110	1971.593	2.134	140.319	48.598
2010-06-10 12:00:00	2.175385e+21	134.130	0.000092	1736.382	1.776	128.176	46.337

5 rows × 201 columns

In [68]:

```
from tqdm import tqdm
```

In [82]:

```

bucket='solarflares'
key='pkl/'+ 'solar_train.pkl'
df_list=[]
lp=pd.DataFrame()
for harp in tqdm(harp_list):
    df_ = extract_features_from_csv(harp)
    if df_.shape[0]==0:
        continue
    df_ = compute_target(df_, goes_events=goes_events)
    df_ = compute_prev_flux(df_)
    df_['Time'] = df_.index
    df_list.append(df_)
train_df = pd.concat(df_list, ignore_index=True).sort_values("Time")
pickle_buffer = BytesIO()
s3_resource = boto3.resource('s3')
train_df.to_pickle(pickle_buffer)
s3_resource.Object(bucket, key).put(Body=pickle_buffer.getvalue())
#train_df.to_pickle(os.path.join(DATA_PATH, 'solar_train.pkl'))

```

100%|██████████| 628/628 [05:35<00:00, 2.03it/s]

Out[82]:

```

{'ResponseMetadata': {'RequestId': '0FDE0DE9BCB70FD7',
  'HostId': 'IBIxSS43ZxYxQ5X3XW0P8HcXww4bKCWKMcNkStRQW3YR0zSz6aeij2EtgyAsK
OikfKE90MA5Z4I=',
  'HTTPStatusCode': 200,
  'HTTPHeaders': {'x-amz-id-2': 'IBIxSS43ZxYxQ5X3XW0P8HcXww4bKCWKMcNkStRQW
3YR0zSz6aeij2EtgyAsKOikfKE90MA5Z4I=',
    'x-amz-request-id': '0FDE0DE9BCB70FD7',
    'date': 'Sat, 11 May 2019 23:31:34 GMT',
    'etag': '"7143642058a4a8517b7385f16b967a50"',
    'content-length': '0',
    'server': 'AmazonS3'},
  'RetryAttempts': 0},
  'ETag': '"7143642058a4a8517b7385f16b967a50"'}

```

In [83]:

```

#Target distribution
'''Strong solar flares is rare events. Let's see to the target distribution. We have 4
values of target'''
train_df.target.value_counts()

```

Out[83]:

```

0      57738
1       2042
2        547
3        221
4         86
5         71
6         30
7         13
8          8
9          7
10         2
11         1
Name: target, dtype: int64

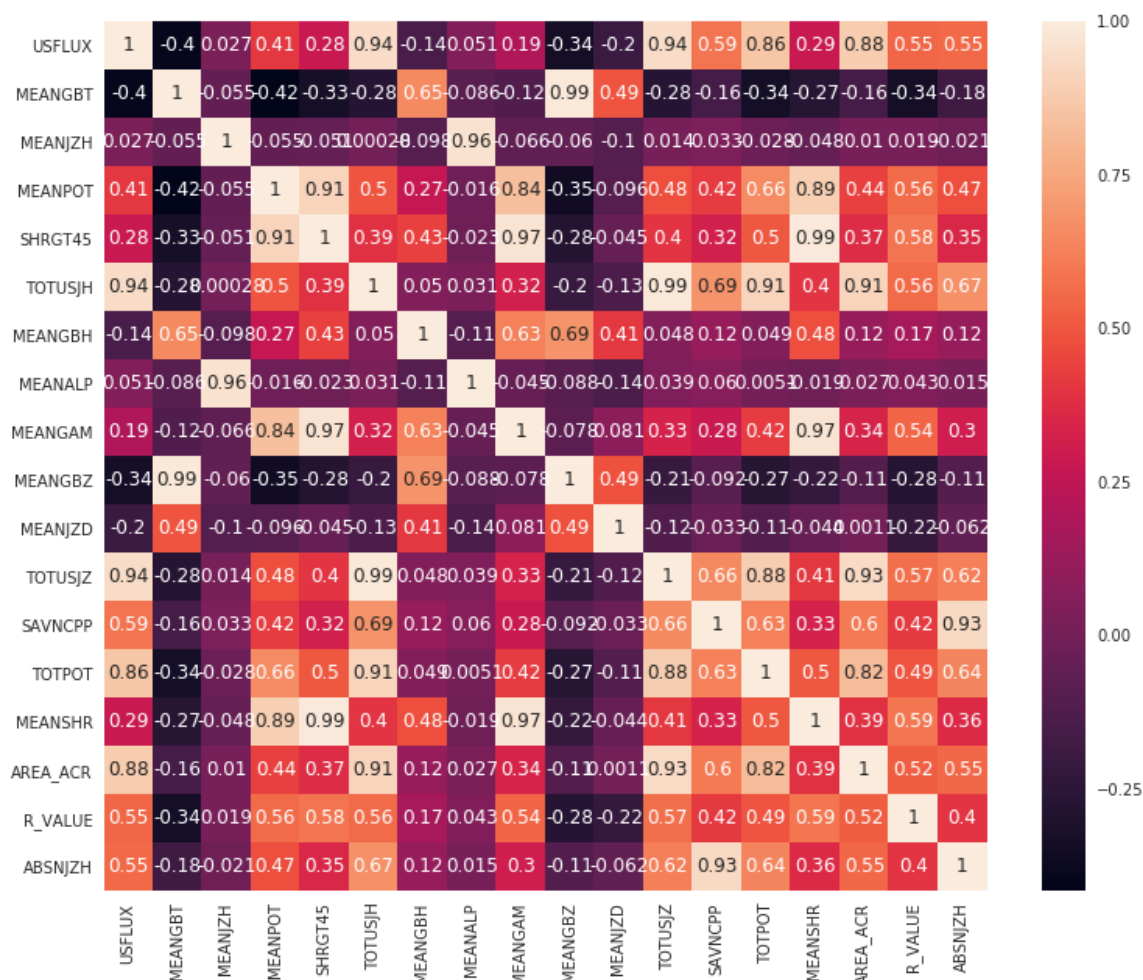
```

```
train_df['bin_target'] = train_df.target.map(lambda x: 0 if x==0 else 1)
train_df['bin_target'].value_counts()
```

```
0      57738
1       3028
Name: bin_target, dtype: int64
```

```
'''Let's see how the main features (without aggregates) depends with each other and with the target'''
key_cols = str.split('USFLUX,MEANGBT,MEANJZH,MEANPOT,SHRGT45,TOTUSJH,MEANGBH,MEANALP,MEANGAM,MEANGBZ,MEANJZD,TOTUSJZ,SAVNCPP,TOTPOT,MEANSHR,AREA_ACR,R_VALUE,ABSJZH', sep=',')
sns.set(rc={'figure.figsize':(12.7,10.27)})
sns.heatmap(train_df[key_cols].corr(), annot=True)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fcfeef6a3c8>
```



In [93]:

```
g = sns.FacetGrid(train_df, hue="bin_target",size=4)
g.map(sns.distplot, 'prev_flux')
```

/home/ec2-user/anaconda3/envs/python3/lib/python3.6/site-packages/matplotlib/axes/_axes.py:6462: UserWarning: The 'normed' kwarg is deprecated, and has been replaced by the 'density' kwarg.

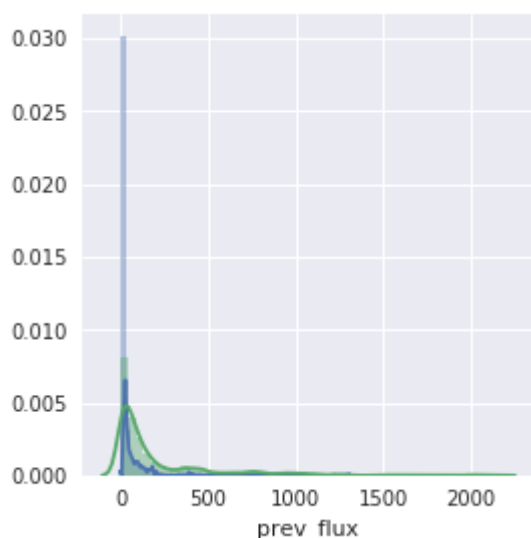
warnings.warn("The 'normed' kwarg is deprecated, and has been "

/home/ec2-user/anaconda3/envs/python3/lib/python3.6/site-packages/matplotlib/axes/_axes.py:6462: UserWarning: The 'normed' kwarg is deprecated, and has been replaced by the 'density' kwarg.

warnings.warn("The 'normed' kwarg is deprecated, and has been "

Out[93]:

```
<seaborn.axisgrid.FacetGrid at 0x7fcfef24f5c0>
```



In [94]:

```
#Data preprocessing. Metric selection and model selection
'''For cross_validation we will use time series split, in other cases we will get data
Leakage, through 24 hours we will definitely know about flare
As a model, we start with logistic regression as a baseline, then try random forest'''
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import TimeSeriesSplit, cross_val_score, GridSearchCV
from sklearn.metrics import roc_auc_score, recall_score, precision_score, accuracy_score,
classification_report, confusion_matrix
from sklearn.linear_model import LogisticRegression
from sklearn.pipeline import Pipeline
from sklearn.ensemble import RandomForestClassifier
```

/home/ec2-user/anaconda3/envs/python3/lib/python3.6/site-packages/sklearn/ensemble/weight_boosting.py:29: DeprecationWarning: numpy.core.umath_tests is an internal NumPy module and should not be imported. It will be removed in a future NumPy release.

```
from numpy.core.umath_tests import inner1d
```

In [95]:

```
#create Year feature
train_df['Year'] = train_df.Time.dt.year
```

In [96]:

```
train_part = train_df.loc[~train_df['Year'].isin([2017,2018])]
test_part = train_df.loc[train_df['Year'].isin([2017,2018])]
```

In [97]:

```
train_part.bin_target.value_counts()
```

Out[97]:

```
0    55533
1     2919
Name: bin_target, dtype: int64
```

In [98]:

```
test_part.bin_target.value_counts()
```

Out[98]:

```
0     2205
1      109
Name: bin_target, dtype: int64
```

In [99]:

```
#So we have 2907 positive events in train set and 109 in test. Try to fit baseline model only with key features without aggregates.
tcv = TimeSeriesSplit(n_splits=10)
logit_pipe = Pipeline([('scaler', StandardScaler()), ('logit', LogisticRegression(class_weight='balanced', random_state=17))])
score = cross_val_score(logit_pipe, train_part[key_cols], train_part['bin_target'], cv=tcv, scoring = 'roc_auc')
print('Validation score:', score)
logit_pipe.fit(train_part[key_cols], train_part['bin_target'])
```

```
Validation score: [0.83811197 0.87744361 0.91214578 0.88775583 0.90635559
0.85281733
0.88134772 0.92024042 0.94550114 0.97176689]
```

Out[99]:

```
Pipeline(memory=None,
      steps=[('scaler', StandardScaler(copy=True, with_mean=True, with_std=True)), ('logit', LogisticRegression(C=1.0, class_weight='balanced', dual=False,
      fit_intercept=True, intercept_scaling=1, max_iter=100,
      multi_class='ovr', n_jobs=1, penalty='l2', random_state=17,
      solver='liblinear', tol=0.0001, verbose=0, warm_start=False))])
```

In [100]:

```
#Actually not so bad, let's see at the confusion matrix at the train and test part.
```

In [101]:

```
y_pred = logit_pipe.predict_proba(train_part[key_cols])
class_names = ['No Flare', 'Flare']
pd.DataFrame(confusion_matrix(train_part['bin_target'], y_pred[:,1]>0.5), index=class_names, columns=class_names)
```

Out[101]:

	No Flare	Flare
No Flare	46671	8862
Flare	432	2487

In [102]:

```
y_pred = logit_pipe.predict_proba(test_part[key_cols])
class_names = ['No Flare', 'Flare']
pd.DataFrame(confusion_matrix(test_part['bin_target'], y_pred[:,1]>0.5), index=class_names, columns=class_names)
```

Out[102]:

	No Flare	Flare
No Flare	1892	313
Flare	10	99

In [106]:

```
#So we missed 11 flares at the test set, and 432 in train set. Let's try Random Forest.
```

In [104]:

```
%%time
rf = RandomForestClassifier(n_estimators = 100, max_depth=3, class_weight='balanced')
score = cross_val_score(rf, train_part[key_cols], train_part['bin_target'], cv=tcv, scoring = 'roc_auc')
print('Validation score:', score)
```

```
Validation score: [0.87104479 0.85416844 0.92363561 0.87315558 0.92748557
0.82182757
0.90410142 0.94510202 0.93116271 0.94686911]
CPU times: user 32.4 s, sys: 0 ns, total: 32.4 s
Wall time: 32.4 s
```

In [105]:

```
%%time
rf = RandomForestClassifier(n_estimators = 500, max_depth=3, class_weight='balanced')
rf.fit(train_part[key_cols], train_part['bin_target'])
```

```
CPU times: user 32.6 s, sys: 0 ns, total: 32.6 s
Wall time: 32.5 s
```

In [107]:

```
rf_pred = rf.predict_proba(train_part[key_cols])  
class_names = ['No Flare', 'Flare']  
pd.DataFrame(confusion_matrix(train_part['bin_target'], rf_pred[:,1]>0.5), index=class_names, columns=class_names)
```

Out[107]:

	No Flare	Flare
No Flare	44627	10906
Flare	341	2578

In [108]:

```
rf_pred = rf.predict_proba(test_part[key_cols])  
class_names = ['No Flare', 'Flare']  
pd.DataFrame(confusion_matrix(test_part['bin_target'], rf_pred[:,1]>0.5), index=class_names, columns=class_names)
```

Out[108]:

	No Flare	Flare
No Flare	1783	422
Flare	10	99

In []: