```
In [4]:  %matplotlib notebook
         from matplotlib import style
         style.use('fivethirtyeight')
         import matplotlib.pyplot as plt
```

```
In [5]:  import numpy as np
         import pandas as pd
         from sqlalchemy import func
         from sqlalchemy import desc
```

```
In [6]:   import datetime as dt
```

```
In [7]:  import os
         from flask import Flask
         from flask_sqlalchemy import SQLAlchemy
         import sqlalchemy
         from sqlalchemy.ext.automap import automap_base
         from sqlalchemy.orm import Session
         from sqlalchemy import create_engine, func
```

```
In [8]:  import sqlalchemy
```

```
In [9]:  engine = create_engine("sqlite:///hawaii.sqlite")
```

```
In [10]:  # reflect an existing database into a new model
          Base = automap_base()
          # reflect the tables
          Base.prepare(engine, reflect=True)
```

```
In [11]:  # We can view all of the classes that automap found
          Base.classes.keys()
```

```
Out[11]: ['measurement', 'station']
```

```
In [12]:  # Save references to each table
          Measurement = Base.classes.measurement
          Station = Base.classes.station
```

```
In [13]:  # Create our session (link) from Python to the DB
          session = Session(engine)
```

```
In [14]:  # Calculate the date 1 year ago from today
          yearago=(dt.date.today() - dt.timedelta(days=365*2))
```

```
In [15]:  yearago.strftime('%Y/%m/%d')
```

```
Out[15]: '2016/08/28'
```

In [16]:
```python
# Perform a query to retrieve the data and precipitation scores
results = session.query(Measurement.date,Measurement.prcp).filter(Measur
ement.date>yearago).all()
```

In [17]:
```python
# Save the query results as a Pandas DataFrame and set the index to the
 date column
df=pd.DataFrame(results)
df.set_index('date')
df.head()
```

Out[17]:

	date	prcp
0	2016-08-29	0.00
1	2016-08-30	0.00
2	2016-08-31	0.13
3	2016-09-01	0.00
4	2016-09-02	0.00

In [18]:
```
#Sort the dataframe by date
df.sort_values(by='date',ascending=False)
```
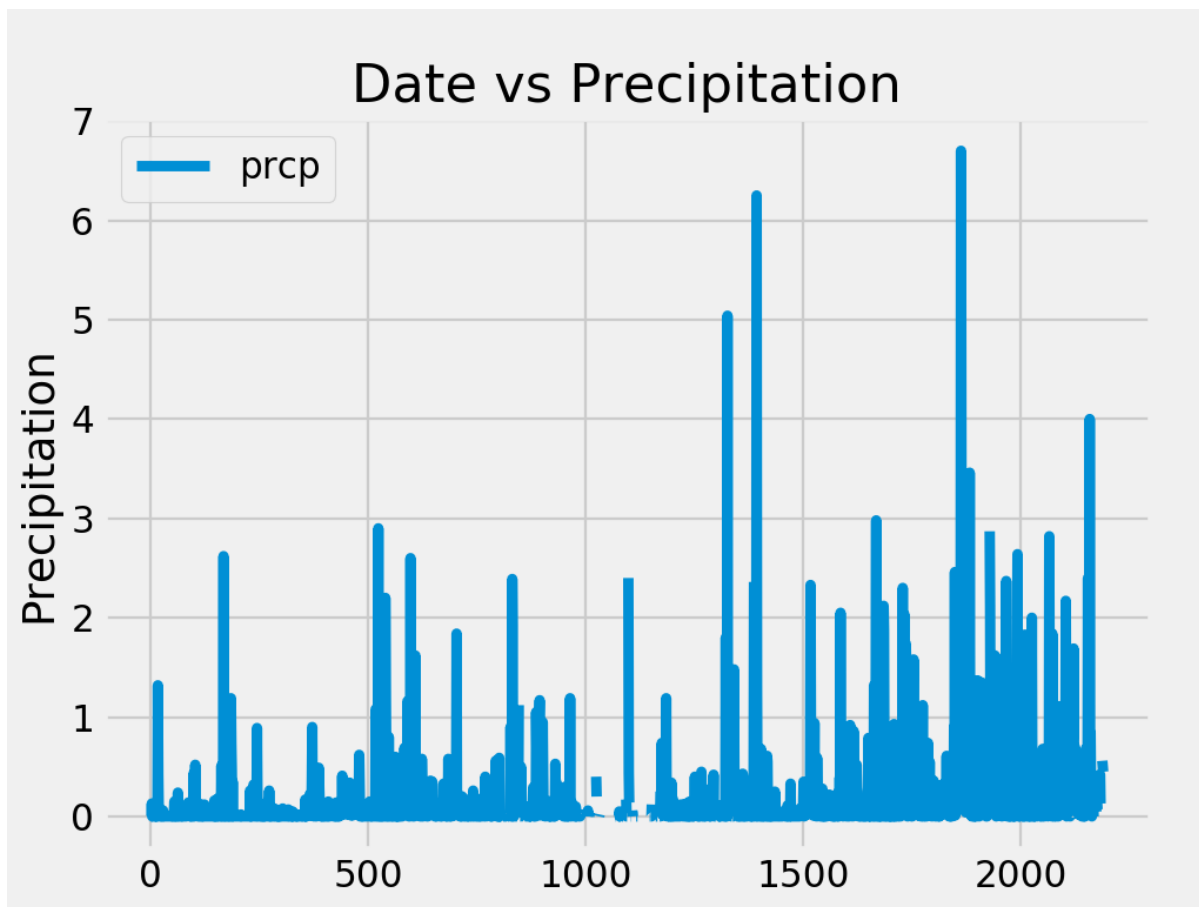
Out[18]:

	date	prcp
2190	2017-08-23	0.45
1500	2017-08-23	0.08
990	2017-08-23	0.00
354	2017-08-23	0.00
1499	2017-08-22	0.00
2189	2017-08-22	0.50
353	2017-08-22	0.00
2188	2017-08-21	0.56
989	2017-08-21	0.02
1498	2017-08-21	NaN
352	2017-08-21	0.00
988	2017-08-20	0.01
2187	2017-08-20	NaN
351	2017-08-20	0.00
2186	2017-08-19	0.09
1497	2017-08-19	NaN
350	2017-08-19	0.00
987	2017-08-19	0.00
986	2017-08-18	0.00
1846	2017-08-18	0.06
349	2017-08-18	0.00
2185	2017-08-18	NaN
1496	2017-08-17	0.05
985	2017-08-17	0.00
1845	2017-08-17	0.01
2184	2017-08-17	0.13
1495	2017-08-16	0.07
2183	2017-08-16	0.42
1844	2017-08-16	0.12
984	2017-08-16	0.00
...	...	...
359	2016-09-02	0.02

	date	prcp
1851	2016-09-02	0.03
1173	2016-09-02	NaN
4	2016-09-02	0.00
358	2016-09-01	0.00
694	2016-09-01	0.00
1850	2016-09-01	0.01
3	2016-09-01	0.00
1504	2016-09-01	0.02
994	2016-09-01	NaN
357	2016-08-31	0.10
1849	2016-08-31	2.46
1172	2016-08-31	0.25
1503	2016-08-31	0.24
2	2016-08-31	0.13
993	2016-08-31	NaN
693	2016-08-31	NaN
1	2016-08-30	0.00
1502	2016-08-30	0.00
356	2016-08-30	0.00
1848	2016-08-30	0.05
1171	2016-08-30	0.00
992	2016-08-30	0.02
692	2016-08-29	0.04
1501	2016-08-29	0.35
355	2016-08-29	0.17
1847	2016-08-29	0.90
1170	2016-08-29	0.00
991	2016-08-29	NaN
0	2016-08-29	0.00

2191 rows × 2 columns

In [44]:
```python
# Use Pandas Plotting with Matplotlib to plot the data
df.plot.line()
plt.title("Date vs Precipitation")
plt.ylabel("Precipitation")
plt.xlabel("Date")
fig.tight_layout()
plt.show()
```


In [20]:
```python
# Use Pandas to calcualte the summary statistics for the precipitation data
df['prcp'].describe()
```

Out[20]:
```
count    1985.000000
mean        0.172383
std         0.453252
min         0.000000
25%         0.000000
50%         0.020000
75%         0.130000
max         6.700000
Name: prcp, dtype: float64
```

In [21]:
```python
 # How many stations are available in this dataset?
no_stations=session.query(Station.id).count()
no_stations
```

Out[21]: 9

In [22]:
```python
# What are the most active stations?
# List the stations and the counts in descending order.
r1=session.query(Measurement.station, func.count(Measurement.tobs)).grou
p_by(Measurement.station).order_by(desc(func.count(Measurement.tobs))).a
ll()
r1
```

Out[22]:
```
[('USC00519281', 2772),
 ('USC00519397', 2724),
 ('USC00513117', 2709),
 ('USC00519523', 2669),
 ('USC00516128', 2612),
 ('USC00514830', 2202),
 ('USC00511918', 1979),
 ('USC00517948', 1372),
 ('USC00518838', 511)]
```

In [23]:
```python
# Using the station id from the previous query, calculate the lowest tem
perature recorded,
# highest temperature recorded, and average temperature most active stat
ion?
st_id=r1[0][0]
minmaxavg=session.query(
    func.min(Measurement.tobs).label("min_temperature"),
    func.max(Measurement.tobs).label("max_temperature"),
    func.avg(Measurement.tobs).label("avg_temperature")
).filter(Measurement.station==st_id).one()
minmaxavg
```

Out[23]: (54.0, 85.0, 71.66378066378067)

In [24]:
```python
# Choose the station with the highest number of temperature observations.
# Query the last 12 months of temperature observation data for this station and plot the results as a histogram
tem= session.query(Measurement.date,Measurement.tobs).filter(Measurement.station==st_id and Measurement.date>yearago).all()
tem
```

```
Out[24]: [('2010-01-01', 70.0),
          ('2010-01-02', 62.0),
          ('2010-01-03', 74.0),
          ('2010-01-04', 75.0),
          ('2010-01-05', 74.0),
          ('2010-01-06', 76.0),
          ('2010-01-07', 69.0),
          ('2010-01-08', 66.0),
          ('2010-01-09', 70.0),
          ('2010-01-10', 75.0),
          ('2010-01-11', 64.0),
          ('2010-01-12', 60.0),
          ('2010-01-13', 61.0),
          ('2010-01-14', 68.0),
          ('2010-01-15', 64.0),
          ('2010-01-16', 66.0),
          ('2010-01-17', 67.0),
          ('2010-01-18', 70.0),
          ('2010-01-19', 67.0),
          ('2010-01-20', 67.0),
          ('2010-01-21', 69.0),
          ('2010-01-22', 60.0),
          ('2010-01-23', 75.0),
          ('2010-01-24', 75.0),
          ('2010-01-25', 65.0),
          ('2010-01-26', 75.0),
          ('2010-01-27', 69.0),
          ('2010-01-28', 67.0),
          ('2010-01-29', 66.0),
          ('2010-01-30', 69.0),
          ('2010-01-31', 72.0),
          ('2010-02-01', 67.0),
          ('2010-02-02', 65.0),
          ('2010-02-03', 64.0),
          ('2010-02-04', 67.0),
          ('2010-02-05', 67.0),
          ('2010-02-06', 68.0),
          ('2010-02-07', 69.0),
          ('2010-02-08', 66.0),
          ('2010-02-09', 69.0),
          ('2010-02-10', 61.0),
          ('2010-02-11', 71.0),
          ('2010-02-12', 70.0),
          ('2010-02-13', 70.0),
          ('2010-02-14', 66.0),
          ('2010-02-15', 71.0),
          ('2010-02-16', 61.0),
          ('2010-02-17', 68.0),
          ('2010-02-18', 67.0),
          ('2010-02-19', 62.0),
          ('2010-02-20', 65.0),
          ('2010-02-21', 69.0),
          ('2010-02-22', 63.0),
          ('2010-02-23', 62.0),
          ('2010-02-24', 61.0),
          ('2010-02-25', 64.0),
          ('2010-02-26', 72.0),
```

```
('2010-02-27', 68.0),
('2010-02-28', 68.0),
('2010-03-01', 68.0),
('2010-03-02', 71.0),
('2010-03-03', 69.0),
('2010-03-04', 65.0),
('2010-03-05', 67.0),
('2010-03-06', 71.0),
('2010-03-07', 70.0),
('2010-03-08', 69.0),
('2010-03-09', 69.0),
('2010-03-10', 70.0),
('2010-03-11', 69.0),
('2010-03-12', 70.0),
('2010-03-13', 73.0),
('2010-03-14', 74.0),
('2010-03-15', 67.0),
('2010-03-16', 68.0),
('2010-03-17', 64.0),
('2010-03-18', 65.0),
('2010-03-19', 68.0),
('2010-03-20', 68.0),
('2010-03-21', 72.0),
('2010-03-22', 67.0),
('2010-03-23', 64.0),
('2010-03-24', 71.0),
('2010-03-25', 70.0),
('2010-03-26', 72.0),
('2010-03-27', 73.0),
('2010-03-28', 74.0),
('2010-03-29', 69.0),
('2010-03-30', 71.0),
('2010-03-31', 72.0),
('2010-04-01', 71.0),
('2010-04-02', 74.0),
('2010-04-03', 73.0),
('2010-04-04', 71.0),
('2010-04-05', 71.0),
('2010-04-06', 69.0),
('2010-04-07', 69.0),
('2010-04-08', 72.0),
('2010-04-09', 68.0),
('2010-04-10', 75.0),
('2010-04-11', 69.0),
('2010-04-12', 65.0),
('2010-04-13', 68.0),
('2010-04-14', 65.0),
('2010-04-15', 66.0),
('2010-04-16', 64.0),
('2010-04-17', 69.0),
('2010-04-18', 69.0),
('2010-04-19', 70.0),
('2010-04-20', 69.0),
('2010-04-21', 69.0),
('2010-04-22', 69.0),
('2010-04-23', 70.0),
('2010-04-24', 77.0),
```

```
('2010-04-25', 77.0),
('2010-04-26', 71.0),
('2010-04-27', 71.0),
('2010-04-28', 70.0),
('2010-04-29', 70.0),
('2010-04-30', 72.0),
('2010-05-01', 73.0),
('2010-05-02', 71.0),
('2010-05-03', 70.0),
('2010-05-04', 72.0),
('2010-05-05', 73.0),
('2010-05-06', 72.0),
('2010-05-07', 68.0),
('2010-05-08', 76.0),
('2010-05-09', 77.0),
('2010-05-10', 73.0),
('2010-05-11', 69.0),
('2010-05-12', 71.0),
('2010-05-13', 73.0),
('2010-05-14', 73.0),
('2010-05-15', 77.0),
('2010-05-16', 73.0),
('2010-05-17', 73.0),
('2010-05-18', 72.0),
('2010-05-19', 72.0),
('2010-05-20', 71.0),
('2010-05-21', 73.0),
('2010-05-22', 72.0),
('2010-05-23', 72.0),
('2010-05-24', 72.0),
('2010-05-25', 72.0),
('2010-05-26', 73.0),
('2010-05-27', 69.0),
('2010-05-28', 69.0),
('2010-05-29', 75.0),
('2010-05-30', 74.0),
('2010-05-31', 75.0),
('2010-06-01', 71.0),
('2010-06-02', 71.0),
('2010-06-03', 72.0),
('2010-06-04', 72.0),
('2010-06-05', 76.0),
('2010-06-06', 77.0),
('2010-06-07', 71.0),
('2010-06-08', 73.0),
('2010-06-09', 73.0),
('2010-06-10', 75.0),
('2010-06-11', 81.0),
('2010-06-12', 74.0),
('2010-06-13', 77.0),
('2010-06-14', 70.0),
('2010-06-15', 69.0),
('2010-06-16', 70.0),
('2010-06-17', 72.0),
('2010-06-18', 71.0),
('2010-06-19', 77.0),
('2010-06-20', 76.0),
```

```
('2010-06-21', 74.0),
('2010-06-22', 74.0),
('2010-06-23', 74.0),
('2010-06-24', 74.0),
('2010-06-25', 71.0),
('2010-06-26', 80.0),
('2010-06-27', 77.0),
('2010-06-28', 72.0),
('2010-06-29', 72.0),
('2010-06-30', 73.0),
('2010-07-01', 73.0),
('2010-07-02', 71.0),
('2010-07-03', 72.0),
('2010-07-04', 73.0),
('2010-07-05', 74.0),
('2010-07-06', 70.0),
('2010-07-07', 70.0),
('2010-07-08', 73.0),
('2010-07-09', 74.0),
('2010-07-10', 74.0),
('2010-07-11', 77.0),
('2010-07-12', 70.0),
('2010-07-13', 69.0),
('2010-07-14', 70.0),
('2010-07-15', 70.0),
('2010-07-16', 76.0),
('2010-07-17', 72.0),
('2010-07-18', 74.0),
('2010-07-19', 73.0),
('2010-07-20', 74.0),
('2010-07-21', 72.0),
('2010-07-22', 74.0),
('2010-07-23', 72.0),
('2010-07-24', 74.0),
('2010-07-25', 74.0),
('2010-07-26', 72.0),
('2010-07-27', 69.0),
('2010-07-28', 71.0),
('2010-07-29', 72.0),
('2010-07-30', 74.0),
('2010-07-31', 77.0),
('2010-08-01', 72.0),
('2010-08-02', 71.0),
('2010-08-03', 74.0),
('2010-08-04', 74.0),
('2010-08-05', 70.0),
('2010-08-06', 73.0),
('2010-08-07', 78.0),
('2010-08-08', 74.0),
('2010-08-09', 72.0),
('2010-08-10', 74.0),
('2010-08-11', 74.0),
('2010-08-12', 74.0),
('2010-08-13', 72.0),
('2010-08-14', 78.0),
('2010-08-15', 76.0),
('2010-08-16', 80.0),
```

```
            ('2010-08-17', 79.0),
            ('2010-08-18', 78.0),
            ('2010-08-19', 78.0),
            ('2010-08-20', 78.0),
            ('2010-08-21', 77.0),
            ('2010-08-22', 75.0),
            ('2010-08-23', 75.0),
            ('2010-08-24', 80.0),
            ('2010-08-25', 74.0),
            ('2010-08-26', 73.0),
            ('2010-08-27', 73.0),
            ('2010-08-28', 78.0),
            ('2010-08-29', 78.0),
            ('2010-08-30', 72.0),
            ('2010-08-31', 70.0),
            ('2010-09-01', 72.0),
            ('2010-09-02', 70.0),
            ('2010-09-03', 71.0),
            ('2010-09-04', 82.0),
            ('2010-09-05', 71.0),
            ('2010-09-06', 75.0),
            ('2010-09-07', 70.0),
            ('2010-09-08', 72.0),
            ('2010-09-09', 73.0),
            ('2010-09-10', 72.0),
            ('2010-09-11', 79.0),
            ('2010-09-12', 79.0),
            ('2010-09-13', 78.0),
            ('2010-09-14', 70.0),
            ('2010-09-15', 75.0),
            ('2010-09-16', 75.0),
            ('2010-09-17', 75.0),
            ('2010-09-18', 77.0),
            ('2010-09-19', 76.0),
            ('2010-09-20', 75.0),
            ('2010-09-21', 73.0),
            ('2010-09-22', 74.0),
            ('2010-09-23', 70.0),
            ('2010-09-24', 70.0),
            ('2010-09-25', 75.0),
            ('2010-09-26', 77.0),
            ('2010-09-27', 68.0),
            ('2010-09-28', 68.0),
            ('2010-09-29', 68.0),
            ('2010-09-30', 68.0),
            ('2010-10-01', 71.0),
            ('2010-10-02', 74.0),
            ('2010-10-03', 78.0),
            ('2010-10-04', 74.0),
            ('2010-10-05', 75.0),
            ('2010-10-06', 71.0),
            ('2010-10-07', 69.0),
            ('2010-10-08', 69.0),
            ('2010-10-09', 79.0),
            ('2010-10-10', 76.0),
            ('2010-10-11', 75.0),
            ('2010-10-12', 74.0),
```

```
('2010-10-13', 71.0),
('2010-10-14', 71.0),
('2010-10-15', 70.0),
('2010-10-16', 74.0),
('2010-10-17', 76.0),
('2010-10-18', 67.0),
('2010-10-19', 70.0),
('2010-10-20', 67.0),
('2010-10-21', 72.0),
('2010-10-22', 72.0),
('2010-10-23', 74.0),
('2010-10-24', 77.0),
('2010-10-25', 75.0),
('2010-10-26', 74.0),
('2010-10-27', 76.0),
('2010-10-28', 75.0),
('2010-10-29', 73.0),
('2010-10-30', 74.0),
('2010-10-31', 73.0),
('2010-11-01', 71.0),
('2010-11-03', 69.0),
('2010-11-04', 70.0),
('2010-11-05', 73.0),
('2010-11-06', 73.0),
('2010-11-07', 76.0),
('2010-11-08', 73.0),
('2010-11-09', 74.0),
('2010-11-10', 72.0),
('2010-11-11', 75.0),
('2010-11-12', 73.0),
('2010-11-13', 74.0),
('2010-11-14', 72.0),
('2010-11-15', 74.0),
('2010-11-16', 68.0),
('2010-11-17', 68.0),
('2010-11-18', 66.0),
('2010-11-19', 73.0),
('2010-11-20', 76.0),
('2010-11-21', 72.0),
('2010-11-22', 65.0),
('2010-11-23', 65.0),
('2010-11-24', 73.0),
('2010-11-25', 76.0),
('2010-11-26', 76.0),
('2010-11-27', 73.0),
('2010-11-28', 72.0),
('2010-11-29', 69.0),
('2010-11-30', 72.0),
('2010-12-01', 72.0),
('2010-12-02', 71.0),
('2010-12-03', 72.0),
('2010-12-04', 74.0),
('2010-12-05', 66.0),
('2010-12-06', 61.0),
('2010-12-07', 58.0),
('2010-12-08', 60.0),
('2010-12-09', 71.0),
```

```
('2010-12-10', 65.0),
('2010-12-11', 72.0),
('2010-12-12', 70.0),
('2010-12-13', 68.0),
('2010-12-14', 67.0),
('2010-12-15', 71.0),
('2010-12-16', 65.0),
('2010-12-17', 64.0),
('2010-12-18', 65.0),
('2010-12-19', 69.0),
('2010-12-20', 70.0),
('2010-12-21', 70.0),
('2010-12-22', 68.0),
('2010-12-23', 69.0),
('2010-12-24', 71.0),
('2010-12-25', 70.0),
('2010-12-26', 71.0),
('2010-12-27', 76.0),
('2010-12-28', 71.0),
('2010-12-29', 72.0),
('2010-12-30', 73.0),
('2010-12-31', 77.0),
('2011-01-01', 77.0),
('2011-01-02', 72.0),
('2011-01-03', 72.0),
('2011-01-04', 71.0),
('2011-01-05', 65.0),
('2011-01-06', 67.0),
('2011-01-07', 63.0),
('2011-01-08', 64.0),
('2011-01-09', 60.0),
('2011-01-10', 71.0),
('2011-01-11', 57.0),
('2011-01-12', 67.0),
('2011-01-13', 68.0),
('2011-01-14', 75.0),
('2011-01-15', 73.0),
('2011-01-16', 67.0),
('2011-01-17', 75.0),
('2011-01-18', 62.0),
('2011-01-19', 64.0),
('2011-01-20', 67.0),
('2011-01-21', 72.0),
('2011-01-22', 76.0),
('2011-01-23', 67.0),
('2011-01-24', 71.0),
('2011-01-25', 62.0),
('2011-01-26', 66.0),
('2011-01-27', 65.0),
('2011-01-28', 71.0),
('2011-01-29', 65.0),
('2011-01-30', 75.0),
('2011-01-31', 60.0),
('2011-02-01', 62.0),
('2011-02-02', 67.0),
('2011-02-03', 68.0),
('2011-02-04', 62.0),
```

```
        ('2011−02−05', 65.0),
        ('2011−02−06', 75.0),
        ('2011−02−07', 67.0),
        ('2011−02−08', 70.0),
        ('2011−02−09', 69.0),
        ('2011−02−10', 67.0),
        ('2011−02−11', 71.0),
        ('2011−02−12', 68.0),
        ('2011−02−13', 72.0),
        ('2011−02−14', 67.0),
        ('2011−02−15', 69.0),
        ('2011−02−16', 73.0),
        ('2011−02−17', 72.0),
        ('2011−02−18', 74.0),
        ('2011−02−19', 73.0),
        ('2011−02−20', 73.0),
        ('2011−02−21', 67.0),
        ('2011−02−22', 70.0),
        ('2011−02−23', 69.0),
        ('2011−02−24', 67.0),
        ('2011−02−25', 63.0),
        ('2011−02−26', 73.0),
        ('2011−02−27', 74.0),
        ('2011−02−28', 66.0),
        ('2011−03−01', 66.0),
        ('2011−03−02', 68.0),
        ('2011−03−03', 69.0),
        ('2011−03−04', 70.0),
        ('2011−03−05', 67.0),
        ('2011−03−06', 74.0),
        ('2011−03−07', 73.0),
        ('2011−03−08', 69.0),
        ('2011−03−09', 72.0),
        ('2011−03−10', 70.0),
        ('2011−03−11', 70.0),
        ('2011−03−12', 76.0),
        ('2011−03−13', 72.0),
        ('2011−03−14', 65.0),
        ('2011−03−15', 67.0),
        ('2011−03−16', 73.0),
        ('2011−03−17', 71.0),
        ('2011−03−18', 73.0),
        ('2011−03−19', 71.0),
        ('2011−03−20', 72.0),
        ('2011−03−21', 71.0),
        ('2011−03−22', 70.0),
        ('2011−03−23', 72.0),
        ('2011−03−24', 71.0),
        ('2011−03−25', 74.0),
        ('2011−03−26', 73.0),
        ('2011−03−27', 73.0),
        ('2011−03−28', 71.0),
        ('2011−03−29', 70.0),
        ('2011−03−30', 76.0),
        ('2011−03−31', 71.0),
        ('2011−04−01', 71.0),
        ('2011−04−02', 68.0),
```

```
('2011-04-03', 73.0),
('2011-04-04', 72.0),
('2011-04-05', 71.0),
('2011-04-06', 68.0),
('2011-04-07', 66.0),
('2011-04-08', 67.0),
('2011-04-09', 76.0),
('2011-04-10', 74.0),
('2011-04-11', 73.0),
('2011-04-12', 72.0),
('2011-04-13', 65.0),
('2011-04-14', 70.0),
('2011-04-15', 67.0),
('2011-04-16', 71.0),
('2011-04-17', 76.0),
('2011-04-18', 69.0),
('2011-04-19', 67.0),
('2011-04-20', 67.0),
('2011-04-21', 67.0),
('2011-04-22', 76.0),
('2011-04-23', 71.0),
('2011-04-24', 77.0),
('2011-04-25', 73.0),
('2011-04-26', 69.0),
('2011-04-27', 71.0),
('2011-04-28', 73.0),
('2011-04-29', 69.0),
('2011-04-30', 68.0),
('2011-05-01', 71.0),
('2011-05-02', 70.0),
('2011-05-03', 69.0),
('2011-05-04', 72.0),
('2011-05-05', 71.0),
('2011-05-06', 68.0),
('2011-05-07', 70.0),
('2011-05-08', 73.0),
('2011-05-09', 73.0),
('2011-05-10', 74.0),
('2011-05-11', 72.0),
('2011-05-12', 70.0),
('2011-05-13', 74.0),
('2011-05-14', 79.0),
('2011-05-15', 75.0),
('2011-05-16', 73.0),
('2011-05-17', 68.0),
('2011-05-18', 69.0),
('2011-05-19', 67.0),
('2011-05-20', 73.0),
('2011-05-21', 72.0),
('2011-05-22', 76.0),
('2011-05-23', 72.0),
('2011-05-24', 73.0),
('2011-05-25', 72.0),
('2011-05-26', 73.0),
('2011-05-27', 73.0),
('2011-05-28', 74.0),
('2011-05-29', 78.0),
```

```
('2011-05-30', 72.0),
('2011-05-31', 72.0),
('2011-06-01', 72.0),
('2011-06-02', 73.0),
('2011-06-03', 73.0),
('2011-06-08', 77.0),
('2011-06-09', 76.0),
('2011-06-10', 79.0),
('2011-06-11', 78.0),
('2011-06-12', 82.0),
('2011-06-13', 79.0),
('2011-06-14', 76.0),
('2011-06-15', 74.0),
('2011-06-16', 74.0),
('2011-06-17', 73.0),
('2011-06-18', 79.0),
('2011-06-19', 77.0),
('2011-06-20', 73.0),
('2011-06-21', 72.0),
('2011-06-22', 72.0),
('2011-06-23', 73.0),
('2011-06-24', 74.0),
('2011-06-25', 77.0),
('2011-06-26', 73.0),
('2011-06-27', 73.0),
('2011-06-28', 72.0),
('2011-06-29', 72.0),
('2011-06-30', 67.0),
('2011-07-01', 72.0),
('2011-07-02', 75.0),
('2011-07-03', 76.0),
('2011-07-04', 76.0),
('2011-07-05', 77.0),
('2011-07-06', 73.0),
('2011-07-07', 72.0),
('2011-07-08', 74.0),
('2011-07-09', 79.0),
('2011-07-10', 77.0),
('2011-07-11', 71.0),
('2011-07-12', 72.0),
('2011-07-13', 73.0),
('2011-07-14', 72.0),
('2011-07-15', 72.0),
('2011-07-16', 75.0),
('2011-07-17', 77.0),
('2011-07-18', 73.0),
('2011-07-19', 73.0),
('2011-07-20', 71.0),
('2011-07-21', 73.0),
('2011-07-22', 74.0),
('2011-07-23', 79.0),
('2011-07-24', 77.0),
('2011-07-25', 69.0),
('2011-07-26', 73.0),
('2011-07-27', 73.0),
('2011-07-28', 73.0),
('2011-07-29', 72.0),
```

```
            ('2011-07-30', 77.0),
            ('2011-07-31', 76.0),
            ('2011-08-01', 73.0),
            ('2011-08-02', 74.0),
            ('2011-08-03', 77.0),
            ('2011-08-04', 75.0),
            ('2011-08-05', 75.0),
            ('2011-08-06', 78.0),
            ('2011-08-07', 79.0),
            ('2011-08-08', 78.0),
            ('2011-08-09', 73.0),
            ('2011-08-10', 79.0),
            ('2011-08-11', 80.0),
            ('2011-08-12', 78.0),
            ('2011-08-13', 73.0),
            ('2011-08-14', 77.0),
            ('2011-08-15', 80.0),
            ('2011-08-16', 77.0),
            ('2011-08-17', 77.0),
            ('2011-08-18', 77.0),
            ('2011-08-19', 78.0),
            ('2011-08-20', 81.0),
            ('2011-08-21', 75.0),
            ('2011-08-22', 75.0),
            ('2011-08-23', 76.0),
            ('2011-08-24', 75.0),
            ('2011-08-25', 79.0),
            ('2011-08-26', 78.0),
            ('2011-08-27', 78.0),
            ('2011-08-28', 78.0),
            ('2011-08-29', 78.0),
            ('2011-08-30', 76.0),
            ('2011-08-31', 77.0),
            ('2011-09-01', 81.0),
            ('2011-09-02', 78.0),
            ('2011-09-03', 78.0),
            ('2011-09-04', 80.0),
            ('2011-09-05', 77.0),
            ('2011-09-06', 70.0),
            ('2011-09-07', 67.0),
            ('2011-09-08', 68.0),
            ('2011-09-09', 71.0),
            ('2011-09-10', 70.0),
            ('2011-09-11', 77.0),
            ('2011-09-12', 72.0),
            ('2011-09-13', 70.0),
            ('2011-09-14', 71.0),
            ('2011-09-15', 73.0),
            ('2011-09-16', 74.0),
            ('2011-09-17', 74.0),
            ('2011-09-18', 76.0),
            ('2011-09-19', 74.0),
            ('2011-09-20', 74.0),
            ('2011-09-21', 74.0),
            ('2011-09-22', 70.0),
            ('2011-09-23', 72.0),
            ('2011-09-24', 79.0),
```

```
('2011-09-25', 73.0),
('2011-09-26', 66.0),
('2011-09-27', 69.0),
('2011-09-28', 72.0),
('2011-09-29', 73.0),
('2011-09-30', 71.0),
('2011-10-01', 77.0),
('2011-10-02', 77.0),
('2011-10-03', 74.0),
('2011-10-04', 73.0),
('2011-10-05', 74.0),
('2011-10-06', 71.0),
('2011-10-07', 74.0),
('2011-10-08', 75.0),
('2011-10-09', 73.0),
('2011-10-10', 73.0),
('2011-10-11', 71.0),
('2011-10-12', 68.0),
('2011-10-13', 69.0),
('2011-10-14', 71.0),
('2011-10-15', 75.0),
('2011-10-16', 74.0),
('2011-10-17', 68.0),
('2011-10-18', 67.0),
('2011-10-19', 67.0),
('2011-10-20', 69.0),
('2011-10-21', 73.0),
('2011-10-22', 71.0),
('2011-10-23', 72.0),
('2011-10-24', 69.0),
('2011-10-25', 71.0),
('2011-10-26', 71.0),
('2011-10-27', 69.0),
('2011-10-28', 69.0),
('2011-10-29', 71.0),
('2011-10-30', 70.0),
('2011-10-31', 69.0),
('2011-11-01', 75.0),
('2011-11-02', 72.0),
('2011-11-03', 72.0),
('2011-11-04', 71.0),
('2011-11-05', 73.0),
('2011-11-06', 75.0),
('2011-11-07', 71.0),
('2011-11-08', 71.0),
('2011-11-09', 71.0),
('2011-11-10', 71.0),
('2011-11-11', 70.0),
('2011-11-12', 73.0),
('2011-11-13', 71.0),
('2011-11-14', 68.0),
('2011-11-15', 68.0),
('2011-11-16', 70.0),
('2011-11-17', 71.0),
('2011-11-18', 73.0),
('2011-11-19', 74.0),
('2011-11-20', 72.0),
```

```
('2011-11-21', 71.0),
('2011-11-22', 70.0),
('2011-11-23', 72.0),
('2011-11-24', 72.0),
('2011-11-25', 70.0),
('2011-11-26', 73.0),
('2011-11-27', 71.0),
('2011-11-28', 69.0),
('2011-11-29', 67.0),
('2011-11-30', 68.0),
('2011-12-01', 67.0),
('2011-12-02', 69.0),
('2011-12-03', 72.0),
('2011-12-04', 74.0),
('2011-12-05', 71.0),
('2011-12-06', 70.0),
('2011-12-07', 68.0),
('2011-12-08', 70.0),
('2011-12-09', 66.0),
('2011-12-10', 72.0),
('2011-12-11', 70.0),
('2011-12-12', 70.0),
('2011-12-13', 70.0),
('2011-12-14', 70.0),
('2011-12-15', 73.0),
('2011-12-16', 71.0),
('2011-12-17', 69.0),
('2011-12-18', 73.0),
('2011-12-19', 72.0),
('2011-12-20', 71.0),
('2011-12-21', 69.0),
('2011-12-22', 70.0),
('2011-12-23', 69.0),
('2011-12-24', 70.0),
('2011-12-25', 75.0),
('2011-12-26', 71.0),
('2011-12-27', 70.0),
('2011-12-28', 69.0),
('2011-12-29', 71.0),
('2011-12-30', 65.0),
('2011-12-31', 67.0),
('2012-01-01', 71.0),
('2012-01-02', 71.0),
('2012-01-03', 63.0),
('2012-01-04', 68.0),
('2012-01-05', 70.0),
('2012-01-06', 66.0),
('2012-01-07', 71.0),
('2012-01-08', 63.0),
('2012-01-09', 65.0),
('2012-01-10', 69.0),
('2012-01-11', 67.0),
('2012-01-12', 62.0),
('2012-01-13', 66.0),
('2012-01-14', 64.0),
('2012-01-15', 74.0),
('2012-01-16', 73.0),
```

```
                ('2012-01-17', 74.0),
                ('2012-01-18', 75.0),
                ('2012-01-19', 71.0),
                ('2012-01-20', 66.0),
                ('2012-01-21', 73.0),
                ('2012-01-22', 72.0),
                ('2012-01-23', 64.0),
                ('2012-01-24', 61.0),
                ('2012-01-25', 68.0),
                ('2012-01-26', 72.0),
                ('2012-01-27', 72.0),
                ('2012-01-28', 73.0),
                ('2012-01-29', 73.0),
                ('2012-01-30', 63.0),
                ('2012-01-31', 67.0),
                ('2012-02-01', 63.0),
                ('2012-02-02', 68.0),
                ('2012-02-03', 61.0),
                ('2012-02-04', 72.0),
                ('2012-02-05', 71.0),
                ('2012-02-06', 66.0),
                ('2012-02-07', 70.0),
                ('2012-02-08', 61.0),
                ('2012-02-09', 60.0),
                ('2012-02-10', 63.0),
                ('2012-02-11', 70.0),
                ('2012-02-12', 72.0),
                ('2012-02-13', 70.0),
                ('2012-02-14', 67.0),
                ('2012-02-15', 66.0),
                ('2012-02-16', 71.0),
                ('2012-02-17', 69.0),
                ('2012-02-18', 70.0),
                ('2012-02-19', 69.0),
                ('2012-02-20', 73.0),
                ('2012-02-21', 71.0),
                ('2012-02-22', 70.0),
                ('2012-02-23', 70.0),
                ('2012-02-24', 69.0),
                ('2012-02-25', 71.0),
                ('2012-02-26', 70.0),
                ('2012-02-27', 69.0),
                ('2012-02-28', 70.0),
                ('2012-02-29', 70.0),
                ('2012-03-01', 71.0),
                ('2012-03-02', 68.0),
                ('2012-03-03', 71.0),
                ('2012-03-04', 69.0),
                ('2012-03-05', 65.0),
                ('2012-03-06', 66.0),
                ('2012-03-07', 66.0),
                ('2012-03-08', 68.0),
                ('2012-03-09', 68.0),
                ('2012-03-10', 73.0),
                ('2012-03-11', 72.0),
                ('2012-03-12', 70.0),
                ('2012-03-13', 69.0),
```

```
('2012-03-14', 69.0),
('2012-03-15', 68.0),
('2012-03-16', 70.0),
('2012-03-17', 75.0),
('2012-03-18', 69.0),
('2012-03-19', 69.0),
('2012-03-20', 64.0),
('2012-03-21', 68.0),
('2012-03-22', 68.0),
('2012-03-23', 69.0),
('2012-03-24', 72.0),
('2012-03-25', 70.0),
('2012-03-26', 70.0),
('2012-03-27', 66.0),
('2012-03-28', 66.0),
('2012-03-29', 67.0),
('2012-03-30', 68.0),
('2012-03-31', 73.0),
('2012-04-01', 75.0),
('2012-04-02', 67.0),
('2012-04-03', 66.0),
('2012-04-04', 69.0),
('2012-04-05', 71.0),
('2012-04-06', 75.0),
('2012-04-07', 73.0),
('2012-04-08', 74.0),
('2012-04-09', 68.0),
('2012-04-10', 65.0),
('2012-04-11', 65.0),
('2012-04-12', 68.0),
('2012-04-13', 64.0),
('2012-04-14', 76.0),
('2012-04-15', 68.0),
('2012-04-16', 71.0),
('2012-04-17', 71.0),
('2012-04-18', 71.0),
('2012-04-19', 71.0),
('2012-04-20', 70.0),
('2012-04-21', 75.0),
('2012-04-22', 70.0),
('2012-04-23', 69.0),
('2012-04-24', 69.0),
('2012-04-25', 67.0),
('2012-04-26', 70.0),
('2012-04-27', 67.0),
('2012-04-28', 77.0),
('2012-04-29', 74.0),
('2012-04-30', 71.0),
('2012-05-01', 70.0),
('2012-05-02', 70.0),
('2012-05-03', 70.0),
('2012-05-04', 70.0),
('2012-05-05', 75.0),
('2012-05-06', 74.0),
('2012-05-07', 71.0),
('2012-05-08', 71.0),
('2012-05-09', 69.0),
```

```
('2012-05-10', 76.0),
('2012-05-11', 76.0),
('2012-05-12', 77.0),
('2012-05-13', 74.0),
('2012-05-14', 77.0),
('2012-05-15', 63.0),
('2012-05-16', 69.0),
('2012-05-17', 72.0),
('2012-05-18', 72.0),
('2012-05-19', 76.0),
('2012-05-20', 78.0),
('2012-05-21', 71.0),
('2012-05-22', 70.0),
('2012-05-23', 73.0),
('2012-05-24', 73.0),
('2012-05-25', 71.0),
('2012-05-26', 74.0),
('2012-05-27', 74.0),
('2012-05-28', 75.0),
('2012-05-29', 72.0),
('2012-05-30', 71.0),
('2012-05-31', 71.0),
('2012-06-01', 71.0),
('2012-06-02', 73.0),
('2012-06-03', 78.0),
('2012-06-04', 71.0),
('2012-06-05', 72.0),
('2012-06-06', 70.0),
('2012-06-07', 72.0),
('2012-06-08', 73.0),
('2012-06-09', 74.0),
('2012-06-10', 81.0),
('2012-06-11', 72.0),
('2012-06-12', 77.0),
('2012-06-13', 69.0),
('2012-06-14', 69.0),
('2012-06-15', 69.0),
('2012-06-16', 78.0),
('2012-06-17', 78.0),
('2012-06-18', 73.0),
('2012-06-19', 72.0),
('2012-06-20', 71.0),
('2012-06-21', 72.0),
('2012-06-22', 72.0),
('2012-06-23', 73.0),
('2012-06-24', 71.0),
('2012-06-25', 70.0),
('2012-06-26', 71.0),
('2012-06-27', 68.0),
('2012-06-28', 72.0),
('2012-06-29', 71.0),
('2012-06-30', 78.0),
('2012-07-01', 77.0),
('2012-07-02', 73.0),
('2012-07-03', 71.0),
('2012-07-04', 74.0),
('2012-07-05', 76.0),
```

```
('2012-07-06', 76.0),
('2012-07-07', 74.0),
('2012-07-08', 77.0),
('2012-07-09', 73.0),
('2012-07-10', 71.0),
('2012-07-11', 71.0),
('2012-07-12', 72.0),
('2012-07-13', 72.0),
('2012-07-14', 73.0),
('2012-07-15', 80.0),
('2012-07-16', 72.0),
('2012-07-17', 72.0),
('2012-07-18', 73.0),
('2012-07-19', 72.0),
('2012-07-20', 69.0),
('2012-07-21', 69.0),
('2012-07-22', 75.0),
('2012-07-23', 72.0),
('2012-07-24', 73.0),
('2012-07-25', 73.0),
('2012-07-26', 72.0),
('2012-07-27', 71.0),
('2012-07-28', 73.0),
('2012-07-29', 72.0),
('2012-07-30', 73.0),
('2012-07-31', 74.0),
('2012-08-01', 75.0),
('2012-08-02', 71.0),
('2012-08-03', 73.0),
('2012-08-04', 74.0),
('2012-08-05', 75.0),
('2012-08-06', 70.0),
('2012-08-07', 74.0),
('2012-08-08', 72.0),
('2012-08-09', 74.0),
('2012-08-10', 72.0),
('2012-08-11', 75.0),
('2012-08-12', 74.0),
('2012-08-13', 74.0),
('2012-08-14', 73.0),
('2012-08-15', 74.0),
('2012-08-16', 82.0),
('2012-08-17', 72.0),
('2012-08-18', 77.0),
('2012-08-19', 73.0),
('2012-08-20', 73.0),
('2012-08-21', 73.0),
('2012-08-22', 71.0),
('2012-08-23', 74.0),
('2012-08-24', 73.0),
('2012-08-25', 75.0),
('2012-08-26', 82.0),
('2012-08-27', 73.0),
('2012-08-28', 79.0),
('2012-08-29', 72.0),
('2012-08-30', 77.0),
('2012-08-31', 76.0),
```
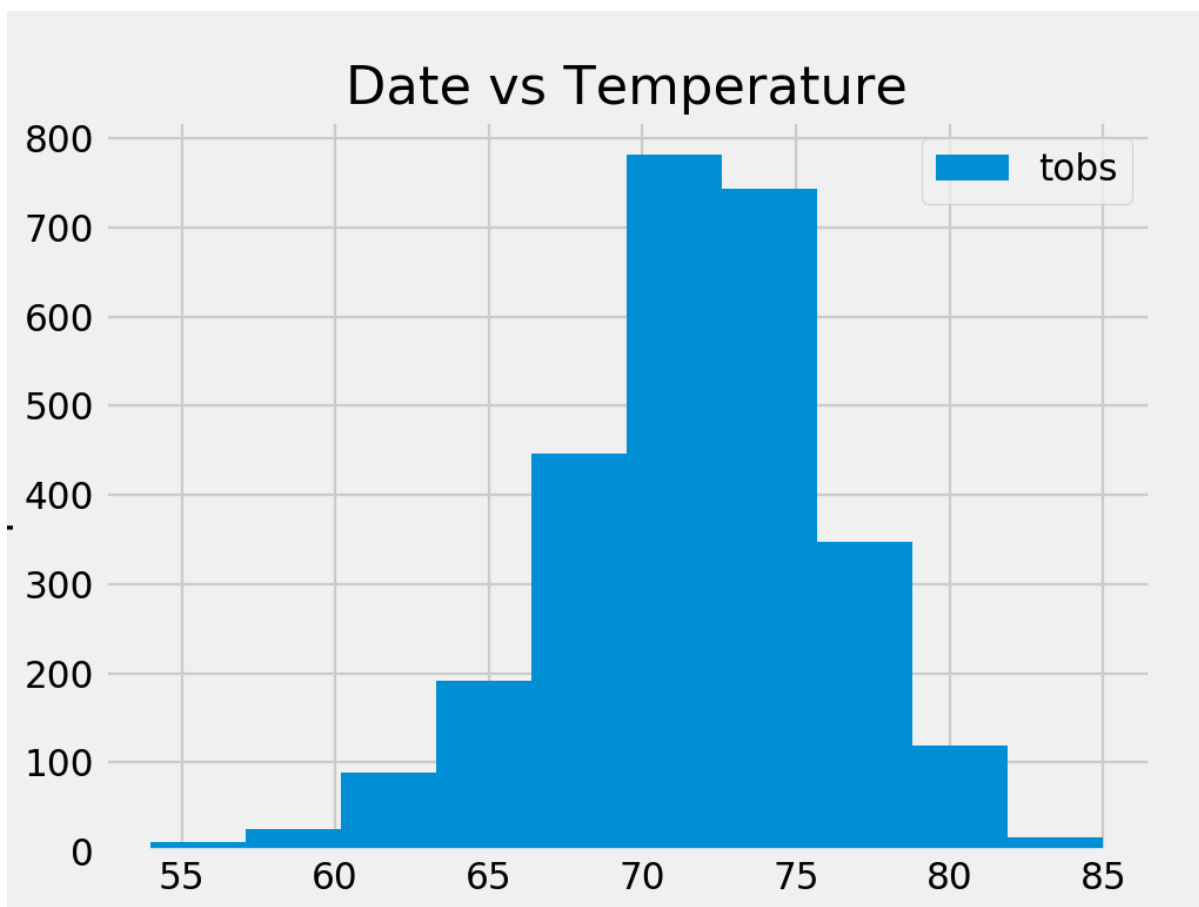
```
             ('2012-09-01', 73.0),
             ('2012-09-02', 78.0),
             ('2012-09-03', 77.0),
             ('2012-09-04', 76.0),
             ('2012-09-05', 73.0),
             ('2012-09-06', 75.0),
             ('2012-09-07', 75.0),
             ('2012-09-08', 73.0),
             ('2012-09-09', 75.0),
             ('2012-09-10', 75.0),
             ('2012-09-11', 71.0),
             ('2012-09-12', 73.0),
             ('2012-09-13', 75.0),
             ('2012-09-14', 74.0),
             ('2012-09-15', 76.0),
             ('2012-09-16', 74.0),
             ('2012-09-17', 76.0),
             ('2012-09-18', 70.0),
             ('2012-09-19', 73.0),
             ('2012-09-20', 73.0),
             ('2012-09-21', 76.0),
             ('2012-09-22', 73.0),
             ('2012-09-23', 74.0),
             ('2012-09-24', 75.0),
             ('2012-09-25', 74.0),
             ('2012-09-26', 74.0),
             ('2012-09-27', 75.0),
             ('2012-09-28', 75.0),
             ('2012-09-29', 72.0),
             ('2012-09-30', 73.0),
             ('2012-10-01', 70.0),
             ...]
```

In [25]:
```
df2=pd.DataFrame(tem)
df2.head()
```

Out[25]:

	date	tobs
0	2010-01-01	70.0
1	2010-01-02	62.0
2	2010-01-03	74.0
3	2010-01-04	75.0
4	2010-01-05	74.0

```
In [26]: df2.plot.hist()
         plt.title("Date vs Temperature")
         plt.ylabel("Temperature")
         plt.xlabel("Date")
         plt.show()
```
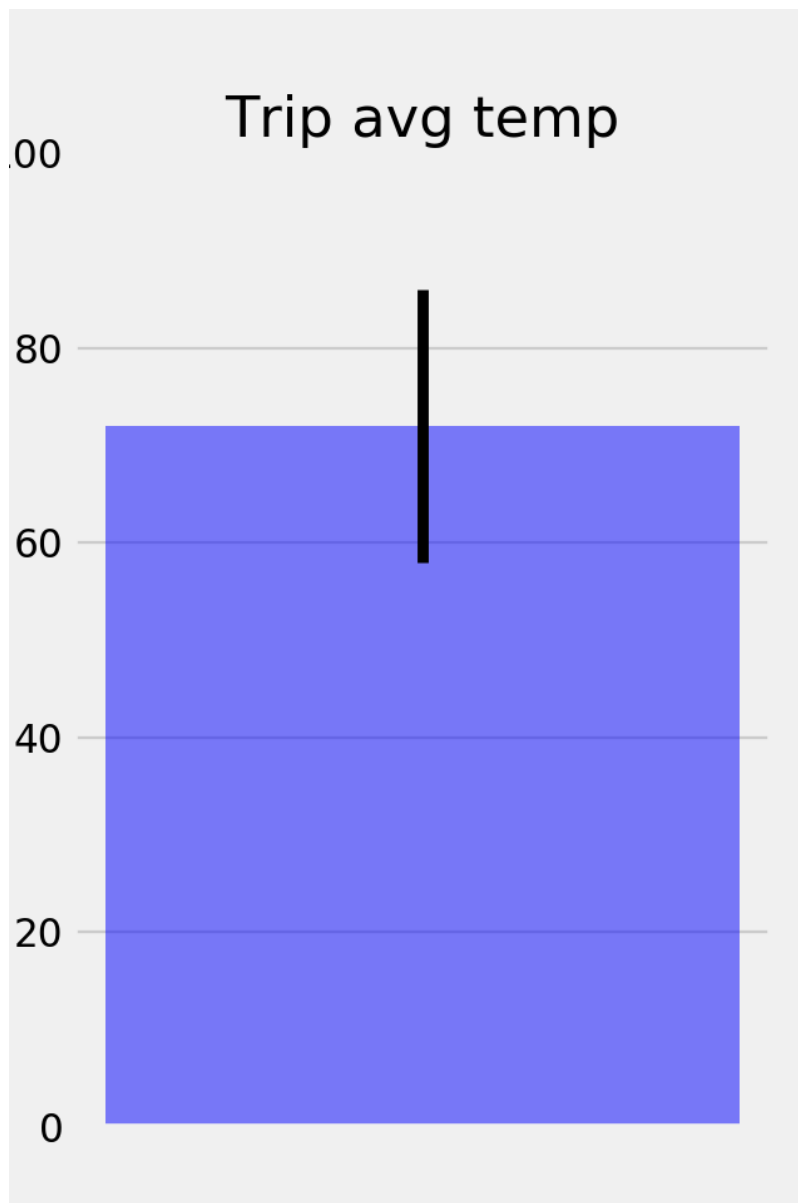
Date vs Temperature


```
In [29]: # Write a function called `calc_temps` that will accept start date and e
         nd date in the format '%Y-%m-%d'
         # and return the minimum, average, and maximum temperatures for that ran
         ge of dates

         def calc_temps(session, start_date, end_date):
             return session.query(
                 func.min(Measurement.tobs),
                 func.avg(Measurement.tobs),
                 func.max(Measurement.tobs)
             ).filter(
                 Measurement.date >= start_date
             ).filter(
                 Measurement.date <= end_date
             ).all()
```

In [75]:
```python
# Use your previous function `calc_temps` to calculate the tmin, tavg, a
nd tmax
# for your trip using the previous year's data for those same dates.
x = calc_temps(session, '2017-02-28', '2017-03-05')
x
```

Out[75]: [(64.0, 72.02777777777777, 78.0)]

In [76]:
```python
# Plot the results from your previous query as a bar chart.
# Use "Trip Avg Temp" as your Title
# Use the average temperature for the y value
# Use the peak-to-peak (tmax-tmin) value as the y error bar (yerr)
plt.figure(figsize=(4,6))
plt.bar(1,height=x[0][1],yerr=x[0][2]-x[0][0],width=0.0001, alpha=0.5,color='blue')
plt.title("Trip avg temp")
plt.xticks([])
plt.ylim(0,100)
plt.ylabel("Temp(F)")
plt.savefig("Trip_avg_tem.png")
plt.show()
```

```
In [77]:    # Calculate the rainfall per weather station for your trip dates using
             the previous year's matching dates.
            # Sort this in descending order by precipitation amount and list the sta
            tion, name, latitude, longitude, and elevation
            session.query(Station.station, Station.name, Station.latitude, Station.l
            ongitude, Station.elevation, func.sum(Measurement.prcp)).group_by(Measur
            ement.station).filter(Measurement.date <= '2017-03-05').filter(Measureme
            nt.date >= '2017-02-28').order_by(func.sum(Measurement.prcp).desc()).all
            ()
```

```
Out[77]:  [('USC00516128',
            'MANOA LYON ARBO 785.2, HI US',
            21.3331,
            -157.8025,
            152.4,
            42.480000000000004),
           ('USC00516128',
            'MANOA LYON ARBO 785.2, HI US',
            21.3331,
            -157.8025,
            152.4,
            40.05),
           ('USC00516128',
            'MANOA LYON ARBO 785.2, HI US',
            21.3331,
            -157.8025,
            152.4,
            36.629999999999995),
           ('USC00516128',
            'MANOA LYON ARBO 785.2, HI US',
            21.3331,
            -157.8025,
            152.4,
            26.820000000000014),
           ('USC00516128',
            'MANOA LYON ARBO 785.2, HI US',
            21.3331,
            -157.8025,
            152.4,
            24.660000000000004),
           ('USC00516128',
            'MANOA LYON ARBO 785.2, HI US',
            21.3331,
            -157.8025,
            152.4,
            20.880000000000003),
           ('USC00516128',
            'MANOA LYON ARBO 785.2, HI US',
            21.3331,
            -157.8025,
            152.4,
            10.440000000000001)]
```