In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
```

In [2]:
```
df = pd.read_csv(r"C:\Users\PC1\Desktop\DS\DataSets\temperatures.csv")
```

In [3]:
```
df
```

Out[3]:

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	JAN-FEB	MAR-MAY	JUN-SEP	OCT-DEC
0	1901	22.40	24.14	29.07	31.91	33.41	33.18	31.21	30.39	30.47	29.97	27.31	24.49	28.96	23.27	31.46	31.27	27.25
1	1902	24.93	26.58	29.77	31.78	33.73	32.91	30.92	30.73	29.80	29.12	26.31	24.04	29.22	25.75	31.76	31.09	26.49
2	1903	23.44	25.03	27.83	31.39	32.91	33.00	31.34	29.98	29.85	29.04	26.08	23.65	28.47	24.24	30.71	30.92	26.26
3	1904	22.50	24.73	28.21	32.02	32.64	32.07	30.36	30.09	30.04	29.20	26.36	23.63	28.49	23.62	30.95	30.66	26.40
4	1905	22.00	22.83	26.68	30.01	33.32	33.25	31.44	30.68	30.12	30.67	27.52	23.82	28.30	22.25	30.00	31.33	26.57
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
112	2013	24.56	26.59	30.62	32.66	34.46	32.44	31.07	30.76	31.04	30.27	27.83	25.37	29.81	25.58	32.58	31.33	27.83
113	2014	23.83	25.97	28.95	32.74	33.77	34.15	31.85	31.32	30.68	30.29	28.05	25.08	29.72	24.90	31.82	32.00	27.81
114	2015	24.58	26.89	29.07	31.87	34.09	32.48	31.88	31.52	31.55	31.04	28.10	25.67	29.90	25.74	31.68	31.87	28.27
115	2016	26.94	29.72	32.62	35.38	35.72	34.03	31.64	31.79	31.66	31.98	30.11	28.01	31.63	28.33	34.57	32.28	30.03
116	2017	26.45	29.46	31.60	34.95	35.84	33.82	31.88	31.72	32.22	32.29	29.60	27.18	31.42	27.95	34.13	32.41	29.69

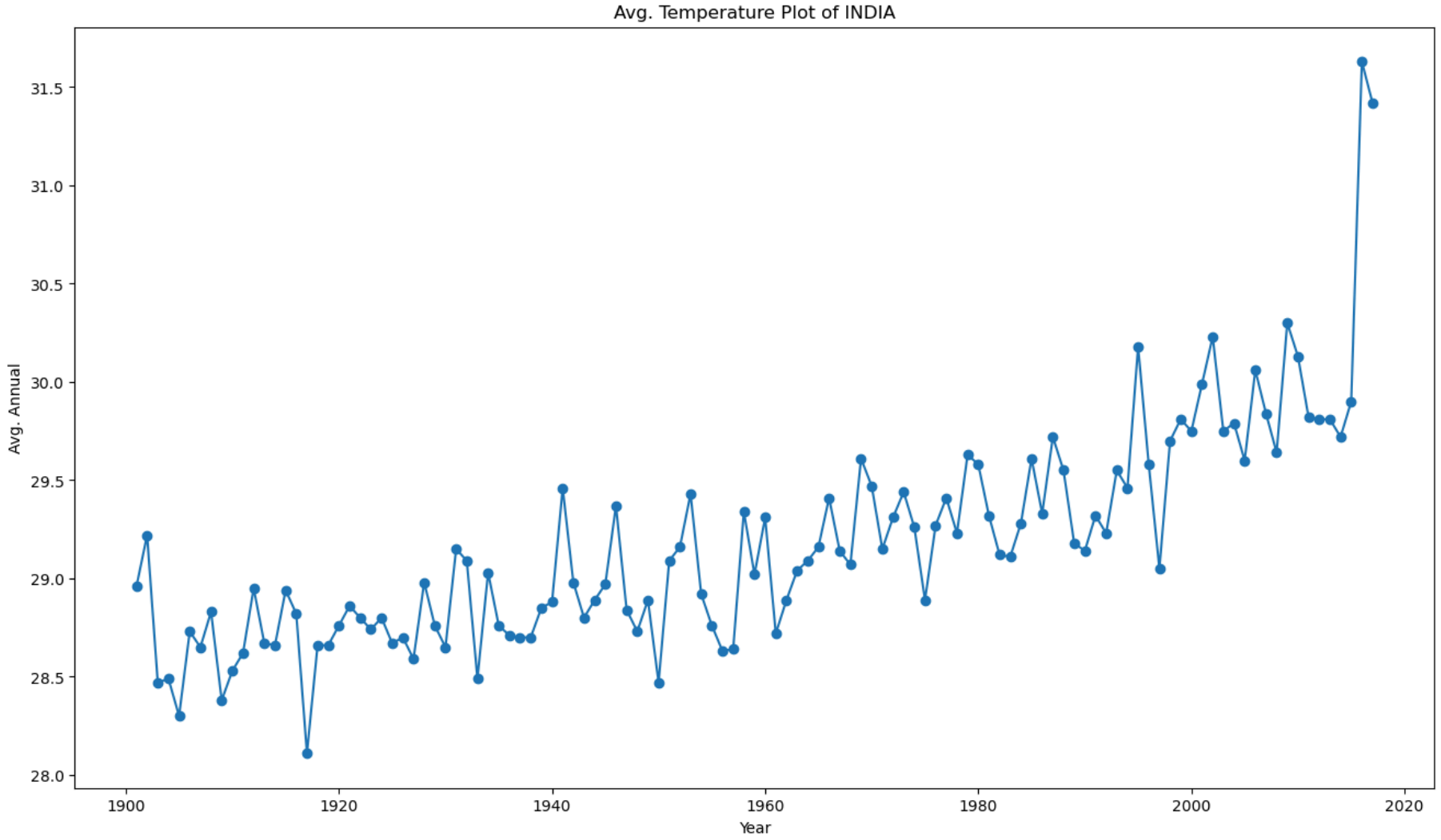
117 rows × 18 columns

In [4]:
```
#input variable for graph
x = df['YEAR']

#output variable for graph
y = df['ANNUAL']
```

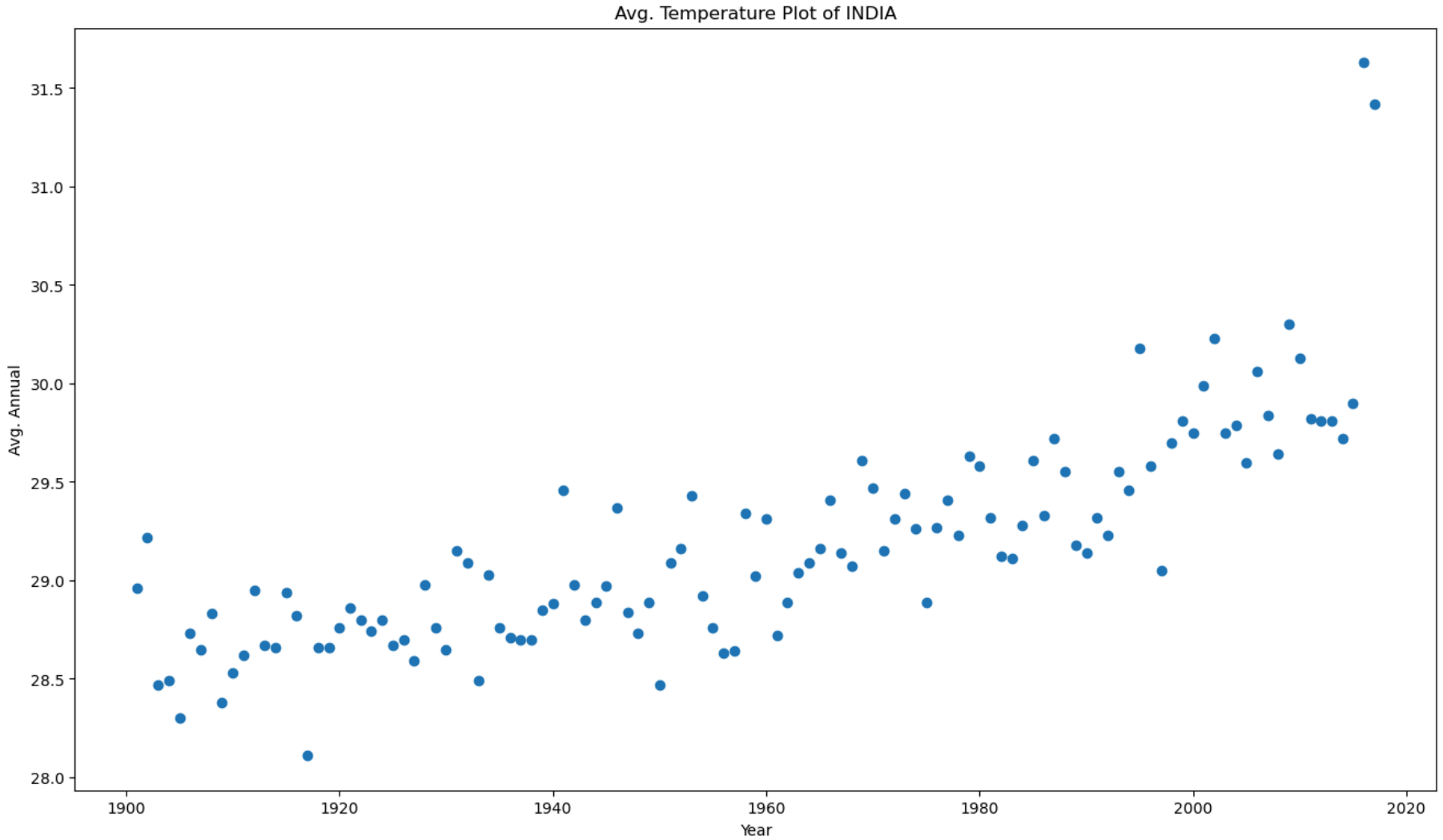
In [5]:
```
plt.figure(figsize=(16,9))
plt.title('Avg. Temperature Plot of INDIA')
plt.xlabel('Year')
plt.ylabel('Avg. Annual')
plt.errorbar(x,y)
plt.scatter(x,y)
```

Out[5]: <matplotlib.collections.PathCollection at 0x21ec849cac0>



In [6]:
```
plt.figure(figsize=(16,9))
plt.title('Avg. Temperature Plot of INDIA')
plt.xlabel('Year')
plt.ylabel('Avg. Annual')
plt.scatter(x,y)
```

Out[6]: <matplotlib.collections.PathCollection at 0x21ec85a7af0>



In [7]:
```
x.shape
```

Out[7]:
```
(117,)
```

In [8]:
```
x
```

Out[8]:
```
0      1901
1      1902
2      1903
3      1904
4      1905
       ...
112    2013
113    2014
114    2015
115    2016
116    2017
Name: YEAR, Length: 117, dtype: int64
```

In [9]:
```
y.shape
```

Out[9]:
```
(117,)
```

In [10]:
```
x = x.values
```

In [11]:
```
x = x.reshape(117,1) #Requirement of python library
```

In [12]:
```
x
```

Out[12]:
```
array([[1901],
       [1902],
       [1903],
       [1904],
       [1905],
       [1906],
       [1907],
       [1908],
       [1909],
       [1910],
       [1911],
       [1912],
       [1913],
       [1914],
       [1915],
       [1916],
       [1917],
       [1918],
       [1919],
```

In [13]:
```
from sklearn.linear_model import LinearRegression
```

In [14]:
```
regressor = LinearRegression()
```

In [15]:
```
regressor.fit(x,y) #Done y=mx+c
```

Out[15]:
```
LinearRegression
LinearRegression()
```

In [16]:
```
regressor.coef_  #m
```

Out[16]:
```
array([0.01312158])
```

In [17]:
```
regressor.intercept_ #c
```

Out[17]:
```
3.4761897126187016
```

In [18]:
```
regressor.predict([[2030]])
```

Out[18]:
```
array([30.1129998])
```

In [19]:
```
predicted = regressor.predict(x)
```

In [20]:
```
predicted
```

Out[20]:
```
array([28.4203158 , 28.43343739, 28.44655897, 28.45968055, 28.47280213,
       28.48592371, 28.49904529, 28.51216687, 28.52528846, 28.53841004,
       28.55153162, 28.5646532 , 28.57777478, 28.59089636, 28.60401794,
       28.61713952, 28.63026111, 28.64338269, 28.65650427, 28.66962585,
       28.68274743, 28.69586901, 28.70899059, 28.72211218, 28.73523376,
       28.74835534, 28.76147692, 28.7745985 , 28.78772008, 28.80084166,
       28.81396324, 28.82708483, 28.84020641, 28.85332799, 28.86644957,
       28.87957115, 28.89269273, 28.90581431, 28.91893589, 28.93205748,
       28.94517906, 28.95830064, 28.97142222, 28.9845438 , 28.99766538,
       29.01078696, 29.02390855, 29.03703013, 29.05015171, 29.06327329,
       29.07639487, 29.08951645, 29.10263803, 29.11575961, 29.1288812 ,
       29.14200278, 29.15512436, 29.16824594, 29.18136752, 29.1944891 ,
       29.20761068, 29.22073227, 29.23385385, 29.24697543, 29.26009701,
       29.27321859, 29.28634017, 29.29946175, 29.31258333, 29.32570492,
       29.3388265 , 29.35194808, 29.36506966, 29.37819124, 29.39131282,
       29.4044344 , 29.41755599, 29.43067757, 29.44379915, 29.45692073,
       29.47004231, 29.48316389, 29.49628547, 29.50940705, 29.52252864,
       29.53565022, 29.5487718 , 29.56189338, 29.57501496, 29.58813654,
       29.60125812, 29.6143797 , 29.62750129, 29.64062287, 29.65374445,
       29.66686603, 29.67998761, 29.69310919, 29.70623077, 29.71935236,
       29.73247394, 29.74559552, 29.7587171 , 29.77183868, 29.78496026,
       29.79808184, 29.81120342, 29.82432501, 29.83744659, 29.85056817,
       29.86368975, 29.87681133, 29.88993291, 29.90305449, 29.91617608,
       29.92929766, 29.94241924])
```

In [21]:
```
y
```

Out[21]:
```
0      28.96
1      29.22
2      28.47
3      28.49
4      28.30
       ...
112    29.81
113    29.72
114    29.90
115    31.63
116    31.42
Name: ANNUAL, Length: 117, dtype: float64
```

In [22]:
```
#Mean Absolute Error
np.mean(abs(y - predicted))
```

Out[22]:
```
0.22535284978630413
```

In [23]:
```
from sklearn.metrics import mean_absolute_error
mean_absolute_error(y, predicted)
```

Out[23]:
```
0.22535284978630413
```

In [24]:
```
#Mean Squared Error
np.mean((y - predicted)**2)
```

Out[24]:
```
0.10960795229110352
```

In [25]:
```
from sklearn.metrics import mean_squared_error
mean_squared_error(y, predicted)
```

Out[25]:
```
0.10960795229110352
```

In [26]:
```
from sklearn.metrics import r2_score
r2_score(y, predicted)
```

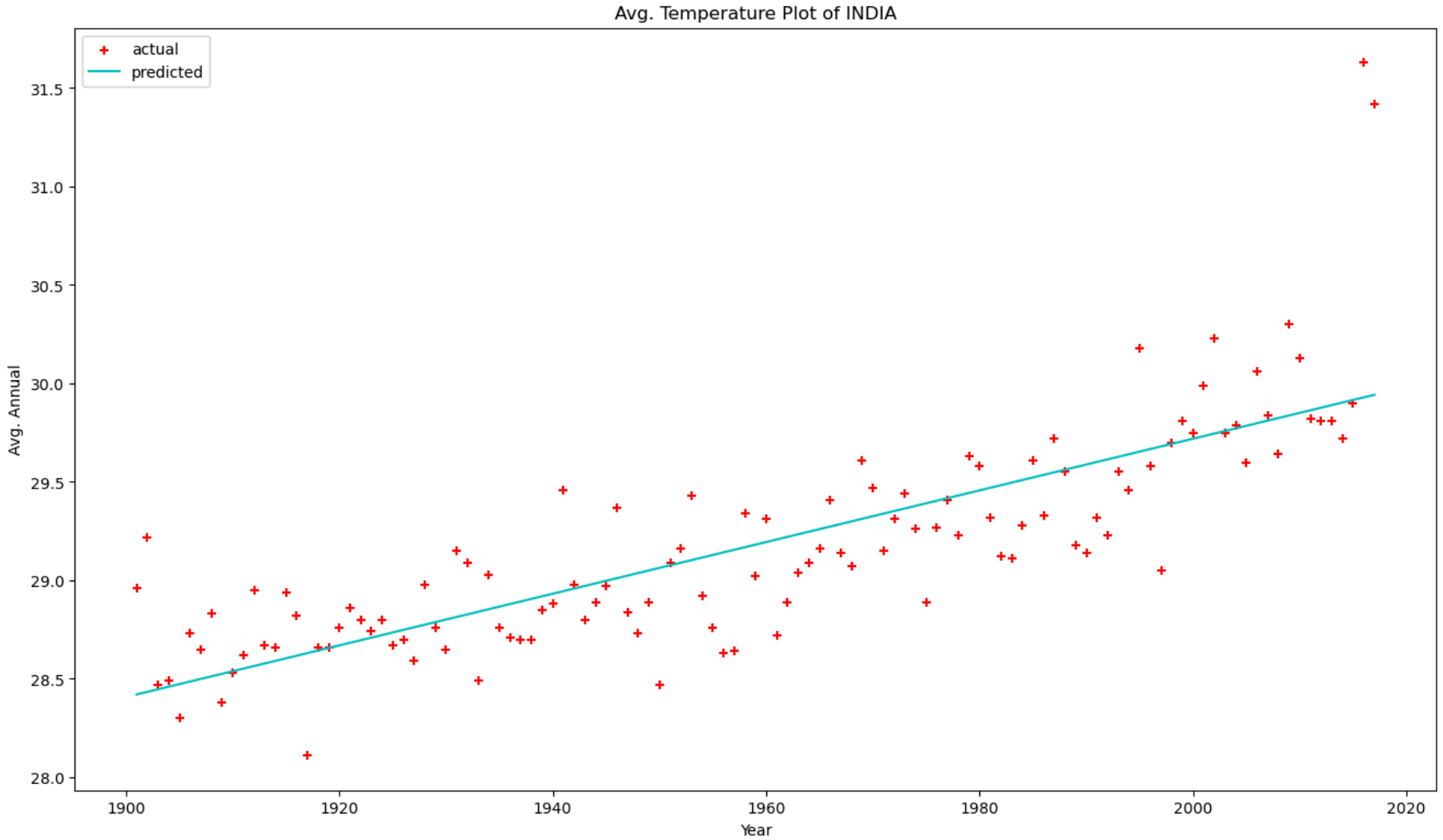
Out[26]: 0.6418078912783682

In [27]:
```
regressor.score(x,y)
```

Out[27]: 0.6418078912783682

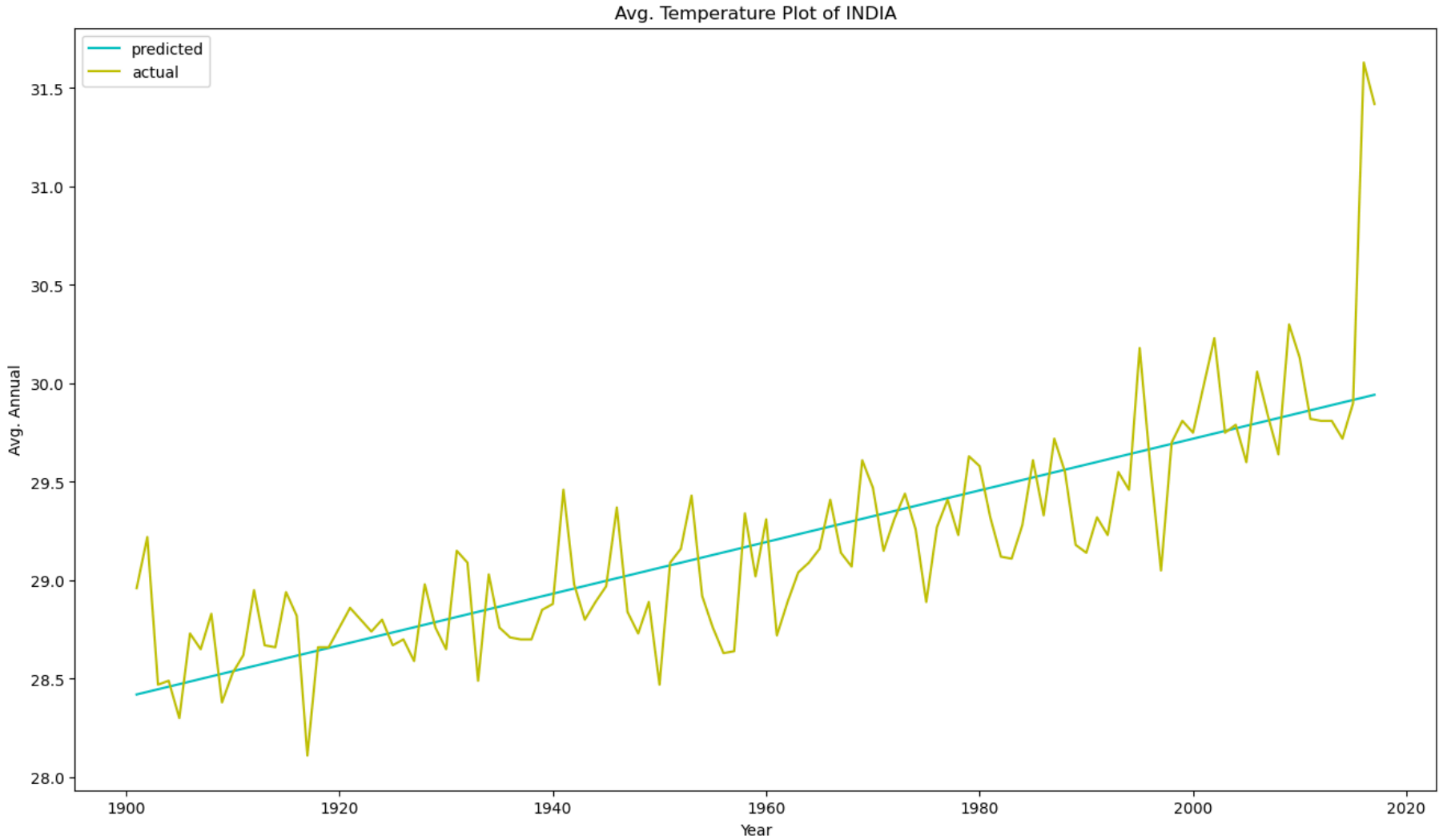
In [28]:
```
plt.figure(figsize=(16,9))
plt.title('Avg. Temperature Plot of INDIA')
plt.xlabel('Year')
plt.ylabel('Avg. Annual')
plt.scatter(x,y, label = 'actual', color = 'r', marker = '+')
plt.errorbar(x, predicted, label = 'predicted', color = 'c')
plt.legend() #To display which color denote what
```

Out[28]: <matplotlib.legend.Legend at 0x21ecbef0c10>



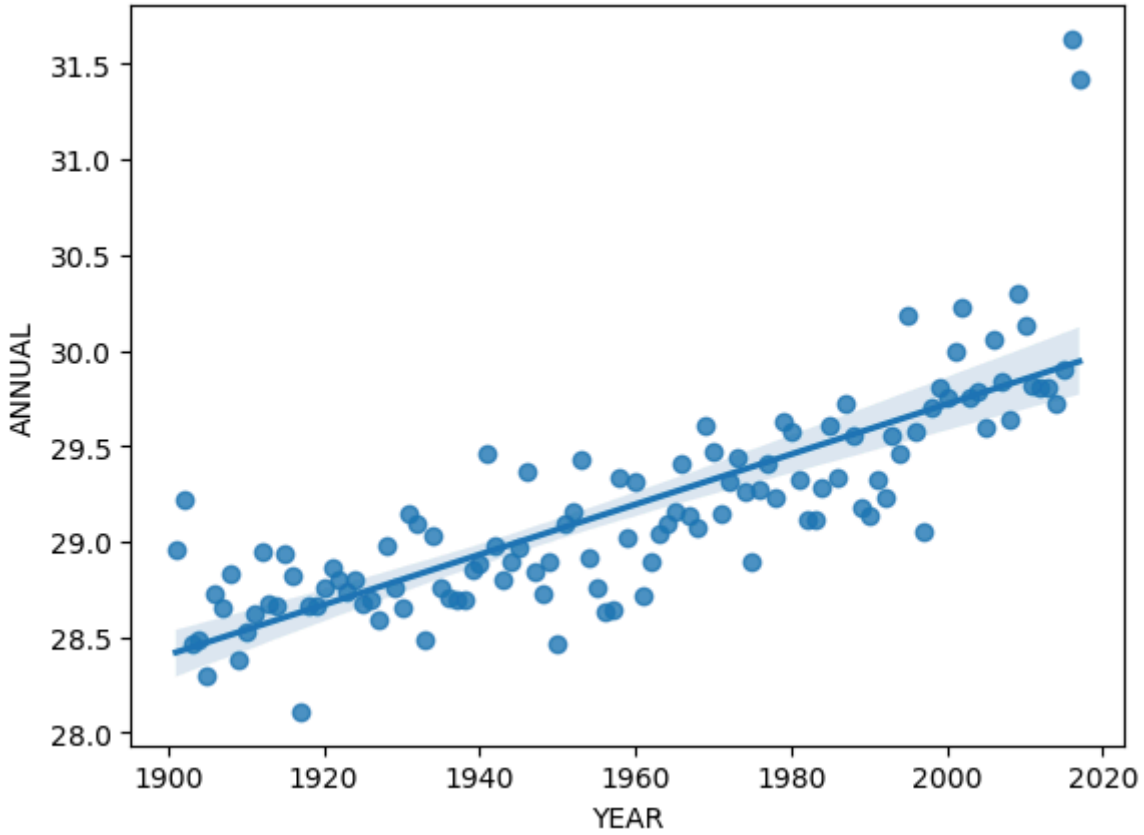
In [29]:
```
plt.figure(figsize=(16,9))
plt.title('Avg. Temperature Plot of INDIA')
plt.xlabel('Year')
plt.ylabel('Avg. Annual')
plt.errorbar(x,y, label = 'actual', color = 'y')
plt.plot(x, predicted, label = 'predicted', color = 'c')
plt.legend() #To display which color denote what
```

Out[29]: <matplotlib.legend.Legend at 0x21ecbef06a0>



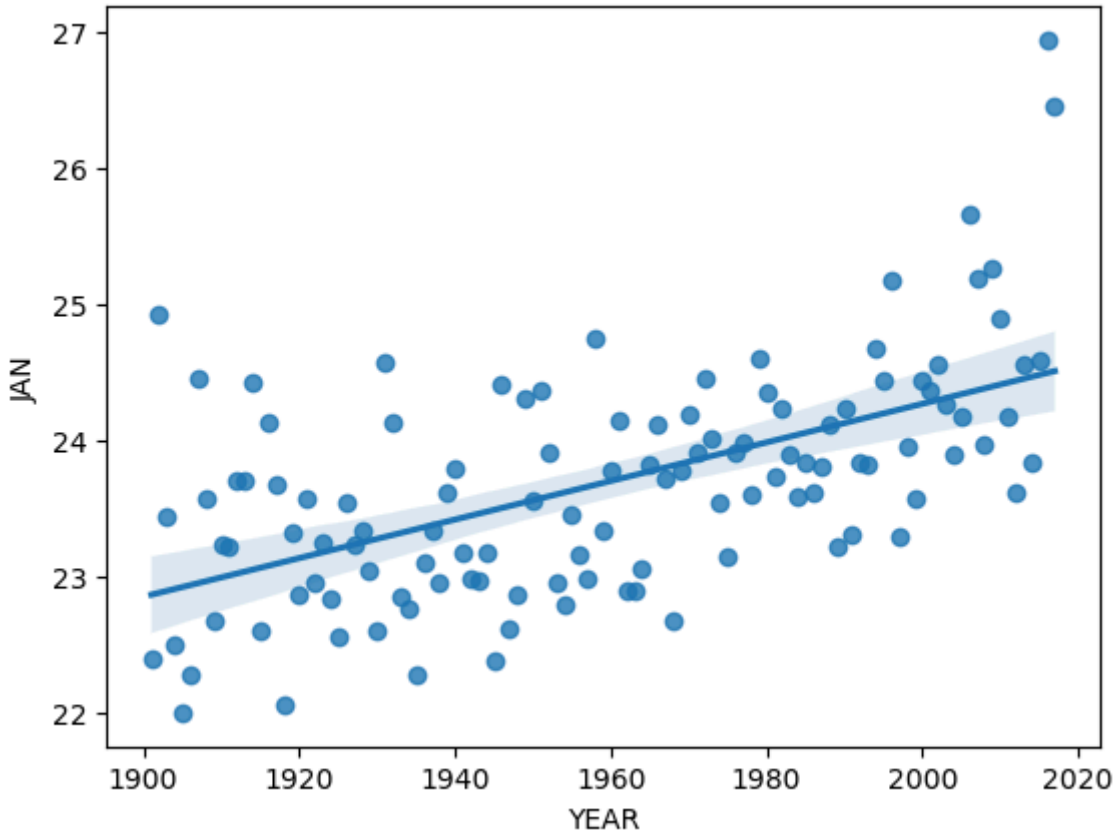
In [30]:
```
import seaborn as sns
sns.regplot(x='YEAR', y='ANNUAL', data=df)
```

Out[30]:
```
<Axes: xlabel='YEAR', ylabel='ANNUAL'>
```



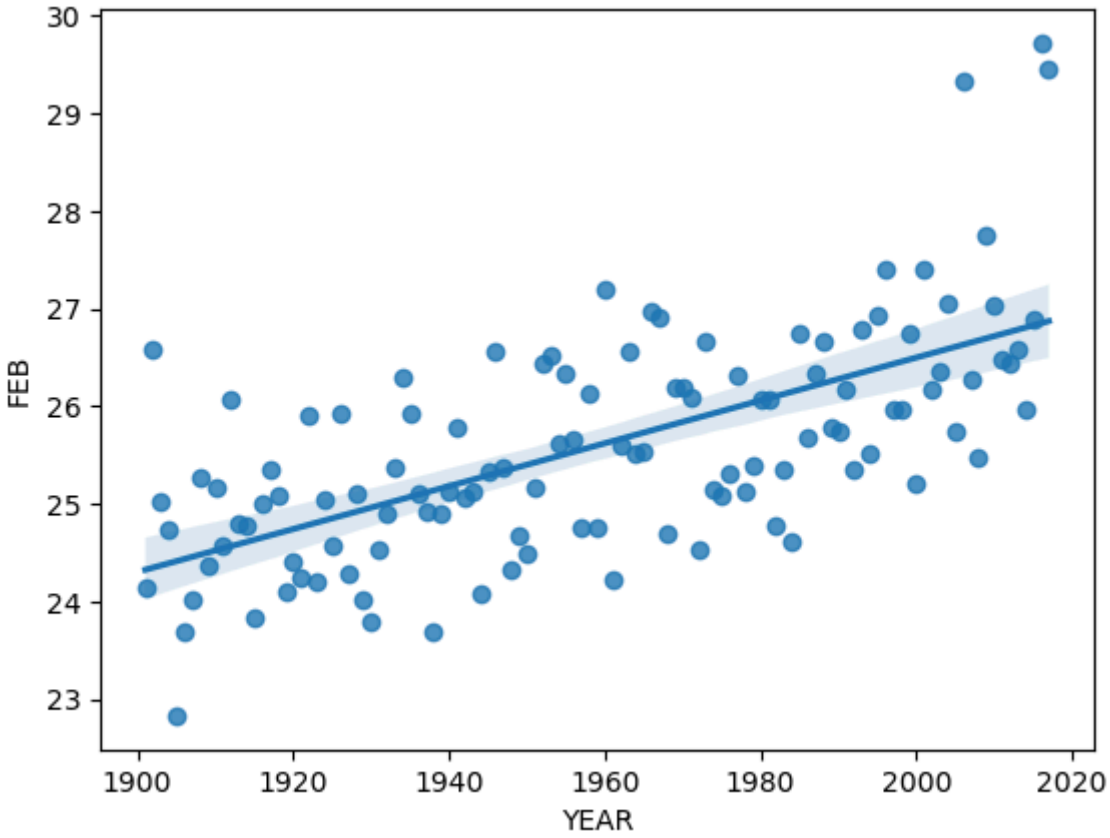
In [31]:
```
sns.regplot(x='YEAR', y='JAN', data=df)
```

Out[31]:
```
<Axes: xlabel='YEAR', ylabel='JAN'>
```



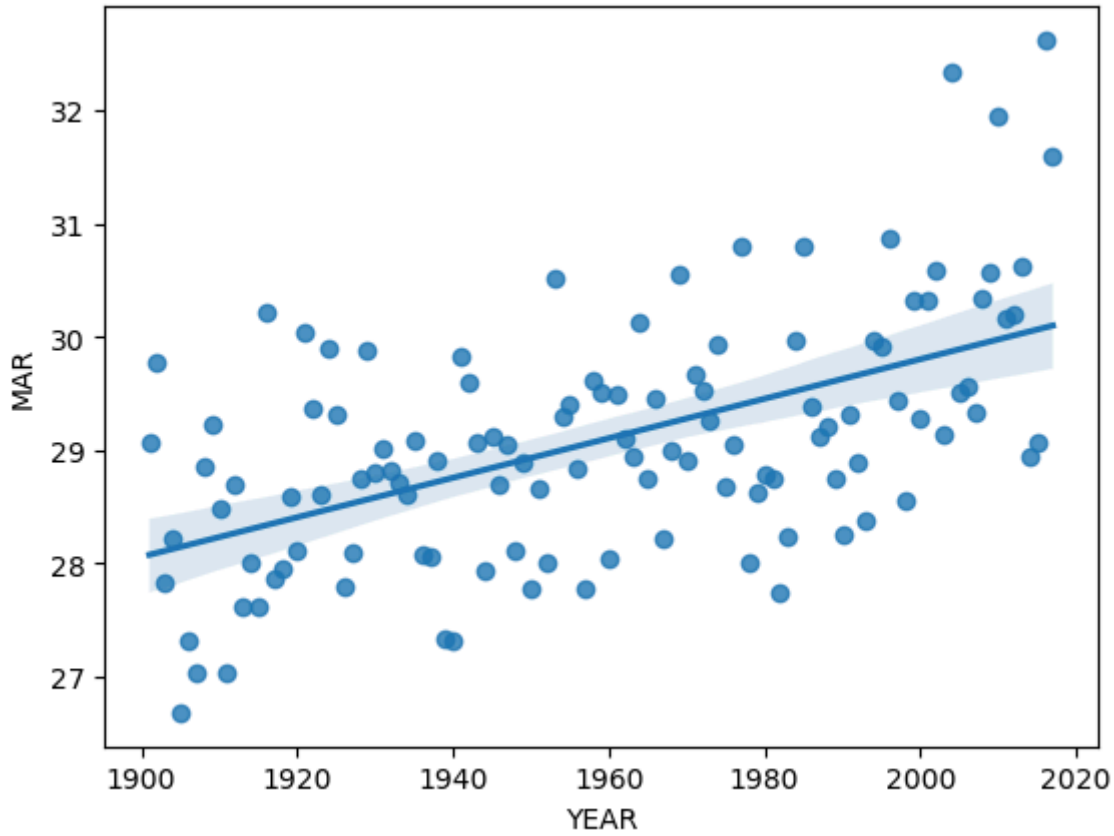
In [32]:
```
sns.regplot(x='YEAR', y='FEB', data=df)
```

Out[32]:
```
<Axes: xlabel='YEAR', ylabel='FEB'>
```



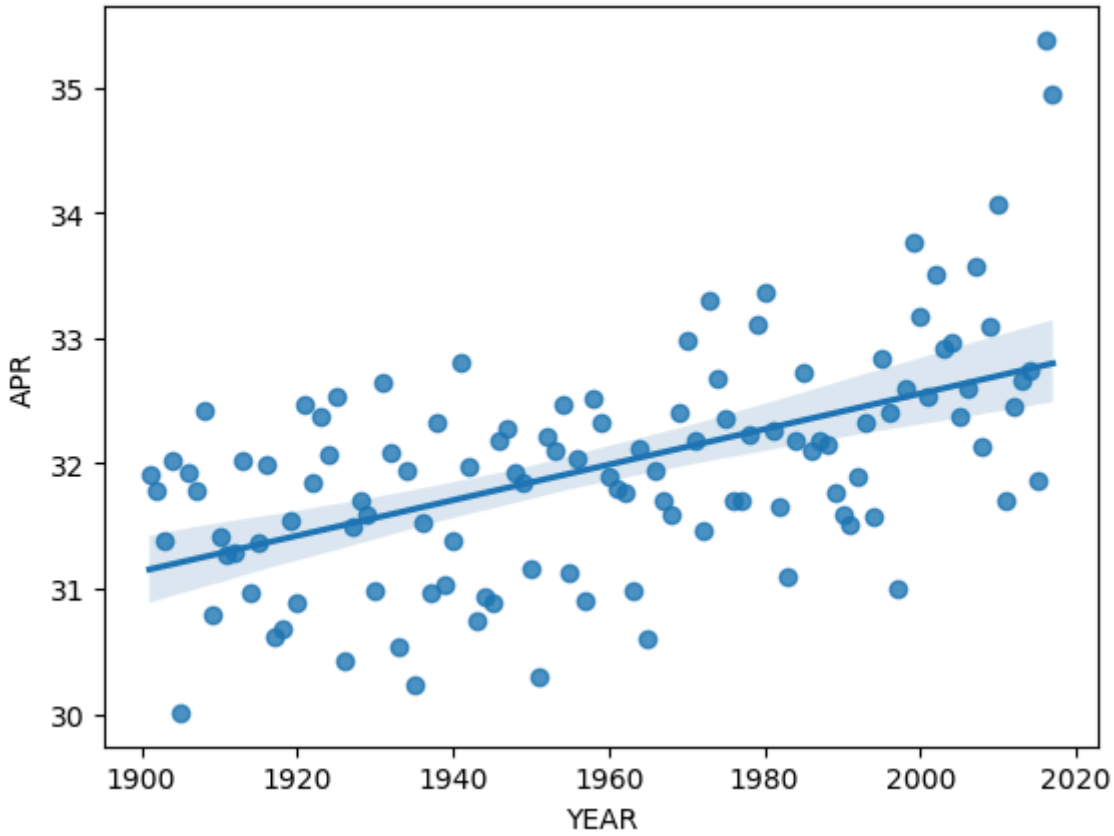
In [33]:
```
sns.regplot(x='YEAR', y='MAR', data=df)
```

Out[33]: <Axes: xlabel='YEAR', ylabel='MAR'>



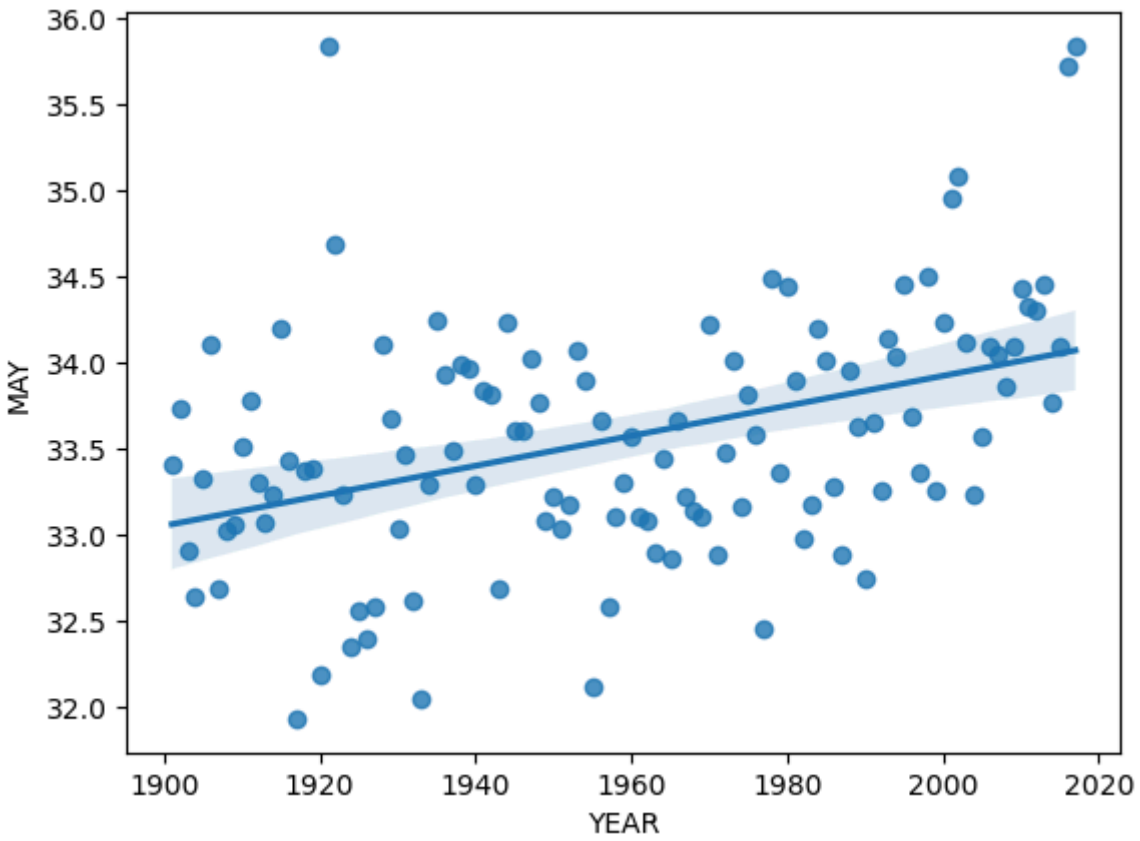
In [34]:
```
sns.regplot(x='YEAR', y='APR', data=df)
```

Out[34]:
```
<Axes: xlabel='YEAR', ylabel='APR'>
```



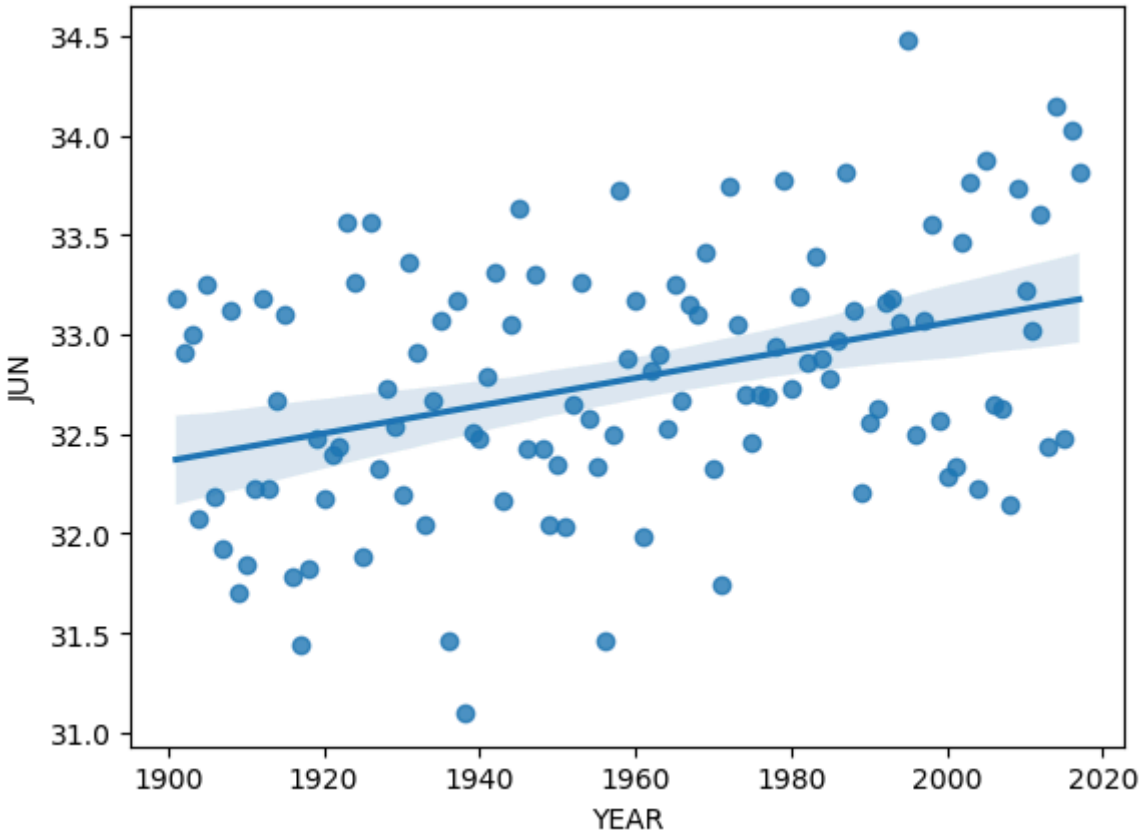
In [35]:
```
sns.regplot(x='YEAR', y='MAY', data=df)
```

Out[35]:
```
<Axes: xlabel='YEAR', ylabel='MAY'>
```



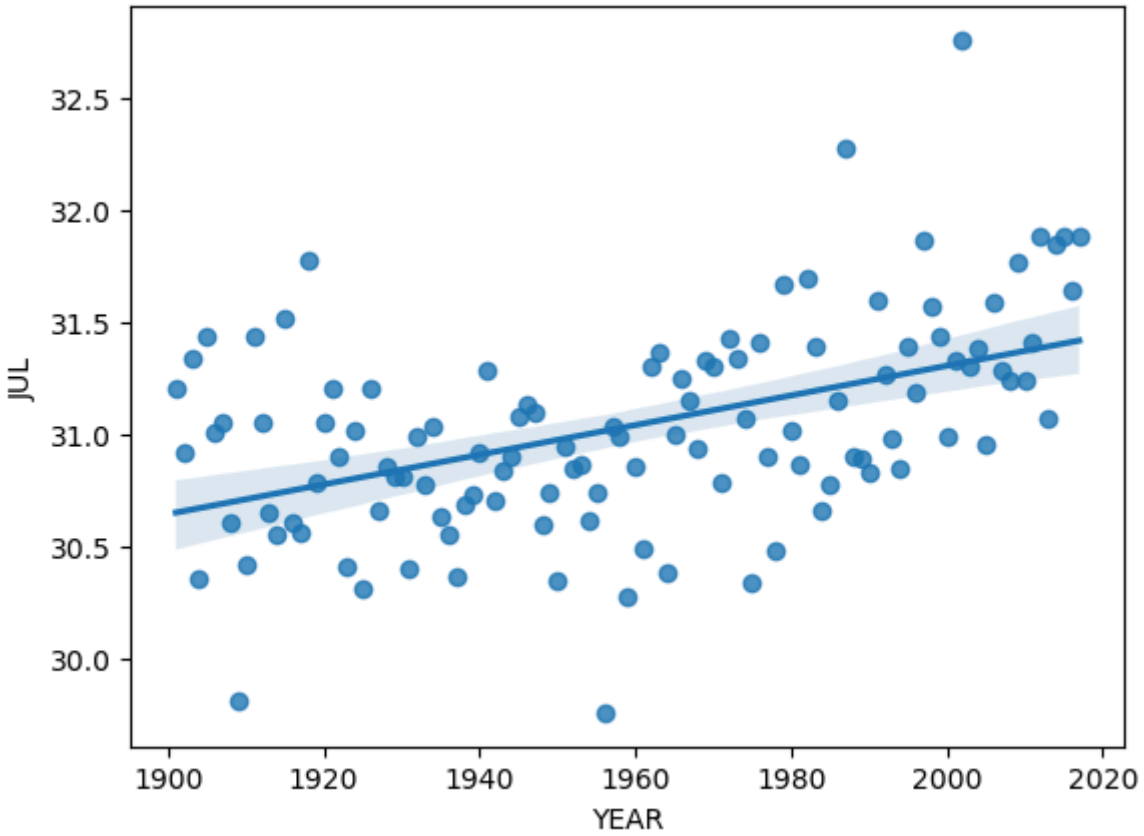
In [36]:
```
sns.regplot(x='YEAR', y='JUN', data=df)
```

Out[36]:
```
<Axes: xlabel='YEAR', ylabel='JUN'>
```



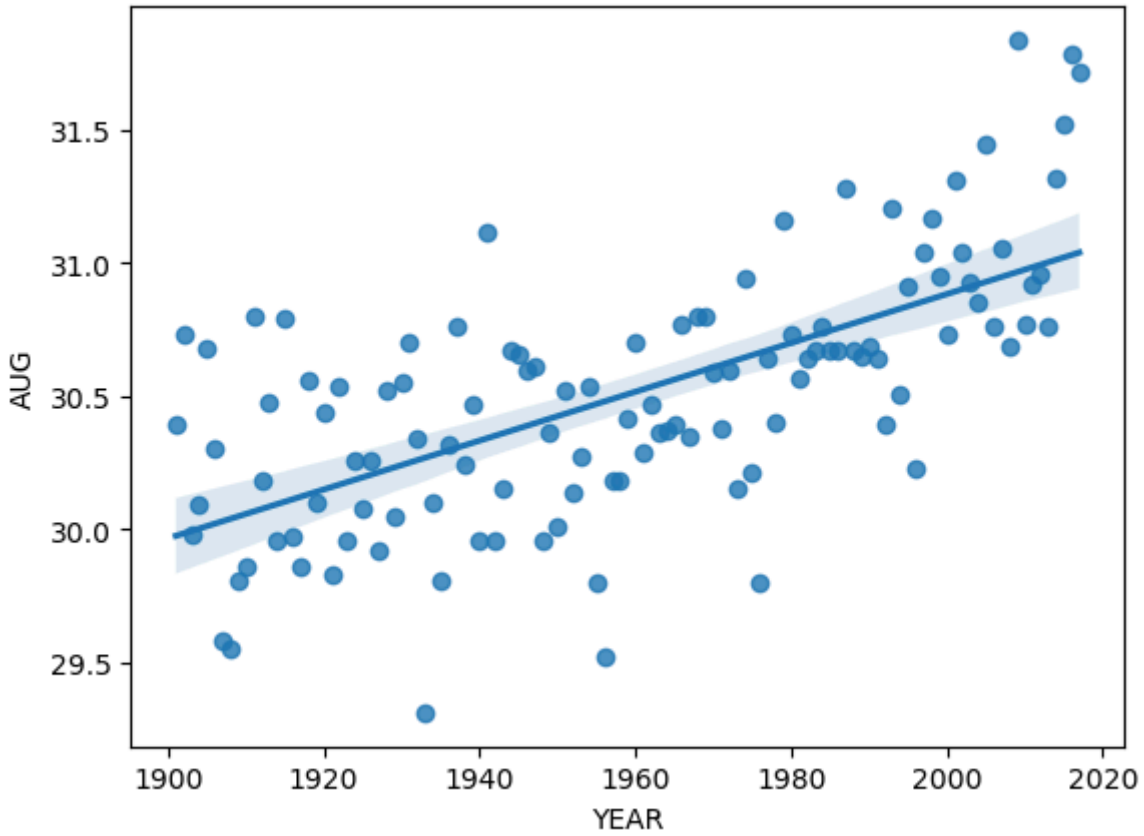
In [37]:
```
sns.regplot(x='YEAR', y='JUL', data=df)
```

Out[37]:
```
<Axes: xlabel='YEAR', ylabel='JUL'>
```



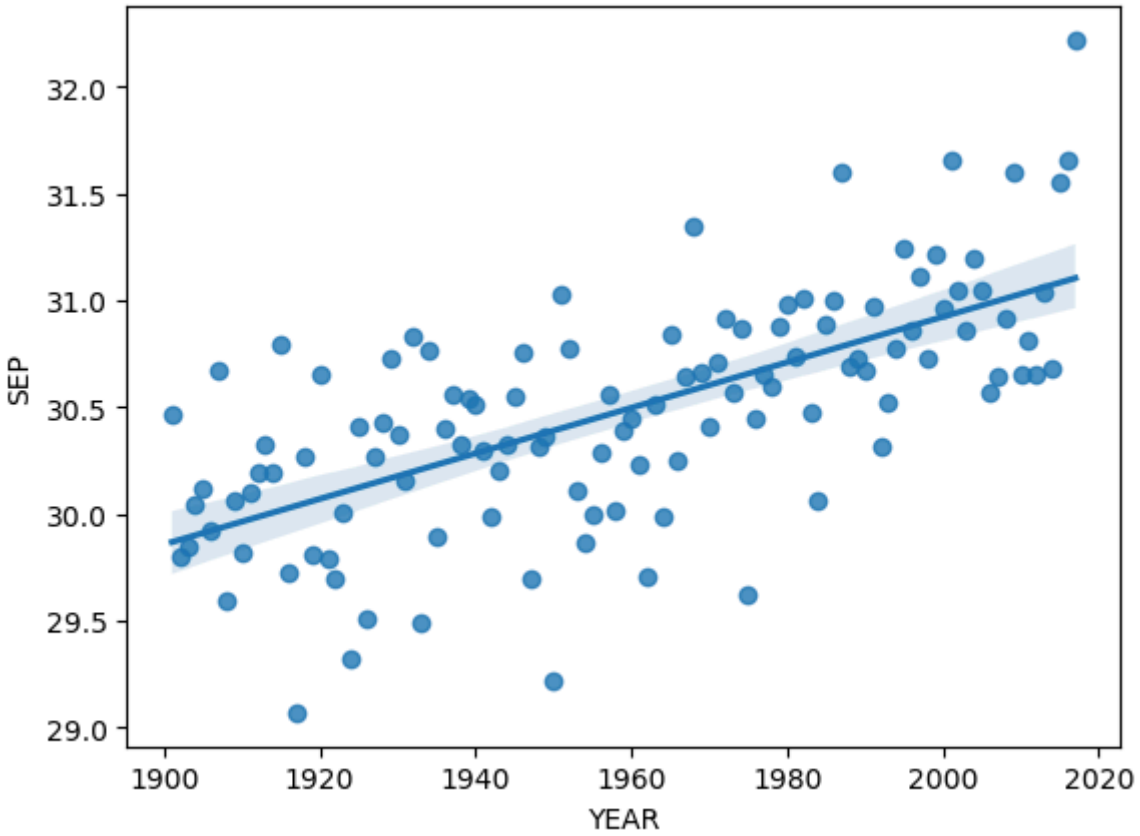
In [38]:
```
sns.regplot(x='YEAR', y='AUG', data=df)
```

Out[38]:
```
<Axes: xlabel='YEAR', ylabel='AUG'>
```



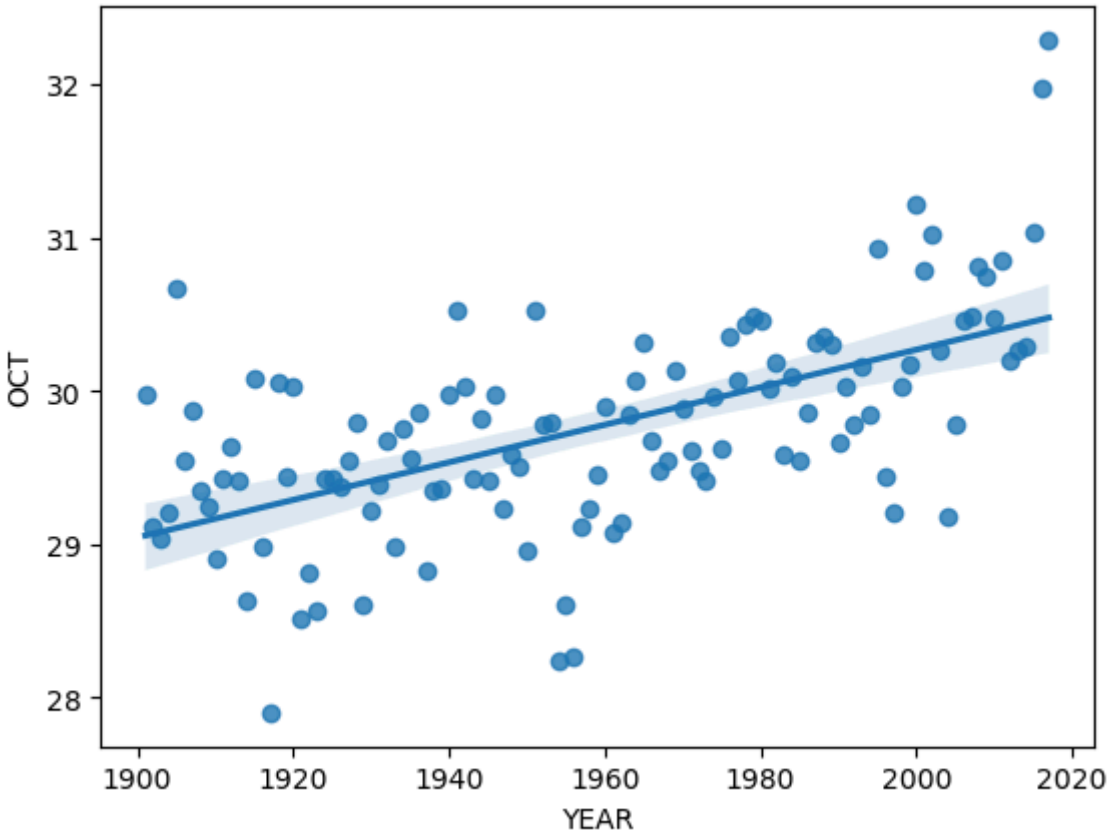
In [39]:
```
sns.regplot(x='YEAR', y='SEP', data=df)
```

Out[39]: <Axes: xlabel='YEAR', ylabel='SEP'>



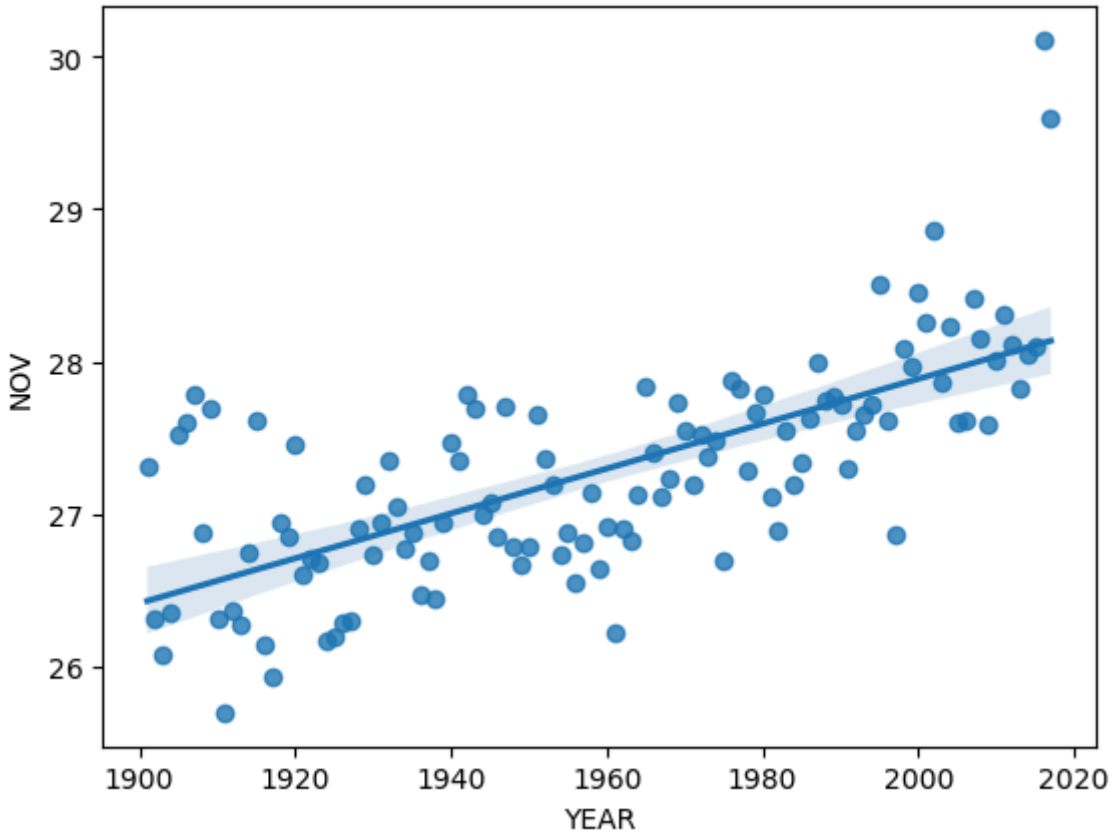
In [40]:
```
sns.regplot(x='YEAR', y='OCT', data=df)
```

Out[40]: <Axes: xlabel='YEAR', ylabel='OCT'>



In [41]:
```
sns.regplot(x='YEAR', y='NOV', data=df)
```

Out[41]: <Axes: xlabel='YEAR', ylabel='NOV'>



In [42]:
```
sns.regplot(x='YEAR', y='DEC', data=df)
```

Out[42]:
```
<Axes: xlabel='YEAR', ylabel='DEC'>
```