

# Temperature Trends

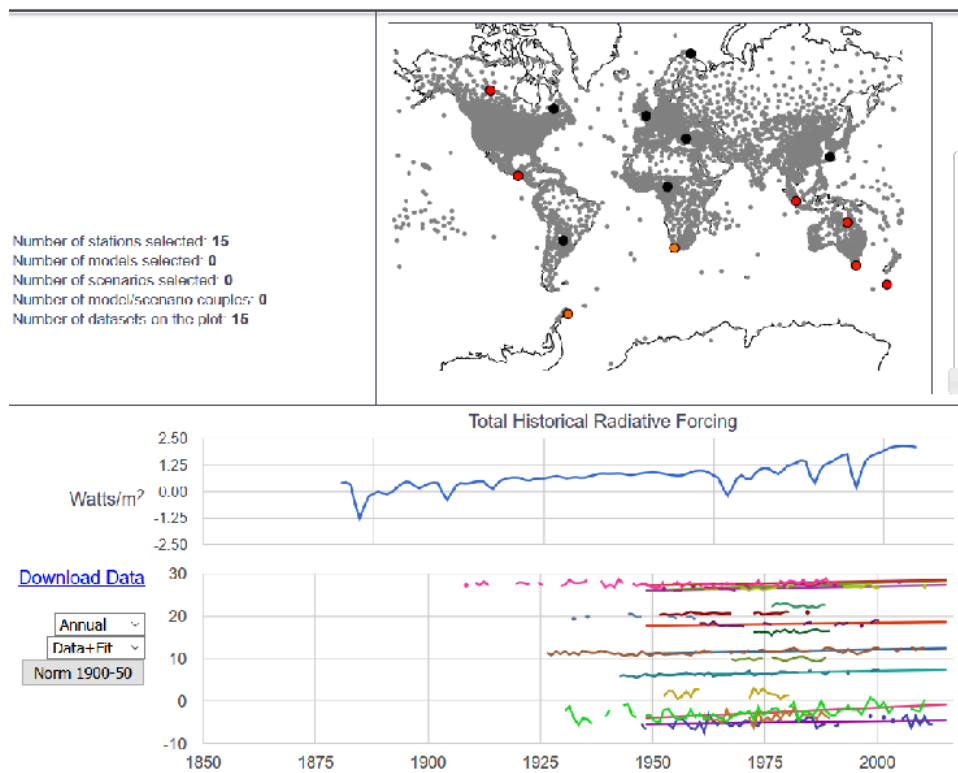
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*29 October 2016*

## Introduction

### Idea

My project started with the idea of showing trends in temperatures from randomly selected stations. I downloaded the list of station names from the [Time Series Browser](#), and wrote a short Python script to select station names at random. I then manually selected stations, see link [here](#). However, there is a problem as the figure makes clear: *stations are not distributed uniformly, so the selection will also be skewed.*



I therefore decided to sample uniformly across the globe: select positions at random, and take the readings from the nearest stations with adequate data. See Methodology Section below.

## References

- Code is stored in [my Github repository](#) - user name ‘weka11’
- The algorithm for uniformly sampling points on the surface of a globe is documented in [Statistical Mechanics: Algorithms and Computations](#), Werner Krauth, PDF [here](#) - *algorithm 1-22, direct-surface*.
- [Time Series Browser](#)
- [NOAA National Climatic Data Center](#)

## Methodology

I decided against using the Time Series Browser, as it was designed for accessing data by station name, not latitude and longitude. I could have written a script to generate random locations, and then screen scrape the data, but past experience with other websites has taught me that this is fraught with difficulty (typically this requires the exploitation of undocumented features in the website: *here be Dragons!*). I decided to use the *data behind the Time Series Browser* instead. The analyses are performed in [R](#), and this document has been generated by [R Markdown](#) - see References above. **NB: as the R code uses a random number generator, the results of each run will be different.**

- Download stations and monthly average temperature readings from [NOAA National Climatic Data Center](#)
- Randomly sample 25 locations, uniformly distributed distributed on the surface of the Globe, using the algorithm from Werner Karuth’s book, above.
- Filter the list of stations so they are restricted to those with readings in the time interval of interest (currently 1950 to the present)
- For each of the 25 locations, find the nearest station.
- Tabulate the stations, and plot the time annual average temperatures, along with a regression line

## Results

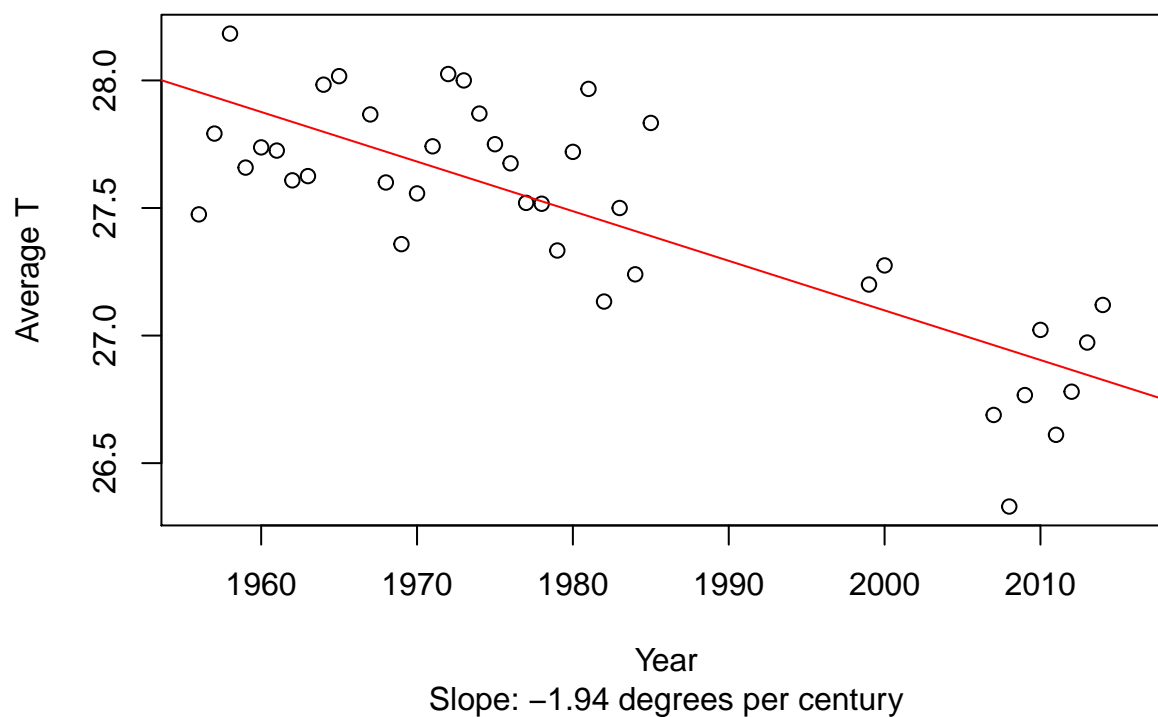
### Stations and their locations

ID	NAME	LATITUDE	LONGITUDE
50397502000	SORONG/JEFMAN	-0.93	131.12
21135542000	IRGIZ	48.62	61.27
14168994000	MARION ISLAND	-46.88	37.87
15567633000	MONGU	-15.25	23.15
14862650000	DONGOLA	19.17	30.48
40371917001	ISACHSEN,NW	78.78	-103.53
64606700000	GENEVE-COINTR	46.25	6.13
50396925000	SANGKAPURA	-5.85	112.63
22224507000	TURA	64.27	100.23
22220274000	OSTROV UEDINE	77.50	82.20
22938763000	KIZYL-ARVAT	38.98	56.28
14361997000	CROZET	-46.43	51.87
21047918000	ISHIGAKIJIMA	24.33	124.17
22443497000	HAMBANTOTA	6.12	81.13
21128952000	KUSTANAI	53.22	63.62
30485488000	LA SERENA	-29.90	-71.20
16161967000	DIEGO GARCIA	-7.30	72.40

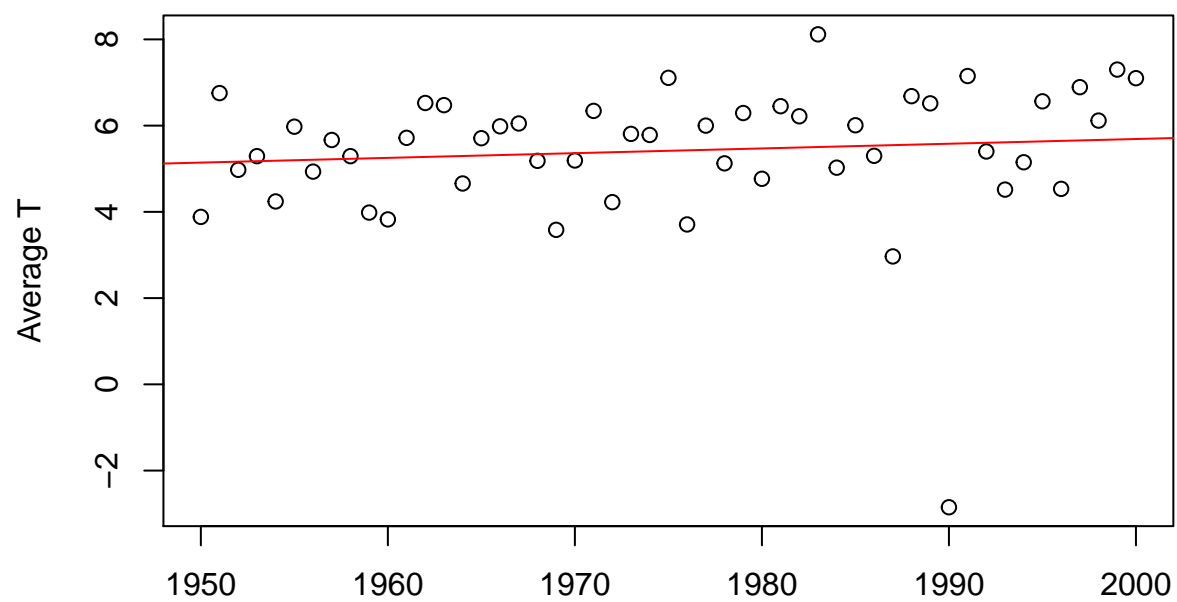
ID	NAME	LATITUDE	LONGITUDE
30382900000	RECIFE	-8.05	-34.92
22230230000	KIRENSK	57.77	108.07
60437735001	KIROVABAD	40.72	46.42
16561984000	SAINT-PIERRE	-21.33	55.48
20551076000	ALTAY	47.73	88.08
31688890001	STANLEY /UK/	-51.70	-57.90
30382983000	PETROLINA	-9.38	-40.48
21744454000	KATHMANDU AIR	27.70	85.37

Details from each Station

### 50397502000: SORONG/JEFMAN

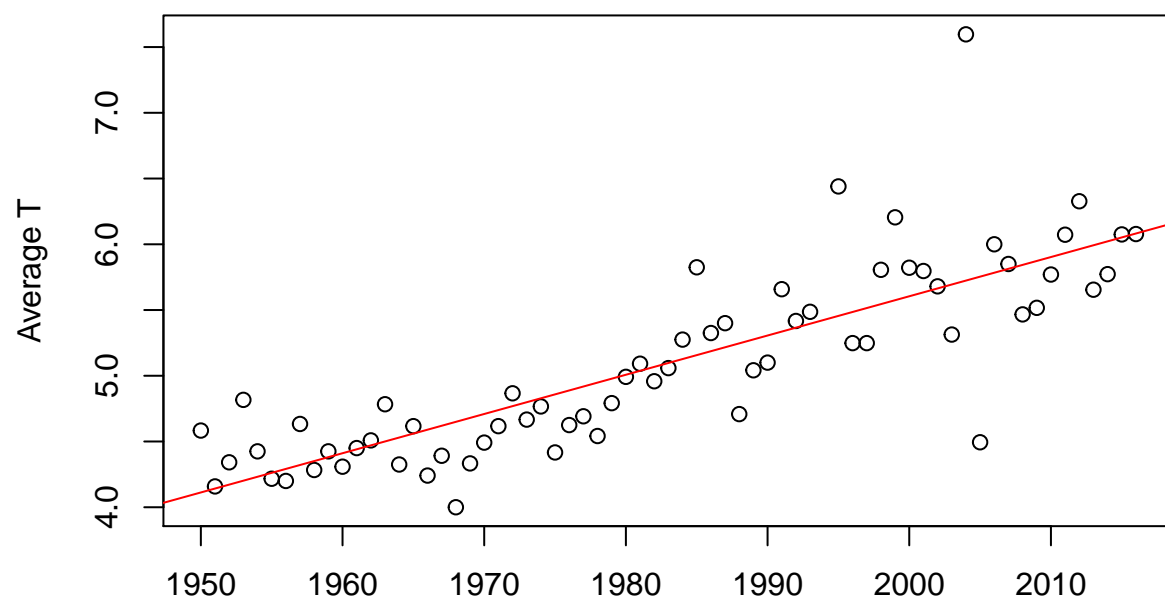


# 21135542000: IRGIZ



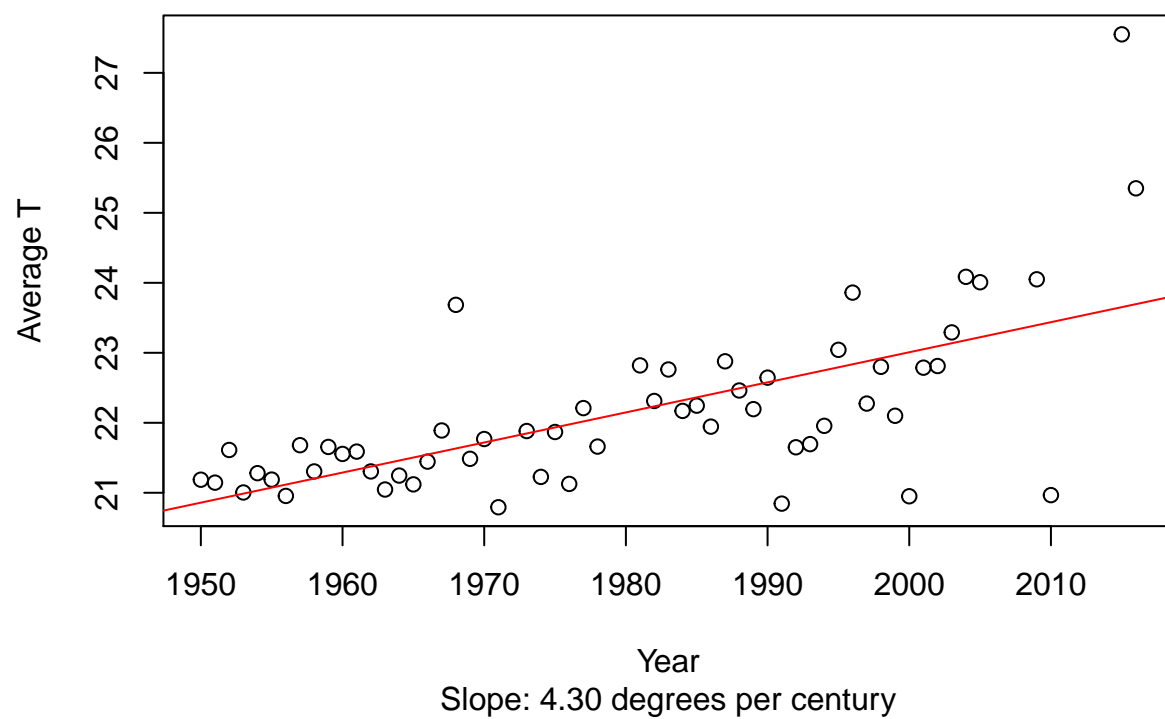
Year  
Slope: 1.09 degrees per century

# 14168994000: MARION ISLAND

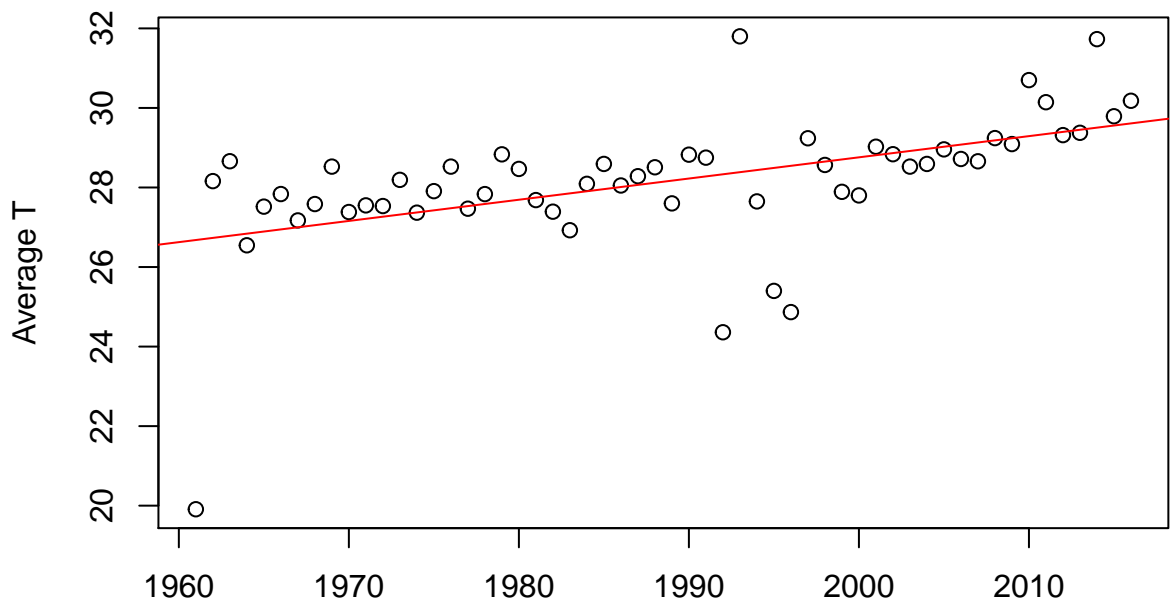


Year  
Slope: 2.98 degrees per century

# 15567633000: MONGU

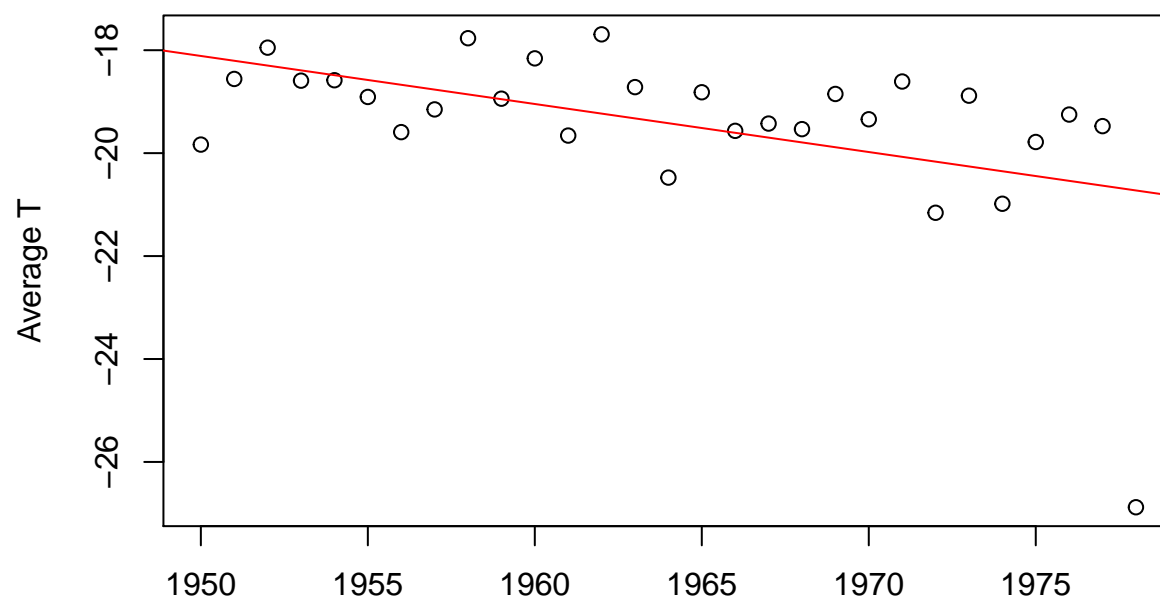


**14862650000: DONGOLA**



Year  
Slope: 5.33 degrees per century

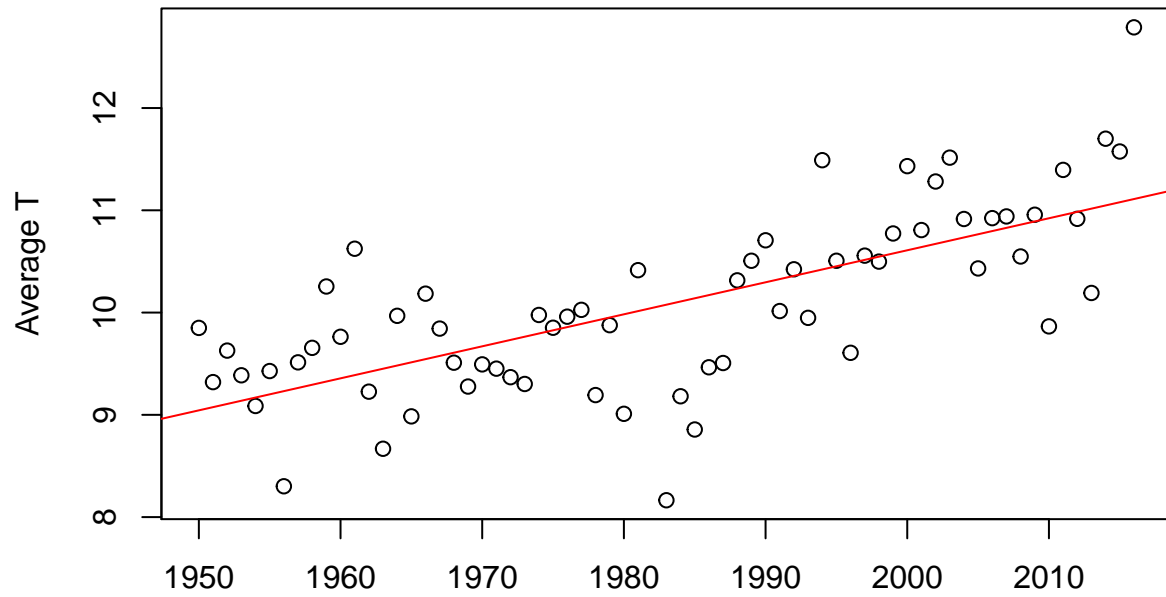
# 40371917001: ISACHSEN,NW



Year  
Slope: -9.33 degrees per century

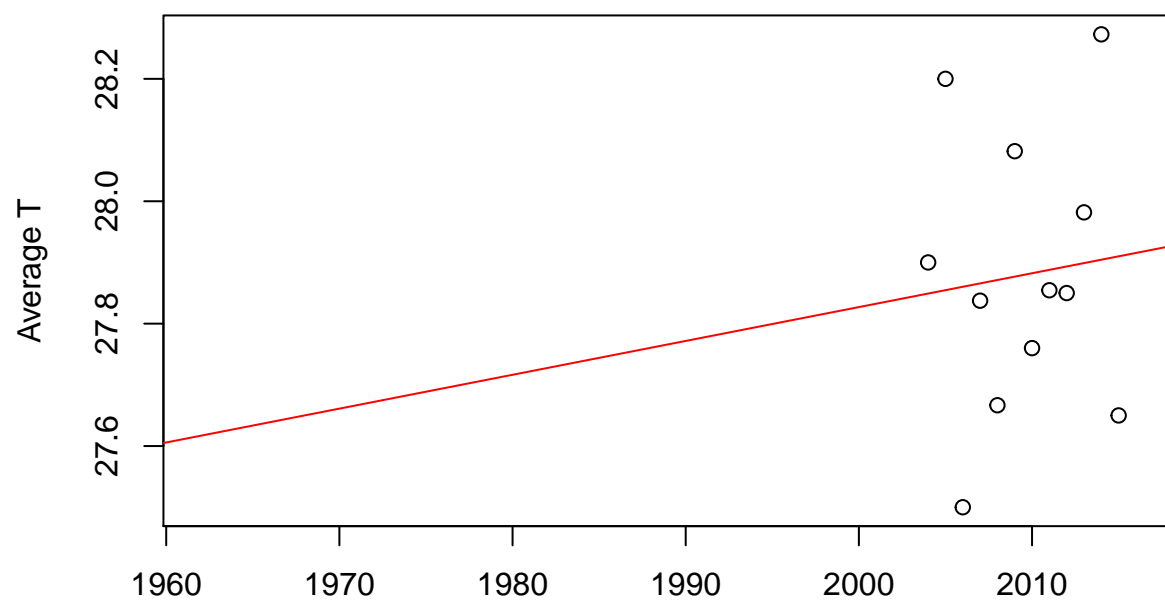


# 64606700000: GENEVE-COINTR



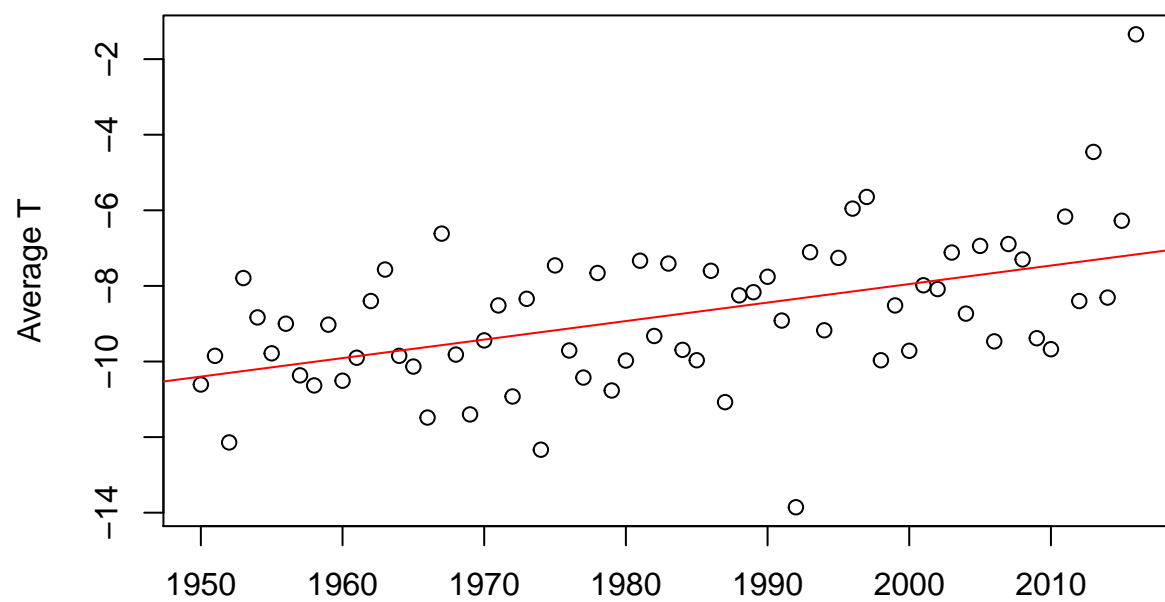
Year  
Slope: 3.13 degrees per century

### 50396925000: SANGKAPURA



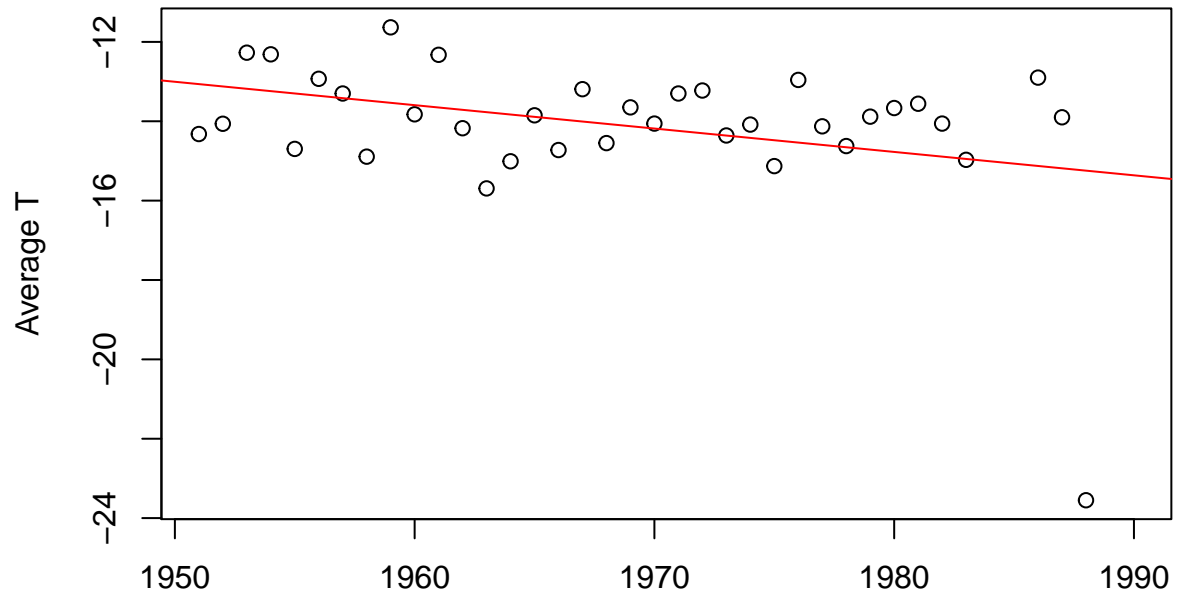
Year  
Slope: 0.55 degrees per century

# 22224507000: TURA



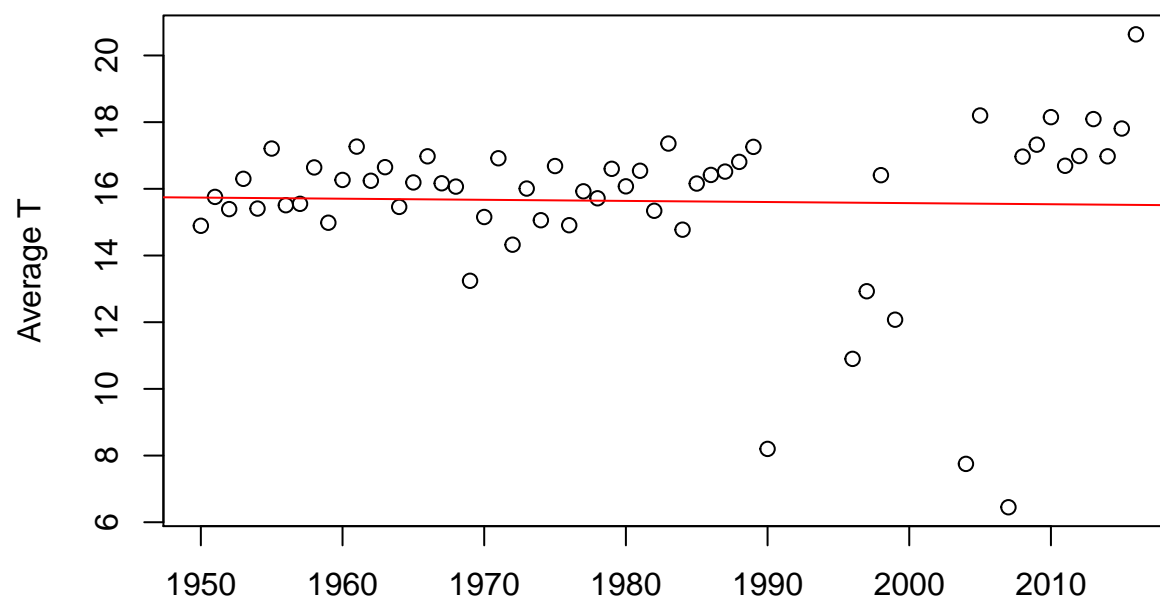
Year  
Slope: 4.90 degrees per century

# 22220274000: OSTROV UEDINE



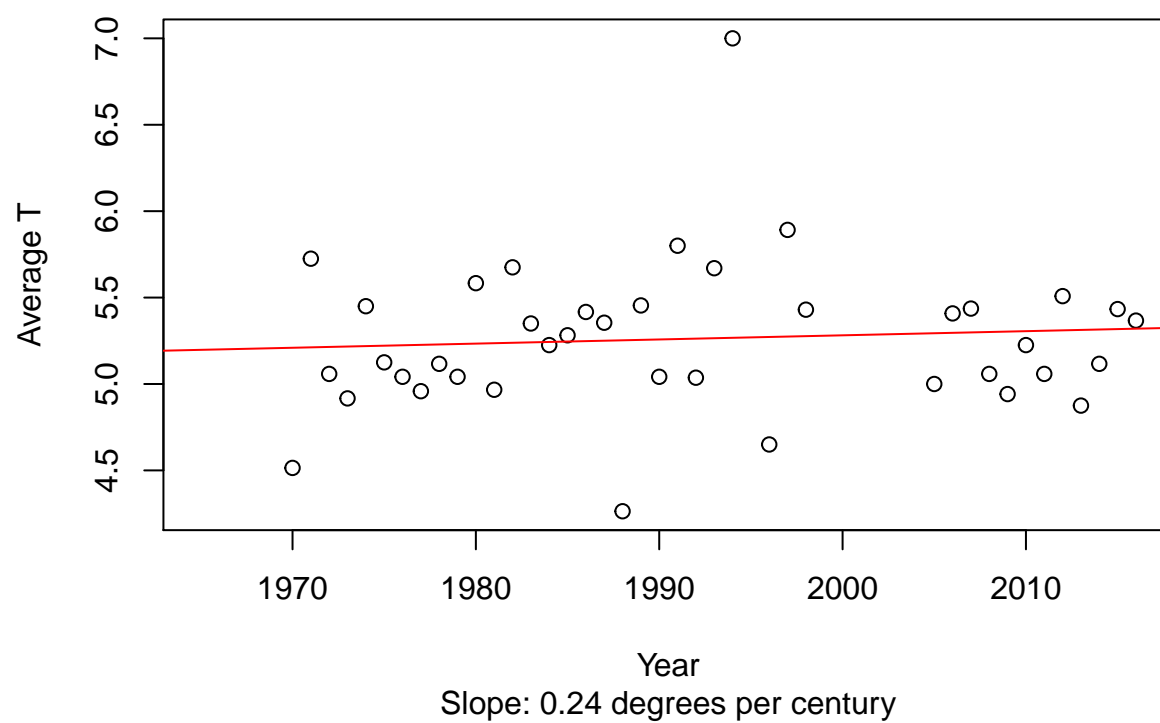
Year  
Slope: -5.89 degrees per century

# 22938763000: KIZYL-ARVAT

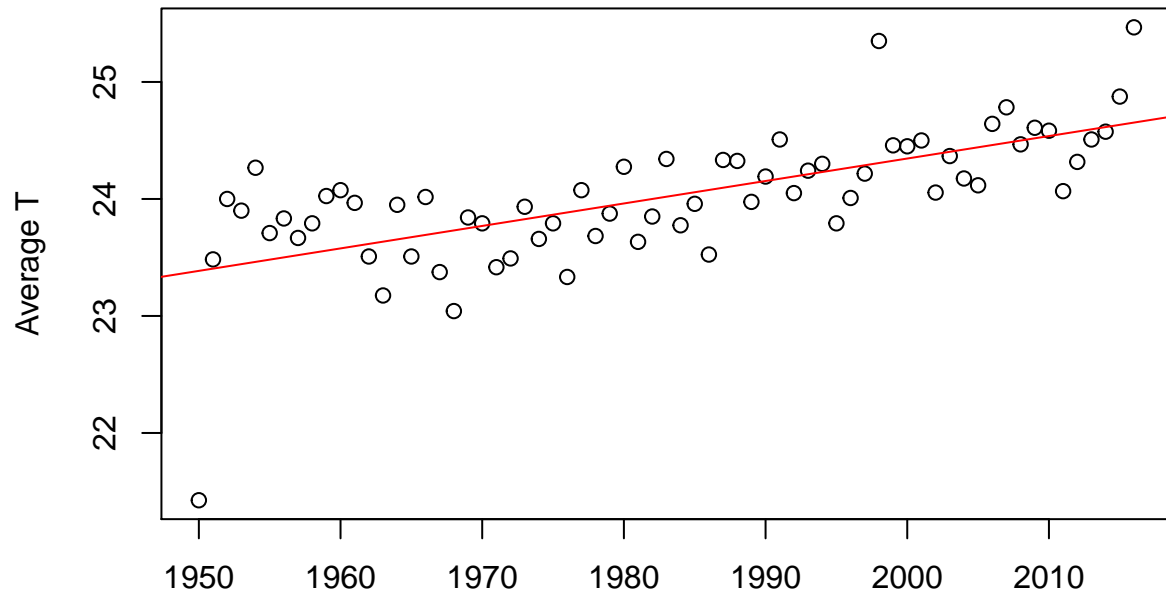


Year  
Slope: -0.33 degrees per century

# 14361997000: CROZET

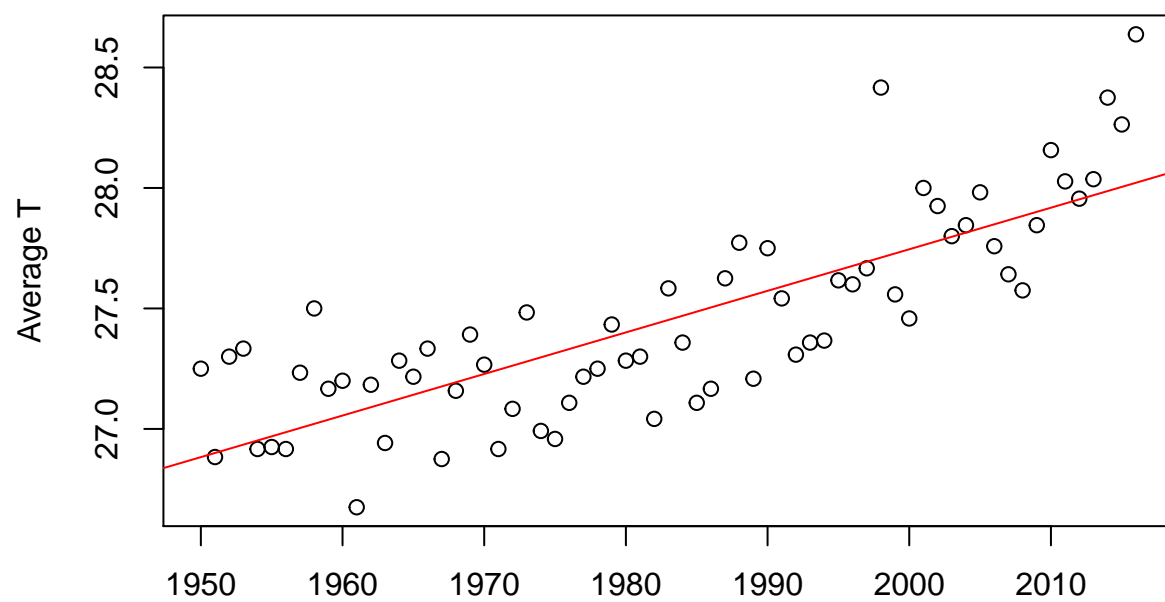


# 21047918000: ISHIGAKIJIMA



Year  
Slope: 1.92 degrees per century

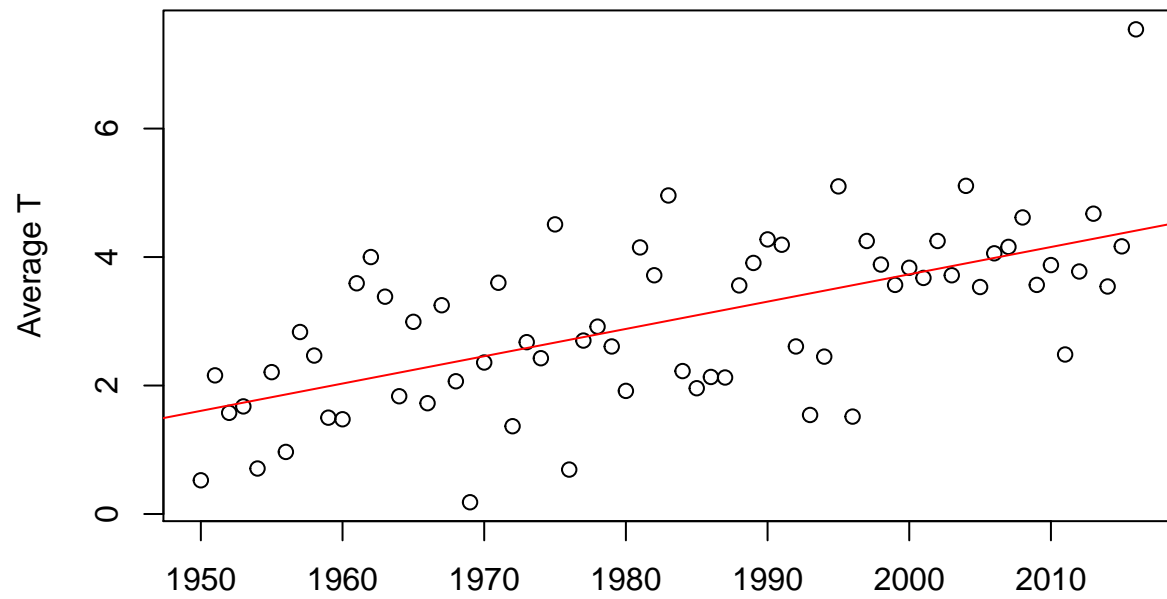
# 22443497000: HAMBANTOTA



Year  
Slope: 1.73 degrees per century

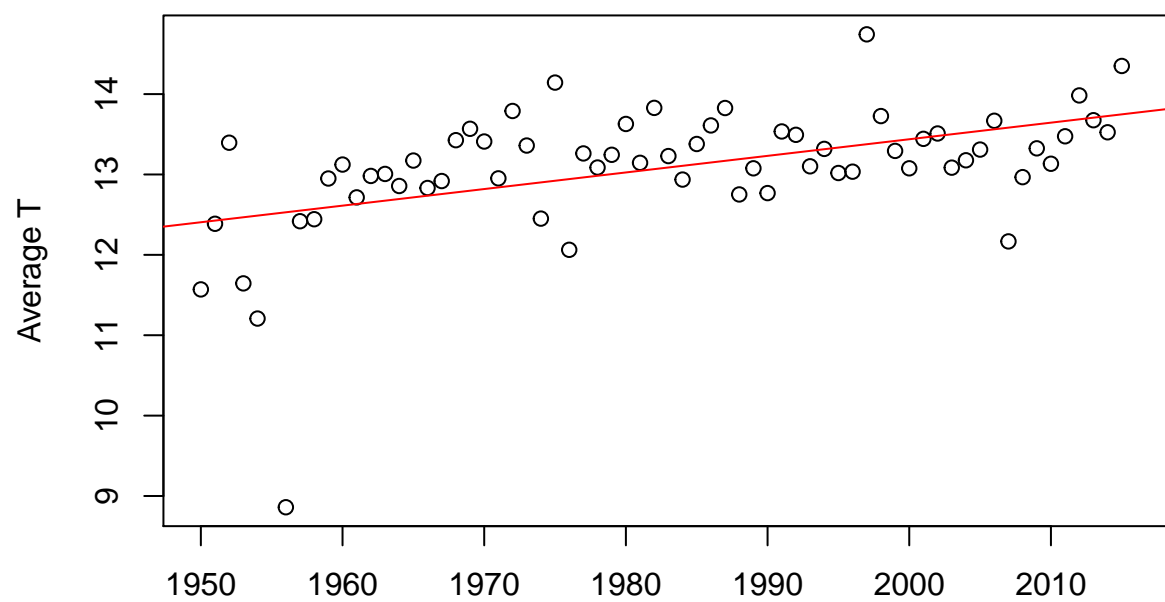


## 21128952000: KUSTANAI



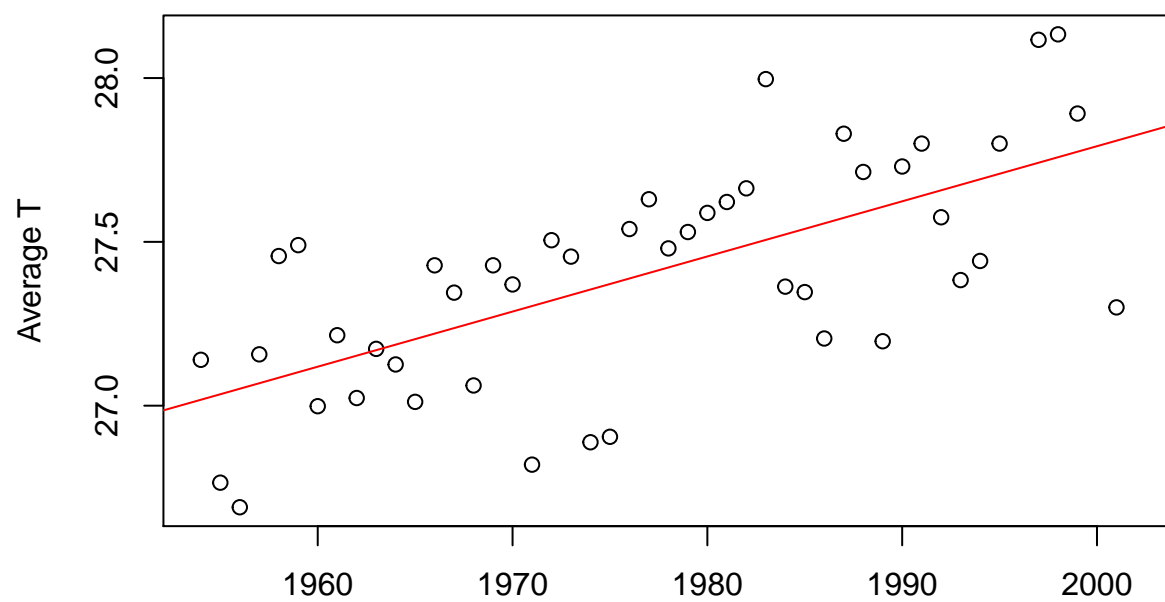
Year  
Slope: 4.25 degrees per century

### 30485488000: LA SERENA



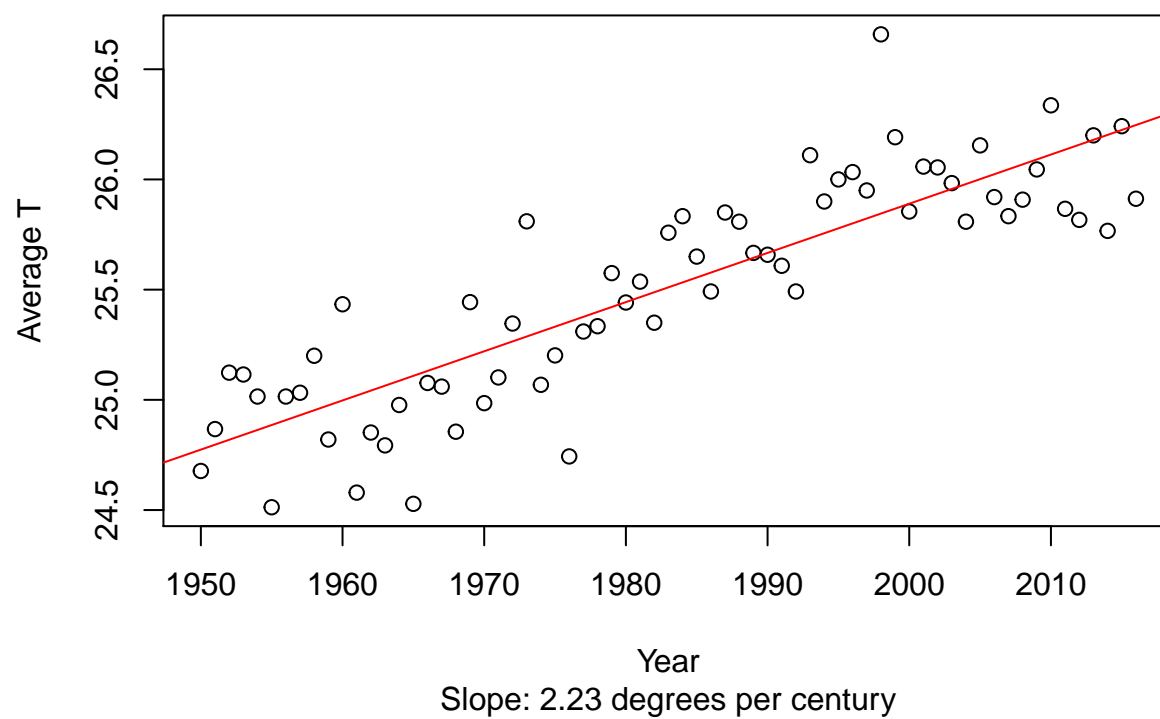
Year  
Slope: 2.07 degrees per century

# 16161967000: DIEGO GARCIA

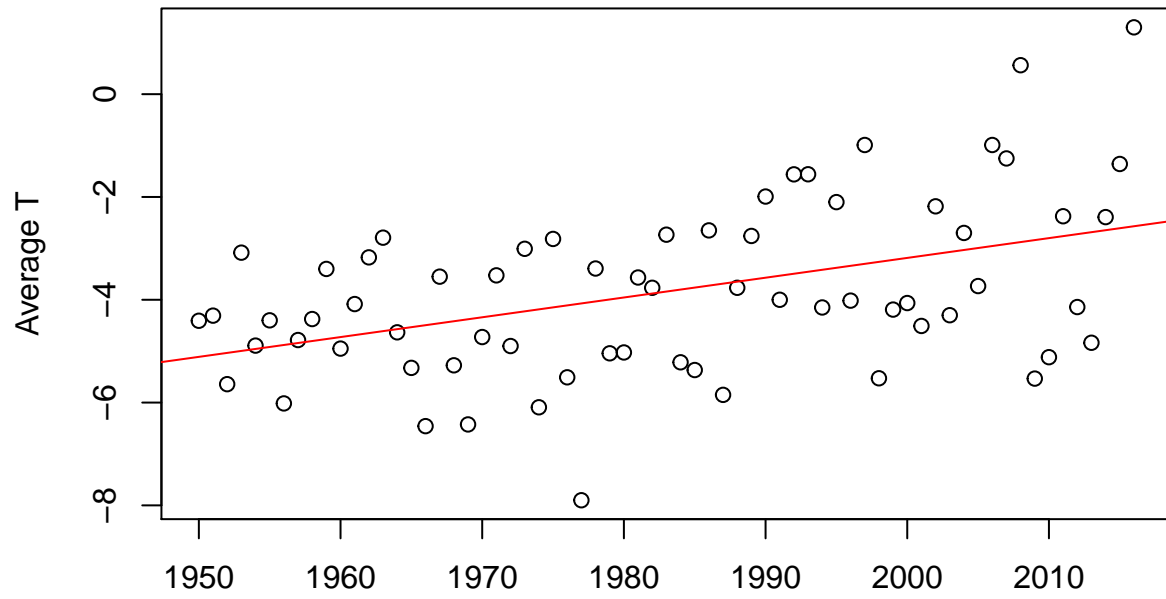


Year  
Slope: 1.68 degrees per century

### 30382900000: RECIFE

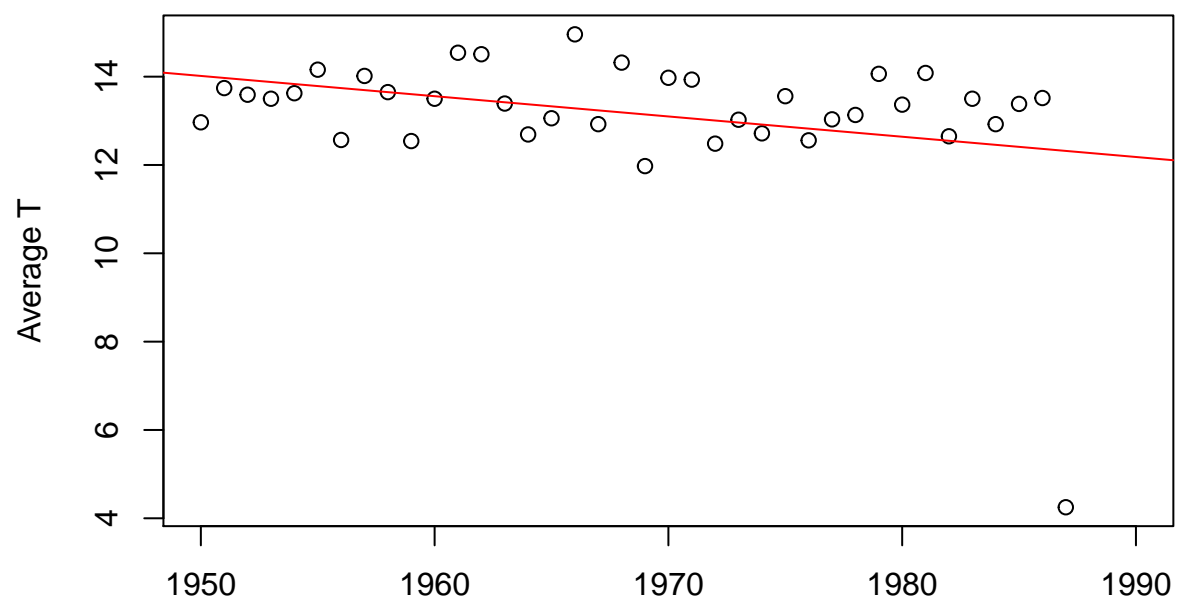


# 22230230000: KIRENSK



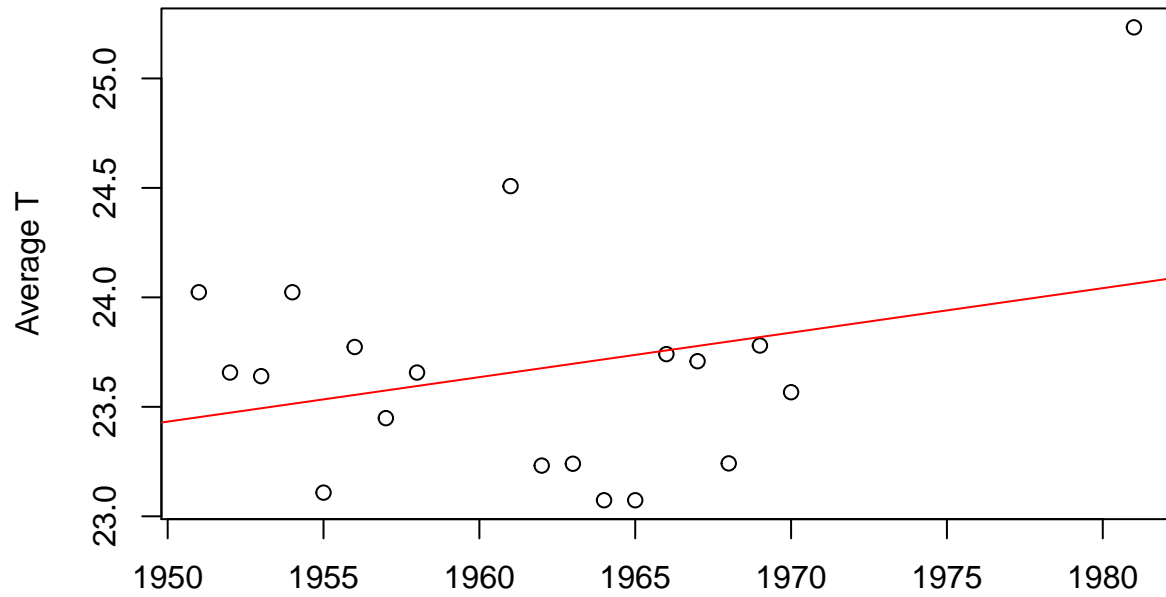
Year  
Slope: 3.85 degrees per century

# 60437735001: KIROVABAD



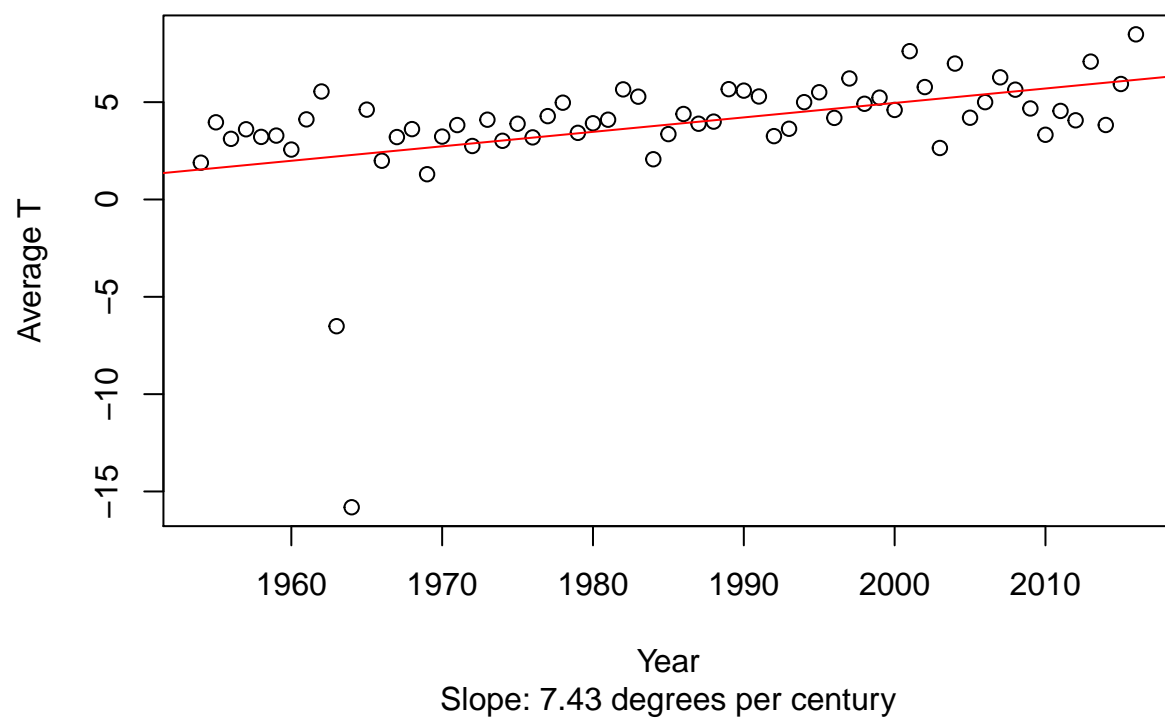
Year  
Slope: -4.59 degrees per century

# 16561984000: SAINT-PIERRE



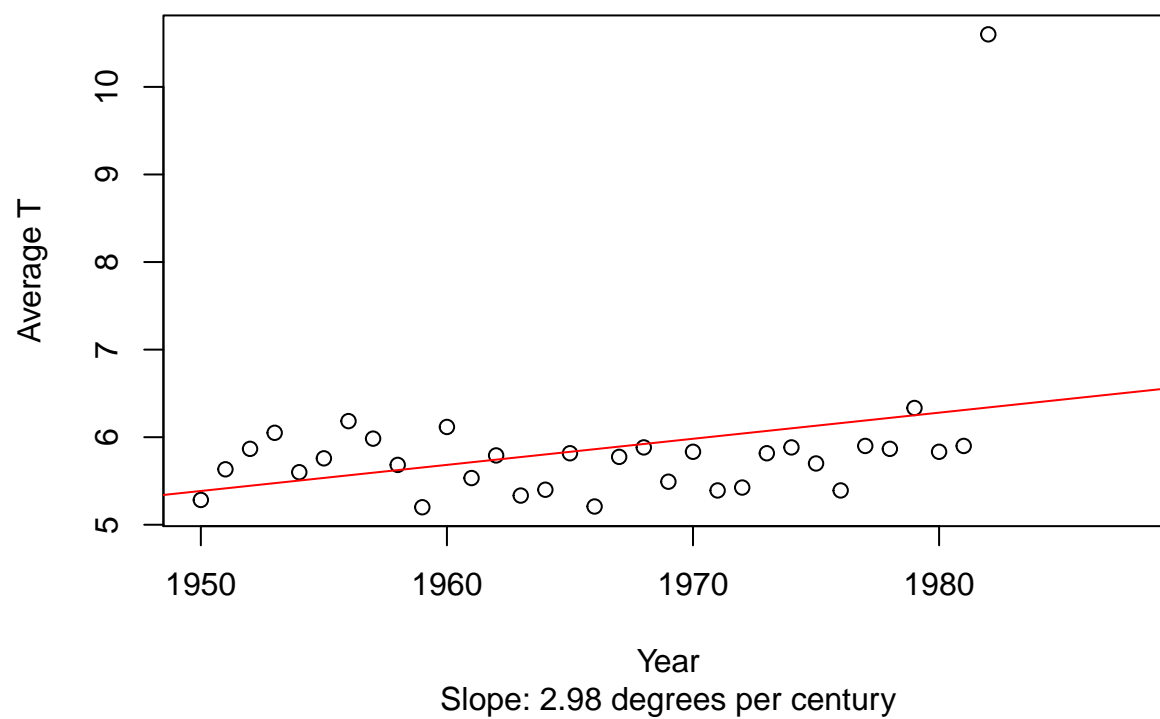
Year  
Slope: 2.03 degrees per century

# 20551076000: ALTAY

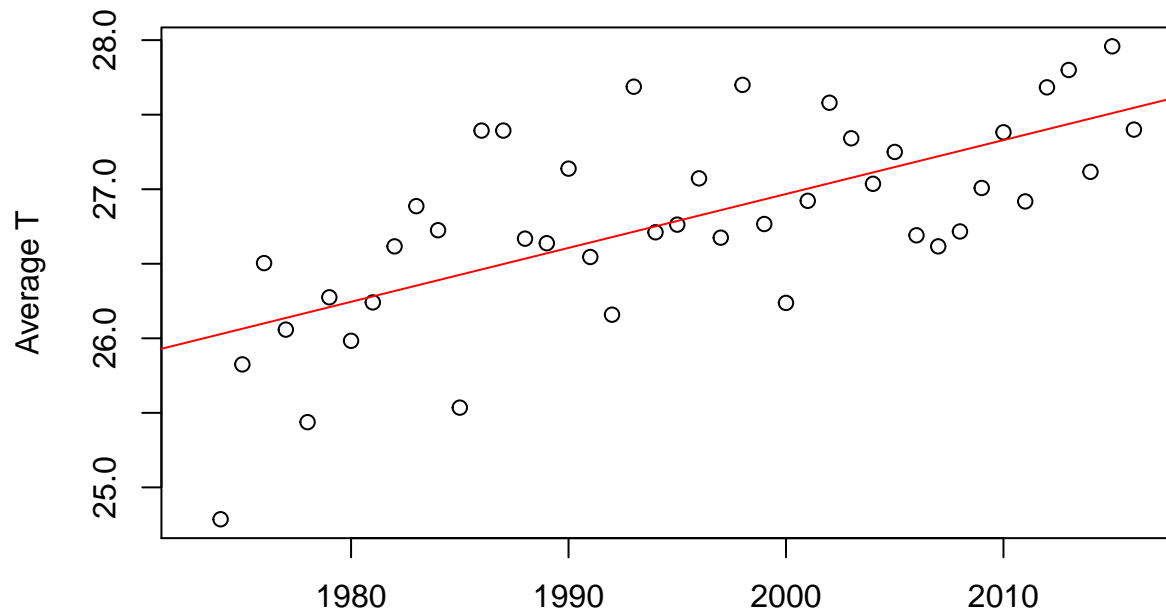




**31688890001: STANLEY /UK/**

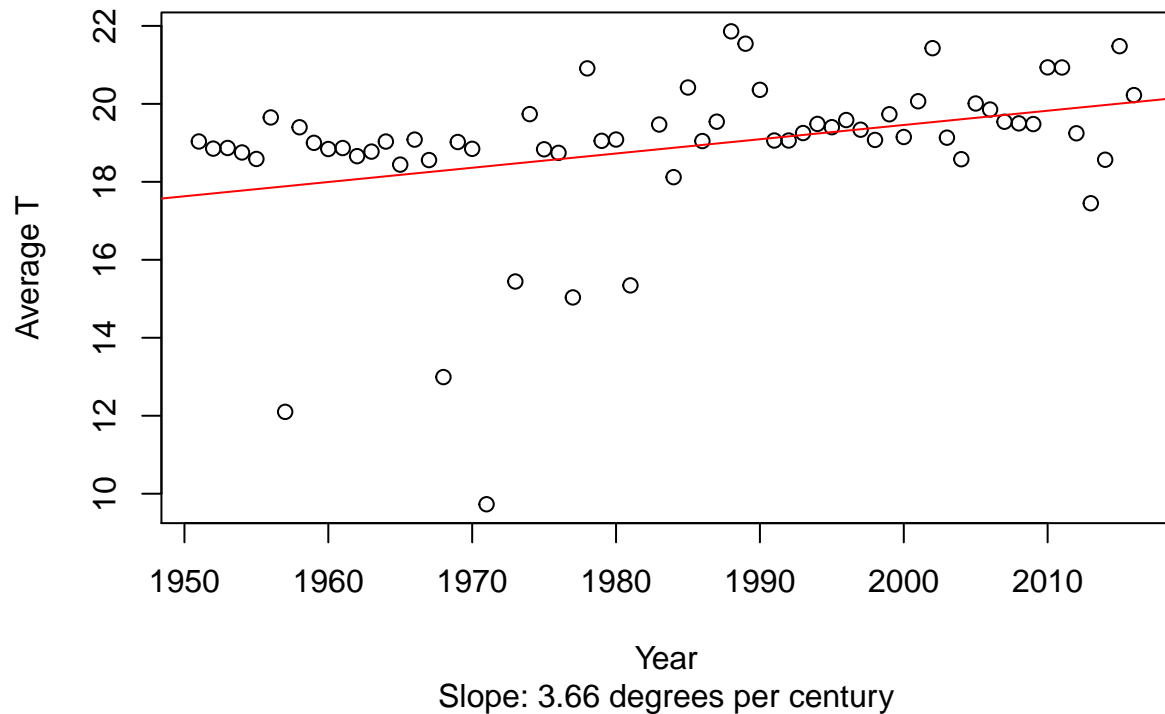


### 30382983000: PETROLINA



Year  
Slope: 3.61 degrees per century

## 21744454000: KATHMANDU AIR



### Conclusion

The temperature increased at 20 stations and decreased at 5 stations. This is in line with the results I have seen each time I have generated this report for a new random selection: there are far more stations with increases than decreases. Average increase is 1.5 degrees/century.

### Future work

- Allow user to specify a threshold for increases, so we would only consider temperature to be increasing if the slope exceeded some value - say 0.5 degrees per century.
- Include a summary plot for all stations.
- Allow program to download latest data from NOAA, instead of using canned data.