Lab 3: Lab Worksheet

Please write your name, cohort, and student number at the top of this page.

All questions must be answered in no more than 5 lines, and most questions should be answered in no more than 3 lines! Be precise but concise in your answers.

Section 1 and 2

a. Fill in Table 1 below. Don't forget to highlight (e.g. circle) trends which are positive within the 95% confidence interval AND to fill in the unit of the trends you give.

Period	Temperature anomaly trend (unit:)	
	UBC	Global
1950-1959	(not enough data)	
1960-1969		
1970-1979		
1980-1989		
1990-1999		
2000-2009		
2010-2017		
1950-2017		

b. Describe the variability in local (UBC) and global temperature anomalies time series.

c. Do you think that the term "global warming" is appropriate to describe the time series you plotted? Why?

d. Do you think that the trend you see in global temperature (if any) is a natural fluctuation? If so, do you think it happen often? What additional data would you like to have to answer these questions?

Section 3

What reasons could explain the differences and the similarities between UBC and global temperature anomalies?

Section 4 and 5

a. Fill in table 2 below. Don't forget to give 95% confidence intervals AND units for each slope.

Independent variable	Slope of the global temperature anomaly vs forcing regression for a			
	Simple linear regression			Multilinear regression ($R^2=$)
	Slopes	R^2		Slopes
TSI				
AOD				
CO2				
SO2				
MEI				

b. Are the results of the simple linear and the multilinear regression always compatible? Why? Which method do you think give the most accurate idea on the dependence of the global temperature anomaly on each forcing?

c. Briefly explain if/why the sign of each slope match/does not match your expectations.

d. In its AR5 report (2014), the International Panel on Climate Change (IPCC) uses various greenhouse gases emissions scenario to forecast future temperature. In particular, for three scenarios, the atmospheric CO_2 in 2100 is assumed to be 400, 500 and 950 ppm respectively. Corresponding temperature anomalies, relative to 1986-2005, would be 1±0.4, 1.8±0.5 and 3.7±0.7 degree Celsius respectively.

Are the results of your regression compatible with such projections? Explain any assumptions made on forcing other than CO2 to answer this question. Discuss where disagreement (if any) may come from.

Section 6

Briefly summarize the main limitations of an approach based on linear regression to establish a causality between two time series and make prediction for the dependent variable.

Wrap-up

For each of the statements below, indicate whether your work in this lab:
-demonstrate the statement
-support the statement
-does not enable to comment the statement
-does not support the statement
-proves the statement wrong
Choose only one option. Briefly explain your choice, and make clear whether it applies to the entire statement, or only part of it.

Statement 1: *"Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia."* (IPCC AR5)

Statement 2: *"*[the main problem for climate scientists is] the fact that there has now been no *"global warming"* for 18 years and six months."* (Breitbart, 2015)

Statement 3: *"[greenhouse gases] are extremely likely to have been the dominant cause of the observed warming since the mid-20th century."* (IPCC AR5)

Statement 4: *"The Sun is the reason for our warming. SO_2 [from volcanoes] is the 'cure' to put a band-aid on it until it rises again. We are not getting the SO_2 needed [the author means we did not get a major volcanic eruption recently] and that is a problem [i.e., what is causing the warming trend] right now."* (southerncaliforniaweatherforce.com)

Statement 5: *"In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans."* (IPCC AR5)