# Title: Climate change and natural climate variability

**Tutor: Nicola Scafetta**

**Co-tutor(s): N/A**

# Proposal

# Global surface temperature has risen by about 1°C since pre-industrial period (1850-1900). However, the interpretation of the physical causes of 20th-century global warming remains an open issue. There is a possibility that the observed warming trend is partly due to the natural variability of the climate and partly linked to the increase in anthropogenic greenhouse gas emissions, as interpreted by global circulation patterns. Ignoring the natural variability of the climate could lead to projections of climate patterns too alarming for the twenty-first century. The proposed study aims to study the climate records obtained from measurements and climate proxies to identify the natural variability of the climatic system, in particular the cyclic variability that can also be modeled. Addressing this issue is crucial for accurate forecasting of climate change.

# Research Program

The PhD student needs to have a sufficient background in physics, mathematics, statistics and atmospheric/oceanic sciences. Some knowledge of astronomy and solar physics is welcome. Moreover, the project also requires some programming knowledge such as in Matlab or other similar software.

The PhD student is expected:

(1) to study the necessary literature,

(2) collect relevant data which is usually available on the Internet,

(3) perform careful comparative statistical analyses of the climatic reconstructions of the past, and

(4) writing a dissertation to summarize the results.

Comparative analysis of the outputs of the climate models is also expected.

The goal of the analysis is to identify as much as possible mechanisms and patterns of natural climate variability. In particular, especially important are climatic patterns that could be associated with specific cycles from the interannual to the multimillennial ones because they could in principle be associated with a number of possible solar and astronomical forcings. Cyclical climate variability could be easily used for accurate forecasts. Thus, the final goal is attempting to develop optimized empirical models for better forecast climate change and to better evaluate the hazards of future climate change.

# =================