

## Abstract:

Monitoring the Earth's climate requires a thorough instrumentation network around the globe and techniques to bring together measurements from various sources with minimal error. The Earth's climate includes many physical systems such as the Earth surface, the lower atmosphere (troposphere), the upper atmosphere (stratosphere), the oceans, the deep Earth, and others. In order to determine the past impacts of human emissions on the climate and future magnitudes of climate change, it is essential to ensure that the measurements are of high accuracy.

In this presentation, an overview of climate science will be given and fingerprinting of climate change will be discussed. In addition, a number of measurement devices will be introduced. Their history of accuracy and biases will be discussed as will data collection methods. The instruments to be discussed will deal with measurements of tropospheric temperatures from the emission spectrum of atmospheric oxygen, measurements of ocean temperatures around the globe, measurements of deep earth temperatures and the inference of past climate changes, measurements of ocean chemical composition (pH), and measurements of land-based air temperatures. Some case studies will be provided wherein biases in instrumentation have been discovered that changed our understanding of climate change.

Finally, the topics of climate models will be introduced with a focus on their utility for predicting future climate change in the presence of increasing human emissions of greenhouse gases.