

Climate Variability

Regional Integrated Multi-hazard Early-warning System (RIMES)

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Climate is all about variability

• Climate is defined by its variability, and this



Temperature varying in **time** over three months in Geneva Switzerland in 1816. On the right side, temperature varies in **space** on one specific day.

Source: CLIMANDES Climate Science e-learning course Swiss and Peruvian Govt, WMO collaboration. Resource person: Professor Stefan Brönnimann. He is a professor in climatology at the University of Bern in Switzerland.

You have two waves: one sine wave with a large amplitude and low frequency (drawn in **red**), and another sine wave with lower amplitude and higher frequency (drawn in **blue**). What happens when they interact?



 If many waves (processes) are interacting, all with different amplitudes (or relative strength) and frequencies. Maybe some interactions even create new processes or mechanisms—entirely new waves that influence the system.

Global Temperature anomaly of the 20th century

Scales of weather and climate phenomena



Climate variability – space scales

As the spatial scale decreases, climate variability increases, making the identification of signals from the underlying natural variability increasingly difficult to distinguish





- *Weather:* Characteristics of the atmosphere over a short period of time, usually no more than a few days.
 - Examples: *Current* Temperature, Rainfall, Humidity, Solar radiation
- *Climate:* The statistics (eg. average) of weather over a long period of time, along with its variations.
 - Examples: Average Temperature, Rainfall, Humidity, Solar radiation



Temperatures at a location for one year:

McPhaden (1999), published in Science entitled "Genesis and Evolution of the 1997-98 El Niño".

$$y_t$$
 or $y_t - \overline{y}$

where t = time of event and y bar = average of variable y.

Monthly averaged sea-surface temperature (in degrees C) for December 1996 and December 1997. Monthly average SST anomaly for





https://www.yunbaogao.cn/report/index/report?reportId=5_3061

