

Sections Européennes - Session 2025

Sujet n°33

Please do not write on this document and do not forget to hand it back to the jury at the end of the exam.

SEQUENCES

El Niño, a complex oceanic-atmospheric phenomenon, is characterized by unusual warming of surface waters in the Eastern Pacific. Climate scientists model its intensity using mathematical sequences. Recent studies show that El Niño events typically retain about 80% of their intensity from one year to the next, while background oceanic and atmospheric processes contribute a constant increase of approximately 0.5°C annually. This study explores a mathematical model simulating El Niño temperature, examining how environmental changes might modify these parameters and impact long-term climatic behaviors.

Let $u(n)$ represent the temperature in $^{\circ}\text{C}$ of the El Niño event in year $2024 + n$, where $n \geq 0$.

In 2024, El Niño temperature was 2°C .

a) Justify the evolution of the intensity is modeled by the following recursive relation :

$$u(n + 1) = 0.8u(n) + 0.5$$

Scientists estimate that if the temperature increases beyond 2.495°C , massive natural catastrophes will become common events.

Despite all this information based on scientific analysis, some people remain confident that "everything is going to be fine".

b) Try and convince them that actions should be taken now in order to prevent future massive destruction events. You will base your argumentation on your mathematical knowledge. (Hint : you may use sequence $v(n) = u(n) - 2.5$)