Project Number: 10

Project Title: Future drought explorer system

Project Clients: Sanaa Hobeichi

Project specializations: Web Application Development;Big data Analytics and Visualization;Cloud Computing;Computer Science and Algorithms;Climate Data Science;

Number of groups: 2-3 groups

Main contact: Sanaa Hobeichi

Background:

Overview

The Future drought explorer system helps stakeholders (e.g., those working in agriculture, water management, climate policy) understand how drought conditions might change in Australia due to climate change. The system integrates future climate data from multiple sources, calculates or retrieves drought metrics from one or multiple drought indices, and displays whether drought conditions will increase, decrease, show no significant change, or remain unclear.

Drought conditions can be defined based on the number of drought events or the length of drought events; users are free to select the definition that matters most to them.

The primary goal is to provide a clear, accessible and interactive representation of potential changes in drought conditions in the future.

Requirements and Scope:

The project encompasses the development of a web-based system that allows users to explore projected drought changes across Australia.

Required Knowledge and skills:

The system must provide all core functionalities listed below and at least one novel functionality. The novel functionality can be one of those suggested here or a different one created by the students.

Core (required) functionalities

1. Interactive Map of Australia

Displays a clickable map subdivided into relevant regions (e.g., Natural Resource Management NRM regions).

2. Drought definition & Index Selection

Users can define drought change based on change in number of events or change in length of events

3. Drought index

- Users can select a drought index, such as:

Standardized Precipitation Index (SPI),

Standardized Precipitation Evapotranspiration Index (SPEI), or

Palmer Drought Severity Index (PDSI), or other available drought indices

- "Drought" or "non-drought" conditions are determined based on thresholds applied to the selected indices

4. Future timeframes

The clickable map displays how drought conditions may potentially change for a future time frame (e.g., near-term: 2020–2059, mid-century: 2040–2079, or late-century: 2060–2099) relative to a baseline period (e.g., 1980–2019).

5. Visualisation of the change

- The main display shows whether each region's drought conditions are increasing, decreasing, unchanged, or unclear compared to the chosen baseline period.

6. Multiple data source

The system integrates climate projection data from at least two providers, such as 2 climate simulations from CMIP5 or CMIP6 (Coupled Model Intercomparison Project).

7. On-click regional summary

Clicking on a region displays a summary table with at least four statistics. For example:

- Average number of drought months per decade in the baseline period.
- Average drought length in the baseline period.
- Projected change (increase, decrease, no change, or unclear) in the number of drought events.
- Projected change (percentage of increase, percentage of decrease) in drought length.

Additional (novel) functionalities

Below are suggestions for additional features that build upon the core idea of visualising how drought may potentially change:

8. Scenario selection

Users can compare drought change under different emission or climate scenarios (e.g., RCP4.5 vs. RCP8.5).

9. Threshold selection

Users can apply custom thresholds to classify conditions as drought or non-drought based on the selected indices.

10. Multiple future timeframes

Users can select and compare results across multiple future timeframes.

11. Agreement/disagreement between different drought metrics

The system provides a visual overlay highlighting areas where different metrics (change in drought length and change in the number of drought events) agree or disagree on the projected change (e.g., cross-hatching or coloured outlines).

12. Agreement/disagreement between different drought indices

The system provides a visual overlay highlighting areas where different drought indices agree or disagree on the projected direction of drought change.

13. Agreement/disagreement between different data sources

The system provides a visual overlay showing where different climate models (i.e. data sources) agree or disagree on drought change.

Expected outcomes/deliverables:

The sutdent are expected to produce a web-based visualisation system and provide a documentation.