# GISC405-22S1(C) (21 February to 03 June 2022)
# GIS Programming and Databases
# "Advanced Earth and Environmental Analytics"

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

## Assignment 3 (marked 25%)
## Due: Monday, 2nd of May 2022, 10:00pm

Hand in you Jupyter Notebook into the Learn assignment dropbox and rename it with your user code: ***abc123_Ass03.ipyn.*** Use commenting within your notebook to explain the objective of the scripts you write and rely on markdown to structure your notebook including discussion text and analysis whenever relevant in the assignment.
In this assignment you will be interacting with the calculated Fire Weather Index from both the Automatic Weather Station (AWS) and meteorological model gridded data from WRF. Use all the available time range in the database. ***Demonstrating the use of data chunking for optimizing the code is necessary whenever possible in your notebook. Do not forget to use geographic projections for producing maps.***

1. ***Objective: To understand how the modelled FWI compares to observations from AWSs leading to a real event of the Port Hills Fire that started on the afternoon of 13th of February 2017. Remember the dataset uses the UTC time zone and units of temperature for FWI calculations should in in Celsius.***
    a. For this subtask use the nearest FENZ weather station to Early Valley Road (EVR), Christchurch. From the selected FENZ AWS construct the time series of FWI based on three different starting date scenarios (1 week prior to the fire event, 1 month prior, and 2 month prior). Avoid starting on a day when precipitation was occurring so adjust accordingly. Please revisit our Lab 07 course recording if you forget how to access the FENZ weather station data.
    b. Repeat task 1a but with data from the nearest WRF grid point to EVR.
    c. Compare and discuss the FWI from task 1a and 1b. Give possible explanations to the differences and use data/figures to support.

2. ***Objective: To develop a national fire weather climatology that can help in answering the following two questions***
    a. Where are the regions in New Zealand that exhibit the highest occurrence of extreme fire weather conditions? Explain the potential reasons for the spatial heterogeneity.
    *Hint: Use the minimum extreme FWI threshold of 31 (inclusive) to calculate the number of days exceeding this threshold for each pixel in the WRF data. You will need to produce one map at the end of this subtask.*
    b. Over the last 20 years, is New Zealand experiencing a shift in fire weather to earlier times in the season?
    *Hint: Use the extended spring-summer-autumn months from September to March (7 months) for these calculations. Use a minimum FWI threshold of 17. Aim to produce a time series that aggregates all New Zealand pixels for a specific month of all the years. You should end up with 7 time series plots (each represents a certain month).*

For further information please contact the course coordinator/lecturer:
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# Important Updates on Assignment

# **Update part 1 of 2:** Email sent on 20/04/2022 (refer to original email for access to attachments)

Subject line: GISC405 - Update part 1 of 2 on Assignment 03

Kia ora GISC'ers

I hope you had a good Easter break. Here is the following update regarding my last email about assignment 3 task 2 updates. Thank you for your patience.

1. For assignment 3 task 2a please only use 5 years of data. Along with the modifications below, this will reduce your computational times.
2. For assignment 3 task 2b we would still like you to use 20 years of FWI, but for this we will be providing the data (see update 2/2 below) for you very soon, so please await this in the following update. However, and if you are keen to setup your notebook in the meantime please use the 5 years of FWI calculations from task 2a for task 2b.
3. The Early Valley station does contain data only after 2021-01-29. You might want to tell all the students to use the most suitable station available during that fire incident period. Motukarara or Mcleans (near airport) might be the most suitable ones that are also available during that fire period.
4. The patch to the Jupyter server to mitigate the memory leak issue is now applied. I have tested the updated server and the issue has been resolved. (The memory leak is related to this issue https://github.com/pydata/xarray/issues/2186. The tricky bit is you can't apply the method mentioned in the github discussion directly in the Jupyter notebook. It has to be applied in the server, so thanks to Jiawei this has been done.
5. To calculate the FWI using the MetService WRF data, it is recommended to use the chunks as following **{"time":24,"height":1}**
6. Be careful if you are reading the WRF data from "/srv/MetService_WRF/storage/data/moana/processed/". It contains files for other variables like "**TSLB_**..." and "**TD_.**..". When you open the files using open_mfdataset, make sure you are using "T_*" to open the temperature files instead of "T*". The later will open TSLB, TD and T files together and will mess up the results.
7. The FWI calculator (fwi_nz.py) is also updated (attached to this email). The new version will by default save the fire weather indices to netcdf files (one file for each year). This is to help you save the data and avoid losing the data if the kernel crashes.
    a. You can use the **save_fwi** parameter to change the default behaviour (False to avoid saving the fire weather indices to netcdf files and **True** to save the indices to netcdf files). You can then just read those files in the future for your fire weather indices analysis. You can choose not to save the file, it will still return the indices like in the screenshot. You just need to do everything from scratch again if your notebook kernel is killed.
    b. The **complevel** paramter can be used to make the netcdf files smaller. Make sure to **set complevel to 1** otherwise you will be using a lot of disk space and we might ask you to delete your files.
    c. The files will be saved to the same location where you have your jupyter notebook by default.

```
ffmc_data, dmc_data, dc_data, isi_data, bui_data, fwi_data = fwi_calc.FWI_combined_calc(
    ds_t2,
    ds_rh2,
    ds_ws10,
    ds_precip,
    ffmc0=85.0,
    dmc0=6.0,
    dc0=15.0,
    start_date="2013-01-01",
    end_date="2020-05-01",
    ws_unit='m/s',
    save_fwi = False,
    complevel=1
)
```

# **Update part 2 of 2:** Email sent on 22/04/2022

Subject line: GISC405 - Update part 2 of 2 on Assignment 03

Kia ora GISC'ers,

This is the update part 2 out of 2 in relation to the access of the precalculated 20-year FWI data needed for assignment 3 task 2b.

For task 2b you can find the FWI indices stored at "**/mnt/data/FWI_WRF**". Each year has a FWI file (FWI_2000.nc for 2000, FWI_2020.nc for 2020 etc.)

I have also attached an updated assignment 3 document where I have copied in the last two email updates for your convenience.