CoE Winter School Data

Accessing the data through VDI on NCI
Most of the data you will need can be found on raijin. Please check the `/g/data/ua8/WinterSchoolData/` directory to browse the data sets.
You should have received some temporary NCI training accounts to log in to raijin.
Go to the NCI website and follow the instruction to install TurboVNC and Strudel.
https://opus.nci.org.au/display/Help/VDI+User+Guide
The procedure is generally: install java runtime, install TurboVNC, install Strudel and configure Strudel.
If installing software on a Mac you need to allow unverified software to be installed.
System Preferences>Security & Privacy>General>Open anyway

You can browse the modules that are available by typing '`module avail`' into a terminal and load them with '`module load <modulename>`'
Some useful software:
nco, cdo, panoply, ferret, ncl, R, python packages: numpy, scipy, pandas, ipython, netcdf4-python, matplotlib, basemap are all available as modules.
MATLAB requires a 'login named user' licence activation before it can be used.

Climate indices
Southern Oscillation index (SOI):
The Southern Oscillation Index (SOI) is a time series used to characterize the large scale sea level pressure (SLP) patterns in the tropical Pacific. Monthly mean SLP at Tahiti [T] and Darwin [D] are used. The SOI is linked to large scale tropical SST variability and as such is a measure of the "SO" part of the ENSO phenomenon. Extended periods of negative SOI correspond with El Nino events, characterized by warm SSTs in the eastern and central tropical Pacific.
https://climatedataguide.ucar.edu/climate-data/southern-oscillation-indices-signal-noise-and-tahitidarwin-slp-soi

Niño n & ONI:
There are several indices used to monitor the tropical Pacific, all of which are based on SST anomalies averaged across a given region. Usually the anomalies are computed relative to a base period of 30 years. The Niño 3.4 index and the Oceanic Niño Index (ONI) are the most commonly used indices to define El Niño and La Niña events.
https://climatedataguide.ucar.edu/climate-data/nino-sst-indices-nino-12-3-34-4-oni-and-tni

Pacific Decadal Oscillation:
The Pacific Decadal Oscillation (PDO) is defined by the leading pattern (EOF) of sea surface temperature (SST) anomalies in the North Pacific basin (typically, polewards of 20°N). The SST anomalies are obtained by removing both the climatological annual cycle and the global-mean SST anomaly from the data at each gridpoint. Positive values of the PDO index correspond with negative SST anomalies in central and western North Pacific (extending eastwards from Japan), and positive SST anomalies in the eastern North Pacific (along the west coast of North America).
https://climatedataguide.ucar.edu/climate-data/pacific-decadal-oscillation-pdo-definition-and-indices

Dipole Mode Index:
Intensity of the Indian Ocean Dipole is represented by anomalous SST gradient between the western equatorial Indian Ocean (50E-70E and 10S-10N) and the south eastern equatorial Indian Ocean (90E-110E and 10S-0N). This gradient is named as Dipole Mode Index (DMI). When the DMI is positive then, the phenomenon is referred as the positive IOD and when it is negative, it is referred as negative IOD.
http://www.jamstec.go.jp/frcgc/research/d1/iod/HTML/Dipole%20Mode%20Index.html

Southern Annular Mode:
The station-based index of the Southern Annular Mode is based on the zonal pressure difference between the latitudes of 40S and 65S. As such, the SAM index measures a "see-saw" of atmospheric mass between the middle and high latitudes of the Southern Hemisphere. Positive values of the SAM index correspond with stronger-than-average westerlies over the mid-high latitudes (50S-70S) and weaker westerlies in the mid-latitudes (30S-50S). The SAM is the leading mode of variability in the SH atmospheric circulation on month-to-month and interannual timescales.
https://climatedataguide.ucar.edu/climate-data/marshall-southern-annular-mode-sam-index-station-based

Madden-Julian Oscillation:
The Madden-Julian Oscillation is an eastward propagating tropical region of enhanced convection, clods and rainfall. The indices used to measure it are based on an EOF analysis of outgoing longwave radiation, cloudiness or winds. It is usually expressed as two indices corresponding to the first two modes, plotted as a phase diagram to demonstrate its spatial progression.
https://www.esrl.noaa.gov/psd/mjo/mjoindex/
or
http://www.bom.gov.au/climate/mjo/

Observations

GHCNDEX indices:
GHCNDEX provides gridded, station-based indices of temperature- and precipitation-related climate extremes. It is intended for climate change detection and attribution studies, climate model evaluation, and operational monitoring of extreme climatic events. Twenty-six indices, including daily maximum and minimum temperatures, number of frost days, maximum 1-day precipitation, and growing season length are provided for 1951 to the present at monthly timesteps on a 2.5°x2.5 ° grid. Definitions of these core indices follow recommendations set forth by the CCl/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETTCCDI). Input data are from the Global Historical Climatology Network (GHCN) Daily station data. Updates are made operationally. The 26 indices are computed for each station, and then the indices are gridded using an angular distance weighting scheme. Compared with the precipitation-based indices, the temperature-based indices generally show larger spatial coherence and large-scale averages that are more robust to sampling gaps.
Raijin Directory:
`/g/data/ua8/WinterSchoolData/GHCNDEX_2.5x2.5deg`

HADEX2:
HadEX2 provides gridded, station-based indices of temperature- and precipitation- related climate extremes. It is intended for climate change detection and attribution studies and climate model evaluation. Twenty-nine indices, including daily maximum and minimum

temperatures, number of frost days, maximum 1-day precipitation, and growing season length are provided for 1901 to 2010 at monthly timesteps on a 2.5° latitude x 3.75 ° longitude grid. Definitions of these core indices follow recommendations set forth by the CCl/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETTCCDI). Input data are from approximately 7000 temperature and 11000 precipitation observing stations distributed worldwide. The indices are computed for each station, and then the indices are gridded using an angular distance weighting scheme. Compared with the precipitation-based indices, the temperature-based indices generally show larger spatial coherence and large-scale averages that are more robust to sampling gaps.
Raijin Directory:
`/g/data/rr7/Extreme_Climdex`

AWAP:
The aim of the Australian Water Availability Project (AWAP) is to monitor the state and trend of the terrestrial water balance of the Australian continent, using model-data fusion methods to combine both measurements and modelling. The project determines the past history and present state of soil moisture and all water fluxes contributing to changes in soil moisture (rainfall, transpiration, soil evaporation, surface runoff and deep drainage), across the entire Australian continent at a spatial resolution of 5 km. Using the same basic framework, the project provides soil moistures and water fluxes from 1900.
Raijin Directory:
Climdex, SPI/SPEI, Heatwaves:
`/g/data/ua8/WinterSchoolData/AWAP`
Relative soil moisture:
`/g/data/ua8/WinterSchoolData/AWAP/WRel1`

Reanalysis

ERA Interim:
ERA-Interim is a global atmospheric reanalysis from 1979, continuously updated in real time. The data assimilation system used to produce ERA-Interim is based on a 2006 release of the IFS (Cy31r2). The system includes a 4-dimensional variational analysis (4D-Var) with a 12-hour analysis window. The spatial resolution of the data set is approximately 80 km (T255 spectral) on 60 vertical levels from the surface up to 0.1 hPa.
Raijin directory:
`/g/data/ua8/WinterSchoolData/ERA-Int/indices_2017`

ERA40:
ERA 40 is a second generation reanalysis. It is the first reanalysis to directly assimilate satellite radiance data (TOVS, SSM/I, ERS and ATOVS). Cloud Motion Winds are also used. The result is better circulation over the tropics and southern hemisphere. However, unless comparing to previous ERA-40 based results, it is recommended that the 3rd generation reanalyses, ERA-Interim or MERRA, be used for new research.
Raijin directory:
`/g/data/ua8/WinterSchoolData/ftp.cccma.ec.gc.ca/data/climdex/ERA40`

NCEP2:
The NCEP/DOE AMIP-II Reanalysis (Reanalysis-2) is based on the widely used NCEP/NCAR Reanalysis. The goal of Reanalysis-2 is to improve upon the NCEP/NCAR Reanalysis by fixing the errors and by updating the parameterizations of the physical processes. While we think that Reanalysis-2 is better than NCEP 1; we know that it should not be considered the "next generation" of reanalysis. Improvements such as higher

horizontal and vertical resolution, direct assimilation of radiances, (proper) use of SSM/I data, assimilation of rainfall data, need to be incorporated.
Raijin directory:
`/g/data/ua8/WinterSchoolData/ftp.cccma.ec.gc.ca/data/climdex/NCEP2`

NCEP:
The NCEP/NCAR Reanalysis 1 project is an analysis/forecast system to perform data assimilation using past data from 1948 to the present.
Raijin directory:
`/g/data/ua8/WinterSchoolData/ftp.cccma.ec.gc.ca/data/climdex/NCEP`

Model data

CMIP5:
The CMIP is a standard experimental framework for studying the output of coupled atmosphere-ocean general circulation models. This facilitates assessment of the strengthsand weaknesses of climate models which can enhance and focus the development of future models. For example, if the models indicate a wide range of values either regionally or globally, then scientists may be able to determine the cause(s) of this uncertainty. CMIP5 (formally: Coupled Model Intercomparison Project Phase 5) is the most current and extensive of the CMIPs.
Raijin directory:
`/g/data/ua8/WinterSchoolData/Climdex/ftp.cccma.ec.gc.ca/data/climdex/CMIP5`

C20C:
The Detection and Attribution project is designed to produce a large modelling data set optimised for addressing questions concerning:
- the characterisation of historical trends and variability in the properties of damaging weather events, including uncertainties such as those encapsulated through differences across models;
- the estimation of the degree to which the occurrence of historical and current damaging extreme weather is attributable to anthropogenic emissions, including understanding of the underlying uncertainties.

The ETTCDI indices are only available for 1 model and for 2 experiments: the CAM5.1 model, run in the All-Hist and NonGHG-Hist experiments. The All-Hist experiment is an estimate of the boundary conditions of the climate that actually occurred, including GHG forcing. The NonGHG-Hist experiment estimates the climate without the influence of GHGs.
Raijin directory:
`/g/data/ua8/WinterSchoolData/C20C/climdex`