Analysis Methods in Atmospheric and Oceanic Science

AOSC 652

- Today: Multiple Linear Regression
- Wed: Description of Projects; Python & IDL breakouts

Week 10, Day 2

2 Nov 2016

AOSC 652: Analysis Methods in AOSC

Student projects:

- 20% of the final grade: you will receive a numerical score for the project and final grade will be found via:

  Final Grade = (0.1)×(Attendance + Participation) + (0.7)×(Homework) + (0.2)×(Final Project)

- 28, 30 Nov , 2, 5, and 7 Dec set aside for "in class" work on your project
- Thurs 8 & Fri 9 Dec: *students present their project (10 minute talks)*, prepared using either Powerpoint, Open Office, etc and converted to PDF prior to the start of class
- Each student must turn in a *brief* written description of the project as well as all *code* used to complete the project
- Good to begin thinking about your project: application of techniques learned in class to a ***scientific problem of your interest***
- I am available to discuss potential projects at any time

Data Access :
Top Ten Websites (as of 2 Nov 2016 … subject to change)

- Global temperature, modern era
  - East Anglia CRU: http://www.cru.uea.ac.uk
  - NASA GISS: http://data.giss.nasa.gov/gistemp
  - NOAA NCDC: http://www.ncdc.noaa.gov/monitoring-references/faq
- Paleoclimate
  - NOAA NCDC: http://www.ncdc.noaa.gov/data-access/paleoclimatology-data
- Aerosols, air quality, ocean color
  - NASA GIOVANNI: http://disc.sci.gsfc.nasa.gov/giovanni
- Trace gases
  - CO_2 – CDIAC: http://cdiac.ornl.gov
  - Others – NOAA ESRL: http://www.esrl.noaa.gov/gmd/dv/data
- Weather
  - NOAA CPC: http://www.cpc.noaa.gov
  - NRL Monterey: http://www.nrlmry.navy.mil/sat_products.html
- Arctic and Antarctic Snow and Ice
  - National Snow and Ice Data Center: http://nsidc.org

Data Access :

Top Ten Websites (as of 2 Nov 2016 … subject to change)

- Global temperature, modern era
  - East Anglia CRU: http://www.cru.uea.ac.uk
  - NASA GISS: http://data.giss.nasa.gov/gistemp
  - NOAA NCDC: http://www.ncdc.noaa.gov/monitoring-references/faq
- Paleoclimate
  - NOAA NCDC: http://www.ncdc.noaa.gov/data-access/paleoclimatology-data
- Aerosols, air quality, ocean color
  - NASA GIOVANNI: http://disc.sci.gsfc.nasa.gov/giovanni
- Trace gases
  - CO_2 – CDIAC: http://cdiac.ornl.gov
  - Others – NOAA ESRL: http://www.esrl.noaa.gov/gmd/dv/data
- Weather
  - NOAA CPC: http://www.cpc.noaa.gov
  - NRL Monterey: http://www.nrlmry.navy.mil/sat_products.html
- Arctic and Antarctic Snow and Ice
  - National Snow and Ice Data Center: http://nsidc.org

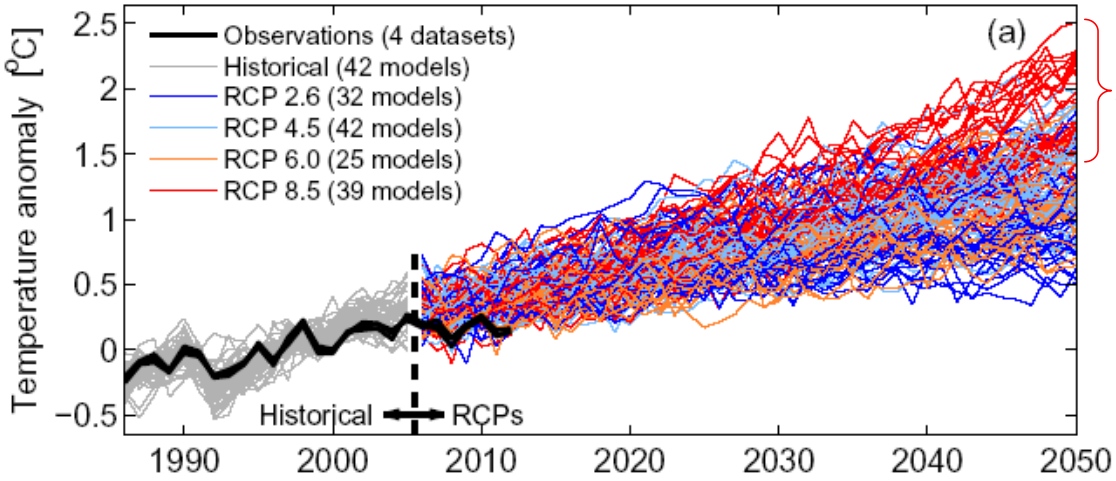
- **Can freely access data on these websites *and* analyze these measurements using tools developed in class !**
- **Free access to plethora of data: exciting, relatively new development !!**
- **Data rich world: only limit to science we conduct is our imagination !!!**

Aside: Another website worth knowing about

CMIP5: Coupled Model Intercomparison Project Phase 5
Climate model calculations used AR5 (IPCC, 2014)
http://cmip-pcmdi.llnl.gov/cmip5

AR4: Fourth Assessment Report; IPCC 2007 AR5: Fifth Assessment Report; IPCC (2014)

- Projected climate change based on RCPs is similar to AR4 in both patterns and magnitude, after accounting for scenario differences. The overall spread of projections for the high RCPs is narrower than for comparable scenarios used in AR4 because in contrast to the SRES emission scenarios used in AR4, the RCPs used in AR5 are defined as concentration pathways and thus carbon cycle uncertainties affecting atmospheric CO_2 concentrations are not considered in the concentration driven CMIP5 simulations. Projections of sea level rise are larger than in the AR4, primarily because of improved modelling of land-ice contributions.{11.3, 12.3, 12.4, 13.4, 13.5}



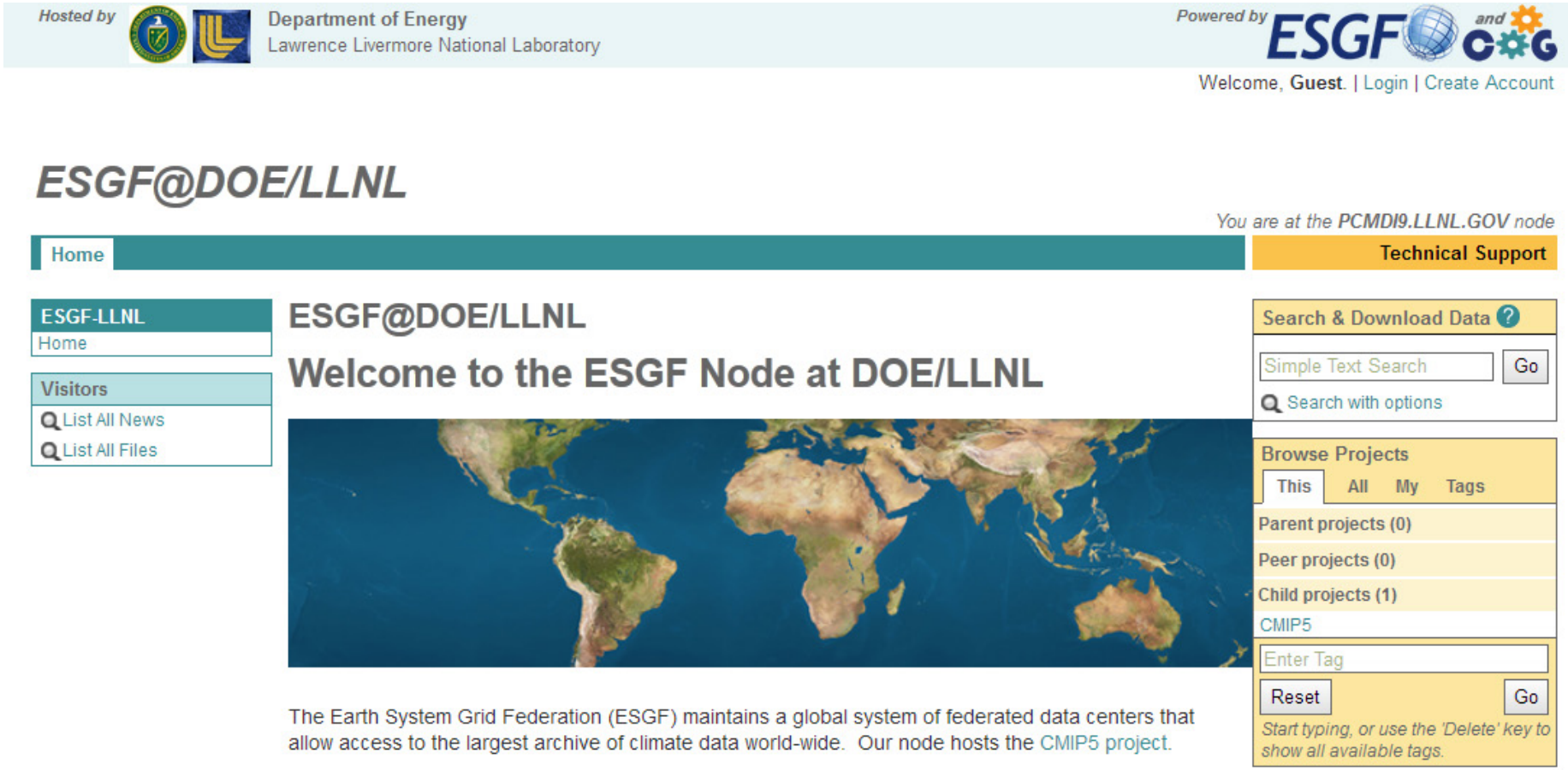
Many GCMs project 2°C warming by 2050 if GHGs follow RCP 8.5

Fig 11.25, IPCC 2014

Aside: Another website worth knowing about

CMIP5 output archived at Lawrence Livermore National Laboratory (LLNL)

Program for Climate Model Diagnosis and Intercomparison (PCMDI) website: https://pcmdi9.llnl.gov/projects/esgf-llnl

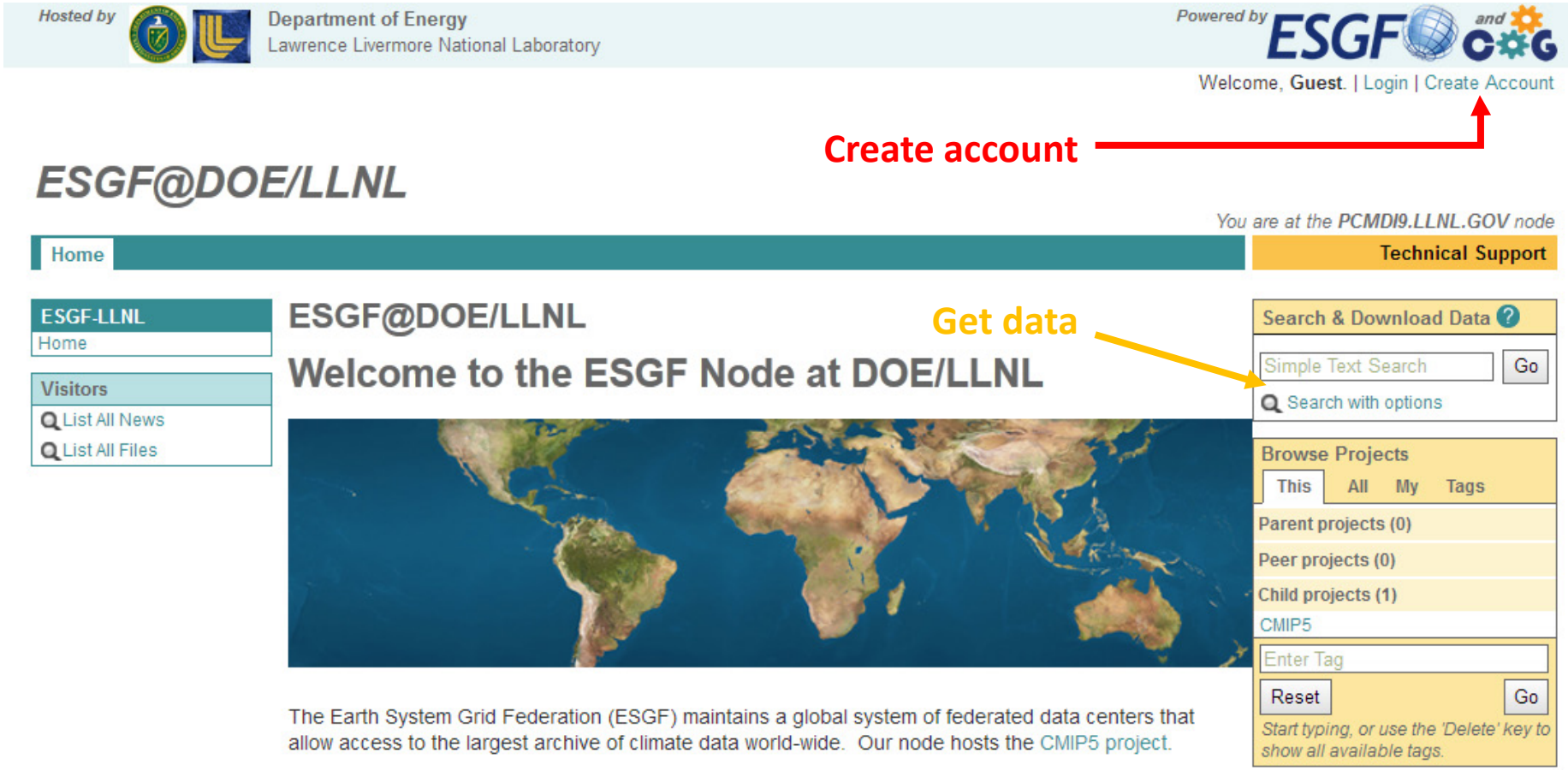


Aside: Another website worth knowing about

CMIP5 output archived at Lawrence Livermore National Laboratory (LLNL)

Program for Climate Model Diagnosis and Intercomparison (PCMDI)

website: https://pcmdi9.llnl.gov/projects/esgf-llnl



Aside: Another website worth knowing about

CMIP5 output archived at Lawrence Livermore National Laboratory (LLNL)
Program for Climate Model Diagnosis and Intercomparison (PCMDI)
website: https://pcmdi9.llnl.gov/projects/esgf-llnl

A small selection of available variables

Variable long name	Variable	Dimensions
Near-Surface Air Temperature	tas	lat, long, time
Precipitation	pr	lat, long, time
Mole fraction of CH_4	ch4	lat, long, pres, time
Sea water salinity	so	lat, long, level, time
Global avg sea level rise	zosga	time

- **Can freely access CMIP5 model output *and* analyze using tools developed in class !**
- **Free access to climate model output is another exciting new development !!**
- **Access to climate model output really means only limit to science we conduct is our imagination !!!**

Assigment #10 Is Now Posted

Due Wed, 9 Nov

Multiple Linear Regression of Global Mean Surface Temperature

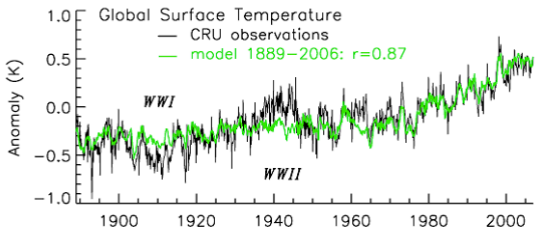
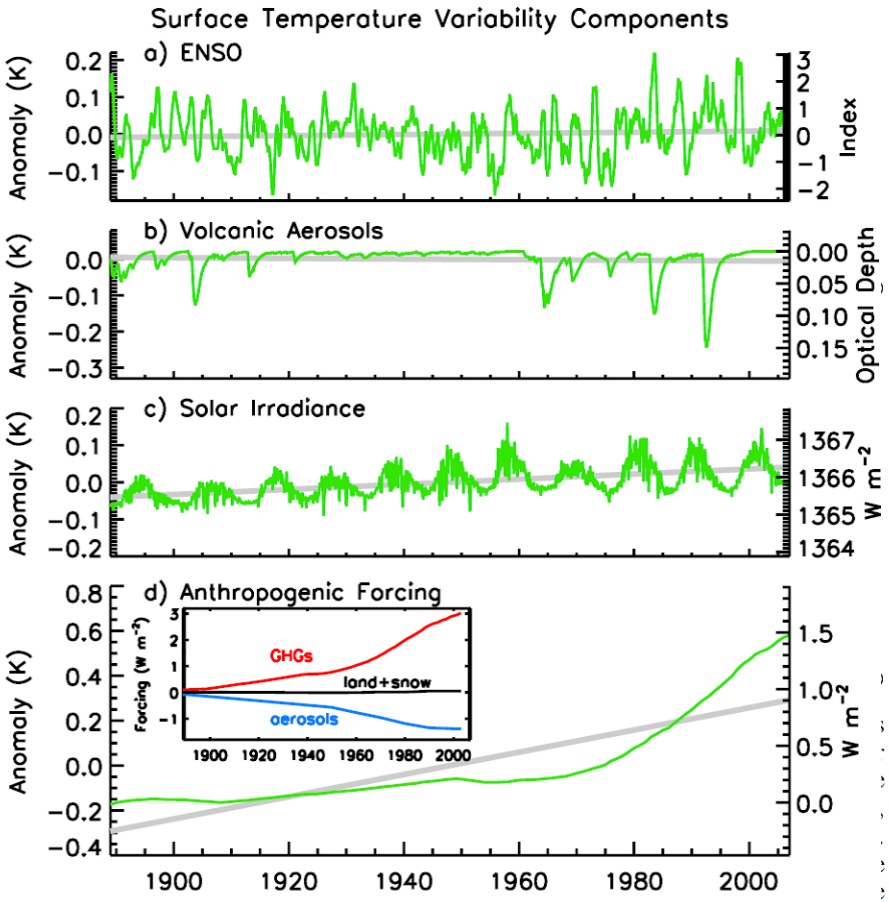


Figure 1. Compared with the CRU monthly mean global temperature time series (hadcrut3vcgl) is an empirical model obtained from multiple regression for the period from 1889 to 2006, inclusive. The value of r is the correlation coefficient for the global temperature observations and empirical model. Largest differences occur at the times of the two World Wars when observations were sparse.

Lean and Rind, GRL, 2008



shown as dashed lines. The vertical black dashed lines in Figure 1a denote 2014 (A) and 2019 (B), at which times corresponding spatial temperature patterns are shown in Figures 3 and 4.

Assigment #10 Is Now Posted

Due Wed, 9 Nov

Multiple Linear Regression of Global Mean Surface Temperature

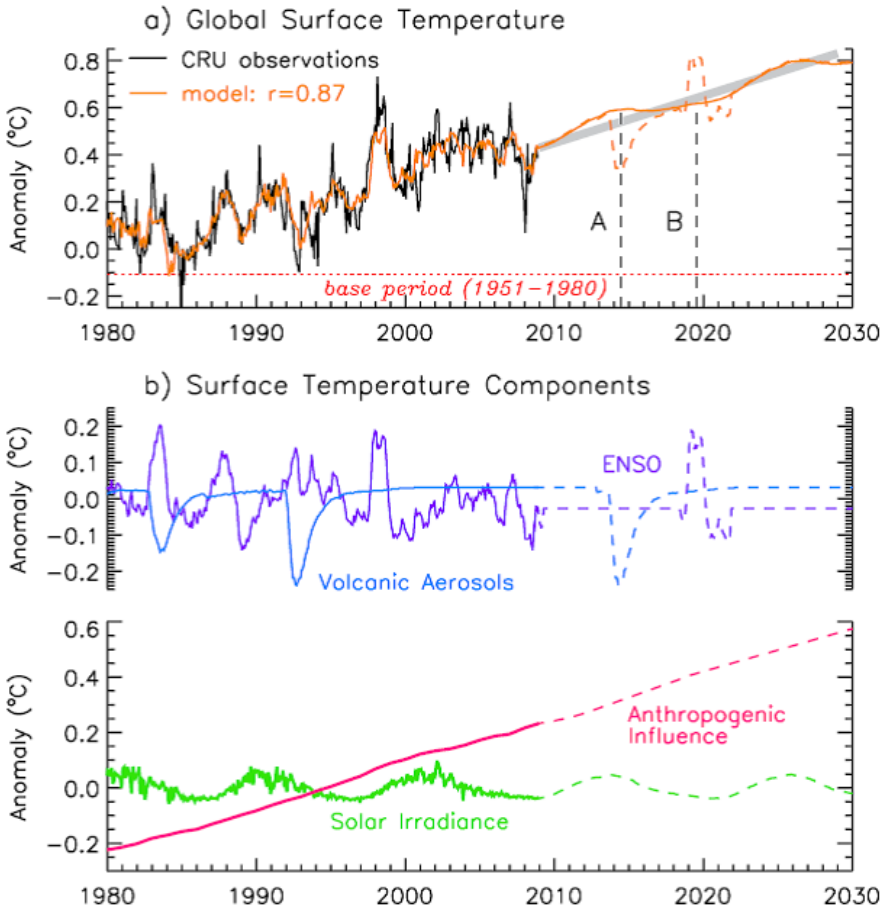


Figure 1. (a) Observed monthly mean global temperatures (black) and an empirical model (orange) that combines four different influences. (b) Individual contributions of these influences, namely ENSO (purple), volcanic aerosols (blue), solar irradiance (green) and anthropogenic effects (red). Together the four influences explain 76% (r^2) of the variance in the global temperature observations. Future scenarios are shown as dashed lines. The vertical black dashed lines in Figure 1a denote 2014 (A) and 2019 (B), at which times corresponding spatial temperature patterns are shown in Figures 3 and 4.

Lean and Rind, GRL, 2009