

Geography 149A: (Changing) Climates of the World, Prof. Norm Miller
Tuesdays and Thursdays, 11:00 – 12:30, McCone 145, 3 Credits
Two Exams (20% each, 75% is from Homework), six homework Sets (10% each),
Text: Atmosphere, Weather & Climate by Roger Barry and Richard Chorley
Office Hours: Tuesday and Thursday 10:30-11:00, 12:30-2:00 and by Appointment
591 McCone Hall; NLMiller@Berkeley.EDU [Test, Papers and Lecture Notes on BSPACE]

We'll begin with a description of atmospheric dynamics and physics at the large scale, followed by region-specific climate systems. We'll look at regional responses to climate change and the inter-relationships between the role of climate variations and impacts. Each week's reading will be integrated into class participation. Class will usually begin with a weekly weather in review that focuses on a specific geographic region. There will be six homework sets that are mostly lecture review and two exams that are 75% based on the homework sets. Guest Lectures will be on extreme weather. *There is ~2 hours outside effort for each lecture hour.* This course is geared toward students with minimal backgrounds in math and physics. *All material is posted on bspace. Syllabus may slightly change some during the course of the semester.*

29 Aug: Introductions, Course Outline, Goals and Expectations

Climate Change: Historic Heat waves, Fires, Drought, Floods
A very brief history of Meteorology
Earth-Sun Relationship

Read: Pages 1-8

3 Sept: Atmospheric Composition

Atmospheric composition, mass, vertical structure
Introduction to High and Low Pressure, Rate Change (2)
Montreal Ozone Protocol & Lessons Learned

Read: Pages 9-28
HW1 (handout)

5 Sept: Conservation of Energy

Earth heat budget, short-wave and long-wave radiation,
Arrhenius' GHG calculation, Keeling's CO₂ observations
Weather Charts and Symbols

Read: Pages 32-60

10 Sept: Global Energy Budget & Climate Assessment

Geographic Energy Distribution
Brief summary of the IPCC Fifth Assessment Report
California Extreme Heat and Energy Demand

IPCC Report1.5
(17 pages, figures)
Santer, Human Influence
Miller, CA Heat and Energy

12, 17 Sept: Atmospheric Moisture and Conservation of Water

The Water Cycle and the Planetary distribution of water.
Water States – Solid, Liquid, Vapor; Polar regions
Geographic Distribution of Precipitation

Read: 64-85
HW1 (10 Sep due)
HW 2 (handout)

19, 24 Sept: Atmospheric Stability and Lapse Rates

Stable, Unstable and Neutral Air Mass, Bouyancy
Climate Projected Convectively Available Potential Energy (CAPE)

Read: 89-102
Diffenbach, CAPE Paper
Lapse Rate Handout

26 Sept: Precipitation Types and Formation

Thunder and Lightning

Read: 103-109
Pierce, Miller et al.

Field Experiments Triggering Lightning
Cloud Seeding and the Bay of Pigs
California Temperature and Precipitation Change

HW 2 (26 Sep due)

3, 8, 10, Oct: Conservation of Mass and Momentum
Pressure Gradient Force, Coriolis Force, Friction Force
Divergence and Convergence (Basics)

Read: 112-125
HW 3 (handout)
Study Guide Part I

15 Oct: Exam I *****

HW 3 (15 Oct due)

17, 22 Oct: Atmospheric Circulation
More on Momentum and Atmospheric Circulation
Upper Atmosphere Jets, Jet slowdown due to Global Warming
ENSO-Walker, monsoonal flow patterns and precipitation.
Sea Breeze

Read: 127-155
HW 4 (handout)

24 Oct: Southeast Asia and the Third Pole
Himalayas and early snowpack melt implications on streamflow.
Asian monsoons, water and energy budgets, groundwater.

Read: 276-298
Missimo & Bollasina
Jin & Miller

31 Oct: Africa
Wind, Rain, Drought and Famine
Harmattan Winds, Long and Short Equatorial Rains
Congo convective systems, lightning, introductory cloud physics
Lake Victoria hydroclimate and impacts. Somalia Famine, Syria

Read: 302-308
Somalia Famine
Kelly et al., Syria Conflict
HW 4 (31 Oct due)
HW 5 (handout)

5 Nov: Palaeoenvironmental, epigraphic and archaeological evidence of total warfare among the Classic Maya.

Reading: Wahl et al. 2019

Guest Lecture: Prof. David Wahl

<https://www.nationalgeographic.com/culture/2019/08/ancient-maya-practiced-total-war-before-drought/>

12 Nov: Equatorial Trade wind and precipitation in Brazil
Drought, Amazon Basin role as the "Lungs of the Planet"
UN REDD (Reduced Emissions by Decreased Deforestation) Agreement

Read: 299-302

14, 19 Nov: Extreme Weather and Hurricanes
Present and projected tropical cyclones and hurricanes.
diagnosing component of the hydrologic cycle.

Read: 262-275
HW 5 (14 Nov due)
HW6 (handout)

19 Nov: Guest Lecture: Dr. Michael Wehner.

Read: TBD

21 Nov: Antarctic Climate Trends
Antarctic Weather, Global Glacier Decline
Short movie from my trip to the Antarctic

3 Dec Review

STUDY GUIDE Part 2

5 Dec: Exam 2 *****

HW 6 (5 Dec due)