AOSC 658N: North American Hydroclimate:
Seasonal-to-Interannual Variability

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Time & Room: AOSC Conference Room (ATL 3425); 9:30-10:45pm (M,W)

Please send Alfredo and me an email with your contact information; include "AOSC 658N" in the title line. Mention your current research interests, name of your advisor, degree sought, topics that you would like to see covered, and list the other courses you are taking this semester. Also let us know if you are auditing the course. Thanks.

Course Format

- Reading assignment & presentation 30%
- Individual Projects 70%

Individual projects

- Assigned by mid-September
- Goal is to produce a small publication quality analysis, culminating in paper
    - *Introduction*: Problem statement, motivation, literature search and contextual discussion of why the proposed analysis strategy is novel and potentially insightful. (15%; no figures; order 5 pages; double spaced; 12 font; due **late September**; looking for a nice, brief synthesis of what is done and not done, and how your project will advance things
    - *Data set and analysis method descriptions* due in **mid October** (10%)
    - Mid-stream presentation (20 minutes) in **mid November** (15%; peer)
    - Full project report with summary and discussion sections due in **mid December;** oral presentations in the Finals week (25%)
- Project logistics: Fortran and Grads; Computer accounts; Datasets' access

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Background: Hydroclimate refers to the weekly (and longer term) averaged distributions of near-surface meteorological and hydrologic fields such as precipitation, surface (air) temperature, streamflow, surface radiative fluxes, sensible and latent heat fluxes, soil temperature, evaporation, soil moisture, surface and subsurface runoff, etc. Many of the fields are influential in shaping both the water and energy cycles; the listing order reflects the increasing uncertainty with which they are known.

Hydroclimate analysis is distinct from hydrologic analysis, which typically focuses on the sub-degree scale basins (e.g., USDA watersheds, Mesonets). The important and interesting connections with the neighboring and remote regions, via atmospheric circulation and moisture fluxes, are highlighted in hydroclimate analyses. The course will thus focus on the structure and mechanisms of regional-to-subcontinental scale hydroclimate variability over North America. Extreme events – droughts and pluvials/floods – in the 20th century record will be discussed. Western Water issues will be covered.

Broad Outline:

- Global Water Cycling
- Data sets: Observations .vs. observationally constrained products
- Annual-mean structure and seasonal/intra-seasonal variability of hydroclimate fields
- Precipitation processes: Convective and Stratiform rainfall; resulting heating profiles
- Named circulation features: North American monsoon, Pacific & Bermuda Highs,
- Great Plains Low Level jet, Gulf of California Low Level jet, etc.
- Moisture transports; stationary & transient fluxes; storm tracks; back trajectories
- Atmospheric water balance: Moisture flux convergence .vs. Evapotranspiration; Storage
- Surface water balance: Evapotranspiration .vs. surface/subsurface runoff
- Surface energy balance: Net radiative influence of clouds; Bowen Ratio
- Interannual hydroclimate variability: Pacific (ENSO, PDO, NPO) and Atlantic (AMO, LF-NAO, TAV) influences in the cold and warm seasons; Mechanisms
- Intraseasonal hydroclimate variability: Influence of the Madden-Julian Oscillation
- Drought and floods in the 20th century; Palmer Drought index; Causes/impact of the Dust bowl drought (1930s)
- Hydroclimate variability in Global Change: Signals in IPCC climate change simulations
- Western Water issues: Solid phase recharge and discharge
- Topics of students' interest