Bioclimatic Evaluation of CMIP Historical Climate Simulations

Objectives

- Use a Köppen vegetation classification scheme—based on observed characteristics of the annual cycles of continental temperature (T) and precipitation (P)—to evaluate the performance of each CMIP3 or CMIP5 model in simulating biologically important features of regional T & P.
- Develop bioclimatic metrics to objectively evaluate model performance.
- Compare collective performance of CMIP3 and CMIP5 models.

Approach/Results

- Derive 14 generic vegetation types v by applying Köppen criteria to both observational and modeled 1980-1999 annual-cycle climatologies of T & P.
- Define bioclimatic metrics of model performance in reproducing:
  1) observed vegetation types v at each grid box (“hits” metric h(v) ),
  2) global areas of observed vegetation types (“area” metric a (v) ).

Impact

- The collective bioclimatic performance of the CMIP5 models is superior to that of the CMIP3 models.
- This mostly results from better simulation of T & P in sub-polar and middle latitudes (vegetation types D and C), but less so in tropical and subtropical regions (vegetation types A and B).
- Thus, considerable improvement in simulating region-al T & P is still needed, as a prerequisite for realistic representation of dynamical vegetation in Earth Systems Models (ESMs).