K. Hayhoe *et al.*: Past and future changes ...

The authors seek to assess the relative importance of global and region-specific climate-change factors in the warming Northeastern US by comparing 20th c. observational data to simulations from 9 standard models (AOGMs). The models are found to correctly retrodict the **signs** of the rates of change of (most) major climatic and hydrological indicators, but to underestimate their **magnitudes**, often by quite large factors. This suggests that **regional conditions are reinforcing global trends**. The models are more successful in retrodicting the climate of the late 20th c. than that of the century as a whole, so **the importance of global-scale factors seems to be increasing.**

The models are also used to predict climate change in the Northeast during the 21st c. under various greenhouse-gas emission scenarios. Because of the importance of regional factors, these predictions indicate the direction but probably not the magnitude of the actual trends. Effects are generally larger in the higher-emission scenarios.

Temperatures will continue to increase, almost as much in summer as in winter (contrary to 20th c. trend). Sea-surface temperatures will rise, and their north-south gradient decrease. Summer **precipitation** will be unchanged, but winter precipitation will increase. (However, this prediction has high associated uncertainty.) Snow will be less common in New England and New York; in more southerly areas, with less snow as it is, the increase in precipitation may cancel that in temperature so far as snow is concerned. **Evaporation** will increase in spring and summer, raising the frequency of minor (but not of long-term) droughts. Extreme **stream-flow** events (both low and high) will be more common, peak flow will occur earlier, and the low-flow season will end later. The **onset of spring**, as given both by hydrological indicators such as the disappearance of ice on ponds and by biological indicators such as first bloom, will be earlier, and the **growing season of plants** will be longer. Adverse **biological, economic, and agricultural consequences** of all these trends (even the longer growing season) are emphasised.

COMMENT:

I was struck by the absence of zoölogical indicators – none in the simulations, and only 3 studies mentioned, all involving cold-blooded vertebrates. I would imagine that bird-watchers and agricultural entomologists would have some interesting and geographically extensive data.

I also wondered whether using arbitrary political boundaries to define the region, rather than biogeographical province-boundaries, might not introduce unwanted edge-effects into the study.