Rapid climate change is likely to impose strong selection pressures on traits important for fitness, and therefore, microevolution in response to climate-mediated selection is potentially an important mechanism mitigating negative consequences of climate change. We reviewed the empirical evidence for recent microevolutionary responses to climate change in longitudinal studies emphasizing the following three perspectives emerging from the published data. First, although signatures of climate change are clearly visible in many ecological processes, similar examples of microevolutionary responses in literature are in fact very rare. Second, the quality of evidence for microevolutionary responses to climate change is far from satisfactory as the documented responses are often - if not typically - based on non-genetic data. We reinforce the view that it is as important to make the distinction between genetic (evolutionary) and phenotypic (includes a non-genetic, plastic component) responses clear, as it is to understand the relative roles of plasticity and genetics in adaptation to climate change. Third, in order to illustrate the difficulties and their potential ubiquity in detection of microevolution in response to natural selection, we reviewed the quantitative genetic studies on microevolutionary responses to natural selection in the context of long-term studies of vertebrates. The available evidence points to the over-all conclusion that many responses perceived as adaptations to changing environmental conditions could be environmentally induced plastic responses rather than microevolutionary adaptations. Hence, clear-cut evidence indicating a significant role for evolutionary adaptation to ongoing climate warming is conspicuously scarce.