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Regional impacts poorly constrained by climate sensitivity

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Climate risk assessments must account for a wide range of possible future changes, so scientists often use many climate models in order to fully explore the range of potential changes in regional climates and their impacts. Many of the latest-generation global climate models have high values of effective climate sensitivity (EffCS), which are unlikely according to independent estimates of EffCS. It has been argued that these “hot” models are unrealistic and should therefore be excluded from analyses of climate change impacts. However, whether this would really improve regional impact assessments, or actually make them worse, is unclear. Here we show that there is no universal relationship between EffCS and projected changes in important climatic impact drivers. Analysing three different impacts - heavy rainfall, meteorological drought, and fire weather in important world regions, we find a significant correlation with EffCS only in some regions and for some metrics. Moreover, even in those cases, internal variability has a larger effect on projected changes than has EffCS. This means that impact studies should not select climate models based solely on their EffCS, which does not help constrain projections and may potentially neglect realistic impacts in models deemed “unrealistic” on the basis of their sensitivity. We recommend that model selection or filtering must be based on a more specific evaluation of models vis-à-vis the impact of interest.