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LETTER

Scenarios for the risk of hunger in the twenty first century using shared socioeconomic pathways

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Abstract

Shared socioeconomic pathways (SSPs) are being developed internationally for cross-sectoral assessments of climate change impacts, adaptation, and mitigation. These are five scenarios that include both qualitative and quantitative information for mitigation and adaptation challenges to climate change. In this study, we quantified scenarios for the risk of hunger in the 21st century using SSPs, and clarified elements that influence future hunger risk. There were two primary findings: (1) risk of hunger in the 21st-century greatly differed among five SSPs; and (2) population growth, improvement in the equality of food distribution within a country, and increases in food consumption mainly driven by income growth greatly influence future hunger risk and are important elements in its long-term assessment.

1. Introduction

Models that integrate changing climate conditions with agricultural and economic models can assess the likely impact of climate change on future food supplies. However, although these studies are useful, they provide limited insight into understanding the future of food security, given that social welfare, distribution, political and institutional effectiveness, among other factors, come into play (Barrett 2010, Godfray *et al* 2010). Nelson *et al* (2014) found that (1) population and gross domestic product (GDP) were significant in determining the impact of climate change on food consumption and child malnutrition, and (2) that climate change would increase the number of malnourished children regardless of population and GDP assumptions, with the largest impact in low-income countries. Schmidhuber and Tubiello (2007) found that the impact of climate change strongly depended on population and GDP, and would be particularly serious in sub-Saharan Africa. However, these studies were based on the Special Report on Emissions Scenarios (SRES) (Nakicenovic *et al* 2000) and past climate data (Meehl *et al* 2007), so impact assessments must be updated.

Hasegawa *et al* (2014) analyzed the effects of autonomous adaptations in crop production to reduce risk of hunger using the latest climate data (Taylor *et al* 2011) with a new scenario framework (introduced below). They found that these adaptations would reduce risk of hunger regardless of population, GDP, and climate conditions. While the above studies did not consider socioeconomic factors, van Ruijven *et al* (2013) showed that socioeconomic indicators should be considered, and expected that explicit treatment of these additional indicators would accelerate climate research. For example, Kii *et al* (2013) used inequality of domestic food distribution as a socioeconomic indicator when assessing food consumption. They found that average food consumption would be higher with lower inequality in food distribution.

A new, interdisciplinary scenario framework has recently been designed for climate change research (O'Neill *et al* 2014, van Vuuren *et al* 2014). It consists of two key elements: the magnitude and extent of climate change and climate policy (as characterized by the representative concentration pathways (RCPs)); and a set of alternative trajectories of future global development (described by shared socioeconomic pathways (SSPs)). The framework enables us to separate these elements to study the effects of climate