



FACCE-MACSUR

## Report D-C4.1.3 Estimates of crop responses to climate change with quantified ranges of uncertainty

D. Cammarano<sup>1</sup>, M. Rivington<sup>[1]</sup>, K.B. Matthews<sup>1</sup>, D.G. Miller<sup>1</sup>, G. Bellocchi<sup>2</sup>

<sup>1</sup> The James Hutton Institute, Craigiebuckler, Aberdeen, AB15 8QH, UK.

<sup>2</sup> Grassland Ecosystem Research Unit, INRA, FRA

\*davide.cammarano@hutton.ac.uk

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 Cammarano, D., Rivington, M., Matthews, K.B., Miller, D.G., Bellocchi, G. (2015):  
**Implications of climate model biases and downscaling on crop models' simulated climate change impacts. European Journal of Agronomy. (in review)**

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**Abstract/Executive summary**

In estimating responses of crops to future climate realisations, it is necessary to understand and differentiate between the sources of uncertainty in climate models and how these lead to errors in estimating the past climate and biases in future projections, and how these affect crop model estimates. This paper investigates the complexities in using climate model projections representing different spatial scales within climate change impacts and adaptation studies. This is illustrated by simulating spring barley with three crop models run using site-specific observed, original (50x50 km) and bias corrected downscaled (site-specific) hindcast (1960-1990) weather data from the HadRM3 Regional Climate Model (RCM). Original and bias corrected downscaled weather data were evaluated against the observed data. The comparisons made between the crop models were in the light of lessons learned from this data evaluation. Though the bias correction downscaling method improved the match between observed and hindcast data, this did not always translate into better matching of crop models estimates. At four sites the original HadRM3 data produced near identical mean simulated yield values as from the observed weather data, despite differences in the weather data, giving a situation of ‘right results for the wrong reasons’. This was likely due to compensating errors in the input weather data and non-linearity in crop models processes, making interpretation of results problematic. Overall, bias correction downscaling improved the quality of simulated outputs. Understanding how biases in climate data manifest themselves in crop models gives greater confidence in the utility of the estimates produced using downscaled future climate projections. The results indicate implications on how future projections of climate change impacts are interpreted. Fundamentally, considerable care is required in determining the impact weather data sources have in climate change impact and adaptation studies, whether from individual models or ensembles.

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