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Contribution to CR Special 22 'Agriculture in a changing climate'

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Preface

Ana M. Tarquis[1], Anne Gobin[2,*], Mikhail A. Semenov[3]

[1]CEIGRAM E.T.S.I. Agrónomos, Universidad Politécnica de Madrid, Spain
[2]Environmental Modelling Unit, Flemish Institute for Technological Research (VITO), Boeretang 200, 2400 Mol, Belgium
[3]Centre for Mathematical and Computational Biology, Rothamsted Research, Harpenden, Herts AL5 2JQ, UK

ABSTRACT: Agriculture is an economic sector that is particularly sensitive to weather. Recent meteorological events have reduced crop production in different parts of the world. Weather extremes resulting from climate change are projected to increase, making crop production more vulnerable and ultimately threatening food security. A continuing effort to develop scientific knowledge in climate and agriculture will help to manage risks and opportunities in these fields. This special issue of Climate Research represents a collection of studies that contribute to the general understanding of weather-related risks and climate impacts on agricultural systems.

KEY WORDS: Agriculture · Climate change · Extreme events

Summer 2010 was the hottest summer in Russia since records began, with Moscow temperatures reaching 39°C for the first time on 29 July. This abnormal heat wave triggered hundreds of wildfires in forests and peat bogs, covering Moscow with acrid smog for weeks. The summer of 2010 has also seen the worst drought in Russia in 40 yr, reducing the wheat harvest by more than one-third. At the same time, devastating floods have submerged 7 million ha of the most fertile land in Pakistan, destroying the crops. A record breaking rainfall of 274 mm fell in Peshawar over 24 h. Nearly 20 million people have been significantly affected by this flooding.

Meteorologists have proposed a possible link between the wildfires across western Russia and the catastrophic flooding in northern Pakistan. The connection between these extreme events could be explained by the unusual shape of the polar jet stream, a large-scale atmospheric circulation pattern that remained static for more than a month moving hot air north over Russia and stopping low pressure systems that would have produced rain in the region. Instead, rain was carried south into the mountains of northern Pakistan. The usual summer monsoon in Pakistan, combined with this additional rain, caused intense flooding.

In its 4th Assessment Report, the Intergovernmental Panel on Climate Change found that rising global temperatures are likely to increase the frequency and magnitude of extreme weather events, including prolonged heat waves and more intense rainfall (although no specific weather event can be linked directly to global warming). There is a need for scientists around the world to develop mathematical models and statistical techniques for better prediction of extreme events such as Russia's heat wave and wildfires and the record floods devastating Pakistan.

Agriculture is an economic activity that is highly dependent upon weather and climate producing the food necessary to sustain human life. Despite technological advances — improved varieties, genetically modified organisms, irrigation systems — weather is still a key factor in agricultural productivity. Changes in climate variability and weather extremes — such as droughts, floods and severe storms — which are expected to result from climate change, will make agriculture more vulnerable and will threaten food security, affecting the livelihoods of billions of people.

As climate change is projected to have significant impacts on agricultural production and food security, global agricultural organisations such as the Food and Agriculture Organization of the United Nations (FAO) have formulated adaptation strategies to curb the costs of non-action. At the same time, agriculture is held responsible for an estimated one-third of climate change,

*Corresponding author. Email: anne.gobin@vito.be

due to the emission of greenhouse gases by use of fossil fuels and fossil fuel based fertilisers, land use conversions, land management effects and livestock raising. Because of the economic importance of agriculture, its vulnerability to climate change, and its contribution to emissions, building resilience to climate change represents an enormous challenge, even as scientific understanding of the climate system and feedback mechanisms among agriculture, weather, and water and carbon cycles progresses.

This CR Special consists of a selection of 9 papers based on presentations at the European Geosciences Union General Assembly in Vienna, Austria, in April 2009. The talks were given by the authors at the Natural Hazards Programme Group during the session on Assessment of Weather-related Risk on Agricultural Production and Agribusiness (NH1.5/HS13.01). Although the authors investigated different agricultural systems at a variety of scales, using diverse mathematical models and techniques, the common theme was to have a better understanding of the effects of climate change on agricultural systems and food security, and to evaluate options for adaptation and mitigation.