Entry No. IRRC-0208

Category	: International Rice Research Conference
Select Theme	: Climate change and environmental sustainability
Endorsement email	:
Keyword 1	: Mitigation of climate change
Keyword 2	: Carbon and nitrogen cycles
Keyword 3	: Climate smart agriculture
Title of Entry	: High nitrous oxide fluxes under reduced flooding conditions indicate need to co-manage water and nitrogen at rice farms
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Select only one type of presentation	: 15 minute oral presentation
Abstract	: Methane (CH4) from global rice cultivation accounts for ~50% of all crop related greenhouse gas emissions. Emissions of nitrous oxide (N2O), a long-lived greenhouse gas, from rice farms are considered negligible relative to CH4, a short-lived greenhouse gas. Based on an as of yet unverified assumption that almost all irrigated rice fields are continuously-flooded, the global community has focused heavily on alternate flooding and drying (also intermittent flooding) for climate mitigation. As an integral part of climate-smart rural development projects taken up by our coalition in 2012-2014, we measured CH¬4 and ¬N2O emissions as well as soil, weather and management parameters at five non-continuously flooded farms across three Indian agro-ecological regions. At each farm, we compared results from baseline/conventional management practices (identified via farmer surveys) with farm-specific potential climate-smart farming practices (with low N, water or more organic inputs). We show that N2O emission rates can be three times higher (33 kg-N2O ha-1 season-1) than ever previously reported at non-continuously flooded rice farms, and N2O emissions increase inversely with the degree of flooding. Because of soil texture & irrigation related infrastructural constraints, intermittent flooding at rice farms is likely much more common (especially in South-Asia, Africa and South America) than acknowledged in existing studies and/or in UNFCCC reports. We quantify the potential global risk of a large climate impact due to N2O emissions from rice paddies through a geospatial extrapolation of observed correlations between N2O emissions and multiple management parameters. This extrapolation suggests that under reduced flooding conditions, annual global rice-N2O emissions might be 30 times higher than current estimates (see our other submission). We also show that while integrated co-management of water with inorganic nitrogen and/or

organic matter inputs can decrease climate net impacts by 60%, managing water independent of nitrogen can increase N2O emissions very significantly. Region-specific studies that map flooding-regimes at rice farms and measure effects of multiple co-managed variables on CH4 and N2O emissions are necessary to determine and lower the climate impacts of rice cultivation over both the short- and long-term. We also recommend visualizing the relative and time-dependent climate implications of different flooding regimes.

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