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Validation of a station-prototype designed to integrate temporally soil N2O fluxes: IPNOA Station prototype.

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Nitrous oxide (N2O) flux measurements from agricultural soil surface still accounts for the scientific community as major challenge. The evaluations of integrated soil N2O fluxes are difficult because these emissions are lower than for the other greenhouse gases sources (CO_2, CH4). They are also sporadic, because highly dependent on few environmental conditions acting as limiting factors.
Within a LIFE project (IPNOA: LIFE11 ENV/IT/00032) a station prototype was developed to integrate annually N2O and CO_2 emissions using automatically chamber technique. Main challenge was to develop a device enough durable to be able of measuring in continuous way CO_2 and N2O fluxes with sufficient sensitivity to allow make reliable assessments of soil GHG measurements with minimal technical field interventions. The IPNOA station prototype was developed by West System SRL and was set up during 2 years (2014 -2015) in an experimental maize field in Tuscan. The prototype involved six automatic chambers; the complete measurement cycle was of 2 hours. Each chamber was closing during 20 min and biogas accumulations were monitoring in line with IR spectrometers. Auxiliary's measurements including soil temperatures and water contents as weather data were also monitoring. All data were managed remotely with the same acquisition software installed in the prototype control unit.
The operation of the prototype during the two cropping years allowed testing its major features: its ability to evaluate the temporal variation of N2O soil fluxes during a long period with weather conditions and agricultural managements and to prove the interest to have continuous measurements of fluxes. The temporal distribution of N2O fluxes indicated that emissions can be very large and discontinuous over short periods less ten days and that during about 70% of the time N2O fluxes were around detection limit of the instrumentation, evaluated to 2 ng N ha-1 day-1. N2O emission factor assessments were 1.9% in 2014 and 1.7 % in 2015, in the range of IPCC ones. The instrumentation was working almost permanently during these two years. The proximity sensors fitted on the chambers allowed showing that the chambers were functioning normally for about 90% of the time. A cross-comparison carried out in September 2015 with the "mobile IPNOA prototype"; a high-sensibility transportable instrument (previously validated), allowed showing a good agreement between the 2 instrumentations.