

Wireless Sensor Network: the innovation for the first FACE experiment in Brazil

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In Brazil, the first FACE facility has been installed near Jaguariúna city - state of São Paulo, besides the installation of six OTCs experiments throughout the country (Belém, PA; Petrolina, PE; Sete Lagoas, MG; Londrina, PR; Jaguariúna, SP; and Vacaria, RS). The project named "Impacts of climate change on plant diseases, pests and weeds", with the nickname "Climapest", has been supported by Embrapa (Brazilian Agricultural Research Corporation).

A FACE facility consists of a set of circles having pipe rings around them to perform the CO₂ fumigation. The circles can be as large as 30m in diameter. The fumigation can be achieved by direct injection or diluted injection. In either case the main operational issue is to maintain acceptable fluctuations and gradients of the CO₂ concentration inside the circles, which are affected mostly by the wind. In Brazil it was chosen the direct injection system and an octagonal arrangement of pipes, which is generally utilized in existing installations. Each octagon segment has individual gas valves to compensate the wind direction and a flow control device to compensate wind speed changes. The OTCs have smaller circles, around 2m in diameter, and are surrounded by a plastic cover with open top. The basic instrumentation for the FACE and OTCs experiments usually consists of an Infra Red Gas Analyzer (IRGA) to measure the CO₂ concentration, an anemometer, a set of on-off valves and other weather sensors (air temperature and humidity, solar radiation and precipitation). The improvement accomplished for the Brazilian FACE and OTCs instrumentation was to operate all those devices based on the Wireless Sensor Network technology, specifically the ZigBee standard, already present in the rural area and which is the expertise of the Brazilian FACE implementation group. The expectation was to facilitate the system installation and maintenance and to improve its electromagnetic compatibility, since lightning is a huge issue in Brazil. Figure 1 shows a Vaisala CO₂ probe adapted to work wirelessly and being powered by solar energy.

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