Factors Affecting Methane Production in Flooded Rice Soils

Charles W. Lindau, William H. Patrick, Jr., and Ron D. DeLaune

Wetland Biogeochemistry Institute
Louisiana State University
Baton Rouge, Louisiana

The "greenhouse effect" is referred to as an increase in infrared absorption in the atmosphere, due to increasing concentrations of specific trace gases (Rowland, 1989). Concentrations of greenhouse gases have been steadily increasing in the atmosphere over the past 50 to 100 yr and may be contributing to an increase in global temperatures and O₃ depletion. Agricultural productivity, conversion of forestlands, burning of fossil fuels, industrial activity and natural wetlands have contributed to increases in atmospheric concentrations of carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), water vapor (H₂O) and chlorofluoromethanes (NASA, 1988). Greenhouse gases are transparent to incoming solar radiation (ultraviolet) that reach the Earth’s surface unhindered, but the trace gases are opaque and capable of absorbing the outflow of long-wave (infrared) radiation (Bouwman, 1990). Trace gas species can have significant effects on the thermal dynamics of the atmosphere if their long-wave absorption bands are in the partially opaque 8- to 12-μm region (Chamberlain et al., 1982). Methane has a strong absorption band at 7.66 μm, N₂O has infrared absorption bands at 7.8 and 17 μm, and CO₂ and chlorofluoromethanes have very strong absorption bands in the 8- to 12-μm region.

Methane is an important trace greenhouse gas that may account for about 15 to 20% of the total current increase to global warming. This may be caused by a 5- to 10-yr atmospheric residence time, but more importantly because 1 g of CH₄ will absorb about 70 times more infrared radiation than 1 g of CO₂ (USEPA, 1990). By 1978 the average tropospheric CH₄ concentration had increased to 1.5 ppmv and in 1988 increased to about 1.7 ppmv (Blake & Rowland, 1988). Globally, atmospheric CH₄ has increased about 1% yr⁻¹ between 1965 and 1975. Trapped air data in dated ice cores suggest that atmospheric CH₄ concentrations have approximately doubled in the last 350 yr (Craig & Chou, 1982). It is estimated by the year 2100, atmospheric CH₄