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The role of radiomethane ($^{14}CH_4$) measurements in constraining the global methane source inventory

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Atmospheric measurements of radiomethane were proposed by Ehhalt more than 30 years ago as a means of inferring the proportion of fossil sources in the global methane source (the "fossil fraction"). Since ca 1986 when small-sample radiocarbon analyses became possible through accelerator mass spectrometry, systematic radiomethane measurements by several groups have enabled the fossil fraction to be estimated. An estimate of 20% is reported in IPCC assessments, but is subject to wide uncertainty: eg, 18$\pm$9% (95% confidence interval) is estimated by Quay et al. from data to 1995. The uncertainty in this estimate is largely due to direct releases of radiomethane from the nuclear-power industry that are poorly quantified. We demonstrate that a lengthening time series of radiomethane measurements, in combination with data describing the evolution of the nuclear-power industry, can permit a more accurate estimate of the mean fossil fraction over time intervals since ca 1986. This suggests a fossil fraction near 30% which in turn suggests a much larger fossil component in the methane source than is commonly supposed. Such an inference is consistent with recent independent assessments of natural fossil methane emissions by Etiope and others which suggest that such emissions may have been appreciably under-estimated.