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Rejoinder

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We would like to thank all of the discussants for their comments which place our work in context and help us to step back a little. This is an extremely timely moment to do this, since we are about to embark on a NERC funded project that aims to develop the models and methods to provide the next internationally-agreed estimates of the calibration curves which are due to be released in 2010. We respond to the written comments from the discussants under three broad headings as follows.

1 Improved modelling of the physical processes

One of the themes in the comments offered by the discussants is that we should seek statistical models that have greater foundation in the processes observed in the physical world. As noted in our discussion section, inclusion of further prior information about $\mu(\cdot)$ is something that we certainly intend to explore in the production of the next curve.

Millard cautions against circularity in the use of the data when modelling periodicity in the curve. Certainly we had no intention of building in cycles of particular lengths; however, allowing for the possibility of periodicity, and seeing what emerges, would seem a natural (and valid) way forward. Alongside this, we will also explore the use of heavier tailed distributions for our random walk prior in order to be sure that we are not over-smoothing; this also helps ensure that we are not over-reacting to outliers, an issue revisited below. For this purpose, the suggestion by Haslett and Parnell of an infinitely-divisible model such as the Normal Inverse Gaussian is very helpful. Applying this in practice will require some care, since we require a method that picks up features supported by multiple data points and that does not too readily create 'wiggles' based on single data points.

Closely allied to these suggestions about modelling the underlying processes is a suggestion from Millard to use more realistic models for the uncertainties on the data, in particular those on the calendar age scale. Exploration of such complexities was not an option given the implementation restrictions for IntCal04, but Millard is quite right that our assumption of normal errors everywhere is simplistic and needs further investigation. When we come to do this, Millard's own work to develop Bayesian models for uranium series dating (Millard 2004, 2006) will be invaluable.

Arguably, the least satisfactory of all of our modelling for IntCal04 was that relating to data derived from sedimentary sequences whose ordering is known and must be incorporated in the analysis. The move to an MCMC implementation allows a great deal more choice about how we handle this aspect of the problem, and we plan to

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