response to associate editor

Hopefully the new abstract meets with your satisfaction. The only thing that has changed in the manuscript is the abstract

There is much to discuss concerning model 3! Maybe we can continue by email, separately from the matter of the current paper? I (the first author) would want to do more playing with simulations before it would be worth doing that?

Robust Isochron Calculation

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Abstract.

The standard classical statistics approach to isochron calculation assumes that the distribution of uncertainties on the data arising from isotopic analysis is strictly Gaussian. This effectively excludes from consideration datasets that have more scatter, even though many appear to have age significance. A new approach to isochron calculations is developed in order to circumvent this problem requiring only that the central part of the uncertainty distribution of the data defines a "spine" in the trend of the data. This central spine can be Gaussian but this is not a requirement. This approach significantly increases the range of datasets from which age information can be extracted but also provides seamless integration with well-behaved datasets, and thus all legacy age determinations. The approach is built on the robust statistics of Huber (1981), but using the data uncertainties for the scale of data scatter around the spine, rather than a scale derived from the scatter itself, ignoring the data uncertainties. This robust data-fitting reliably determines the position of the spine when applied to data with outliers, but converges on the classical statistics approach for datasets without outliers. The spine width is determined by a robust measure, the normalised median absolute deviation of the distances of the data points to the centre of the spine, divided by the uncertainties on the distances. A test is provided to ascertain that there is a spine in the data, requiring that the spine width is consistent with the uncertainties expected for Gaussian-distributed data. An iteratively-reweighted least squares algorithm is presented to calculate the position of the robust line and its uncertainty, accompanied by an implementation in Python.