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Strategies towards statistically robust interpretations of in situ U-Pb zircon geochronology.

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Zircon U–Pb geochronology continues to be an increasingly important tool in Earth science and is used more widely than any other geochronologic technique in resolving deep geological time. The development of rapid in situ analysis of zircon via laser ablation and secondary ionization mass spectrometry has allowed for obscene amounts of data to be generated in a short amount of time. Such large datasets offer the ability to address a range of geological questions that would otherwise remain obscured. The ease of acquisition, while bringing benefit to the Earth science community, has also led to diverse interpretations of geochronological data. In this work we seek to refocus best practices of U–Pb zircon geochronology to provide statistically robust interpretations. We discuss a range of data filtering approaches and their inherent limitations (e.g. discordance and the reduced chi-squared; MSWD). We evaluate appropriate mechanisms to calculate the most geologically appropriate age from both $^{238}U/^{206}Pb$ and $^{207}Pb/^{206}Pb$ ratios and demonstrate the cross over position when chronometric power swaps between these ratios. We present a coherent workflow to aid in the digestion of U-Pb data among 'users' of geochronology who may not be experts. In addition we discuss some of the new and exciting applications of statistical analysis to geochronology with specific focus on handling large quantities of data.