Indication of glacially-induced fault reactivation in Latvia, Lithuania and the Kaliningrad District of Russia from models of glacial isostatic adjustment

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We model the change of Coulomb Failure Stress ($\delta$CFS) during the Weichselian glaciation up until today at 12 locations in Latvia, Lithuania and Russia that are characterised by soft-sediment deformation structures (SSDS). If interpreted as seismites, these SSDS may point to glacially-induced fault reactivation. The $\delta$CFS suggests a high potential of such reactivation when it reaches the instability zone. We show that $\delta$CFS at all 12 locations reached this zone several times in the last 120,000 years. Most notably, all locations exhibit the possibility of reactivation after ca. 15 ka BP until today. Another time of possible activity likely happened after the Saalian glaciation until ca. 96 ka BP. In addition, some models suggest unstable states after 96 ka BP until ca. 28 ka BP at selected locations but with much lower positive $\delta$CFS values than during the other two periods.

For the Valmiera and Rakuti seismites in Latvia, we can suggest a glacially-induced origin, whereas we cannot exactly match the timing at Rakuti. Given the (preliminary) dating of SSDS at some locations, at Dyburiai and Ryadino our modelling supports the interpretation of glacially-induced fault reactivation, while at Slinkis, Kumečiai and Liciškėnai they likely exclude such a source.

Overall, the mutual benefit of geological and modelling investigations is demonstrated. This helps in identifying glacially-induced fault reactivation at the south-eastern edge of the Weichselian glaciation and in improving models of glacial isostatic adjustment.

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Reference: