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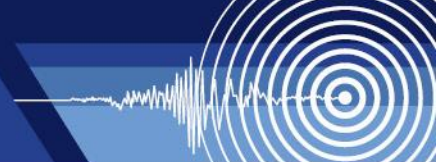
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Improving the accuracy of earthquake magnitudes for North Sea seismicity

Tom Kettlety¹, Peter Voss^{2*}, Daniela Kühn^{3,4}, Brian Baptie⁵, Evgeniia Martuganova⁶, Johannes Schweitzer^{3,8}, Trine Dahl-Jensen², Annie Jerkins³, Elin Skurtveit^{7,8}

¹Department of Earth Sciences, University of Oxford, Oxford, United Kingdom, ²Geological Survey of Denmark and Greenland - GEUS, Copenhagen, Denmark, ³NORSAR, Kjeller, Norway, ⁴GFZ German Research Centre for Geosciences, Potsdam, Germany, ⁵British Geological Survey, Edinburgh, United Kingdom, ⁶Department of Geoscience & Engineering, Delft University of Technology, Delft, The Netherlands, ⁷Norwegian Geotechnical Institute (NGI), Oslo, Norway, ⁸Department of Geosciences, University of Oslo, Oslo, Norway

* pv@geus.dk

To effectively design and operate the many CO₂ storage projects that are being developed in the North Sea, seismicity needs to be accurately characterised. Measuring seismicity can provide insights into the stress state in the region, fault density and faulting style, as well as fracturing in the overburden. Understanding background seismicity rates is also key to discriminating, determining the risk of, and mitigation against induced seismicity that could result from injection. Communicating earthquake risk is a key challenge in this field, and central to that is the reporting of earthquake sizes or magnitudes. These magnitudes are reported to the public, and thus their integrity needs to be ensured and their uncertainties thoroughly characterised. Magnitudes also are key input into seismic hazard analysis, a necessary step in the site characterisation of CO₂ storage projects and other offshore infrastructure. This study compares and re-evaluates the magnitude estimates from a large database of North Sea seismicity compiled by the ACT3 project SHARP Storage. Magnitudes and their associated uncertainties are computed in a consistent manner and compared to the recordings reported by the regional agencies. Systematic differences are explored, and key sensitivities are identified. These results will aid in the monitoring of seismicity in the North Sea, risk assessment for CO₂ storage and other infrastructure, and the communication of seismic hazard.

