Location accuracy of earthquake hypocentres beneath Eyjafjallajökull, Iceland, prior to the 2010 eruptions

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Abstract — *The depth of seismicity preceding the 2010 Fimmvörðuháls and Eyjafjallajökull eruptions in South Iceland has implications for the interpretation of the magma plumbing system that was active prior to those eruptions. Significant discrepancies exist in the hypocentral depths reported by different studies of the same earthquakes beneath Eyjafjallajökull in early-mid March 2010. Reported depths range from 3 km to 12 km. We use both real earthquake data and synthetic tests to show that the dominant factor controlling the best-fit hypocentral depths beneath the Eyjafjallajökull glacier is the network configuration. Hypocentral depths of 6–12 km are obtained when only data from permanent seismometer stations operated by the Icelandic Meteorological Office are used, the closest of which is located 13 km from the epicentral zone. Inclusion of data from six temporary seismometer stations deployed around Eyjafjallajökull, all within 4–15 km of the epicentral zone, constrains earthquake depths to be shallower than ∼6 km. A lack of proximal stations on top of the glacier limits resolution of earthquake sources that are shallower than ∼4 km, even when data from the six temporary stations are included. The choice of two plausible distinct velocity models has only a second-order effect on inferred hypocentral depths. We suggest that the true depth of seismicity is ∼2–6 km, which coincides with the depth of inflating magmatic intrusions inferred from surface deformation at that time.*