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Measurement of earthworm radial pressures during peristaltic motion

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Earthworm activity and formation of burrowing networks are important for soil structure formation and transport processes. We developed models for earthworm penetration cavity expansion that consider soil hydration and mechanical status. A key parameter is the maxima axial and radial pressure exerted by the earthworm hydroskeleton (presently estimated at 200 kPa). To test a range of pressures exerted by moving earthworms we developed a coaxial chamber consisting of Plexiglas tube fitted with a thin and inflatable silicon tubing that hosts the earthworm. We pressurize the gap between the Plexiglas and flexible tubing using an incompressible liquid linked to a pressure transducer. Earthworm motion and concurrent pressure were recorded by the transducer and a dedicated video camera. The instrument was calibrated using a cardiac catheter resulting in close agreement between the catheter and chamber pressures. Measurements using anecic earthworms passing across the cylinder show mean radial pressures of 70 kPa, consistent with earlier findings of anecic earthworm pressure measurements using different measurement techniques. Analyses are underway to resolve local pressures induced during peristaltic motion. The study delineates mechanical constraints to soil bioturbation by earthworms for different mechanical conditions including compaction. Tests are underway for direct measurement of plant root pressures during growth.