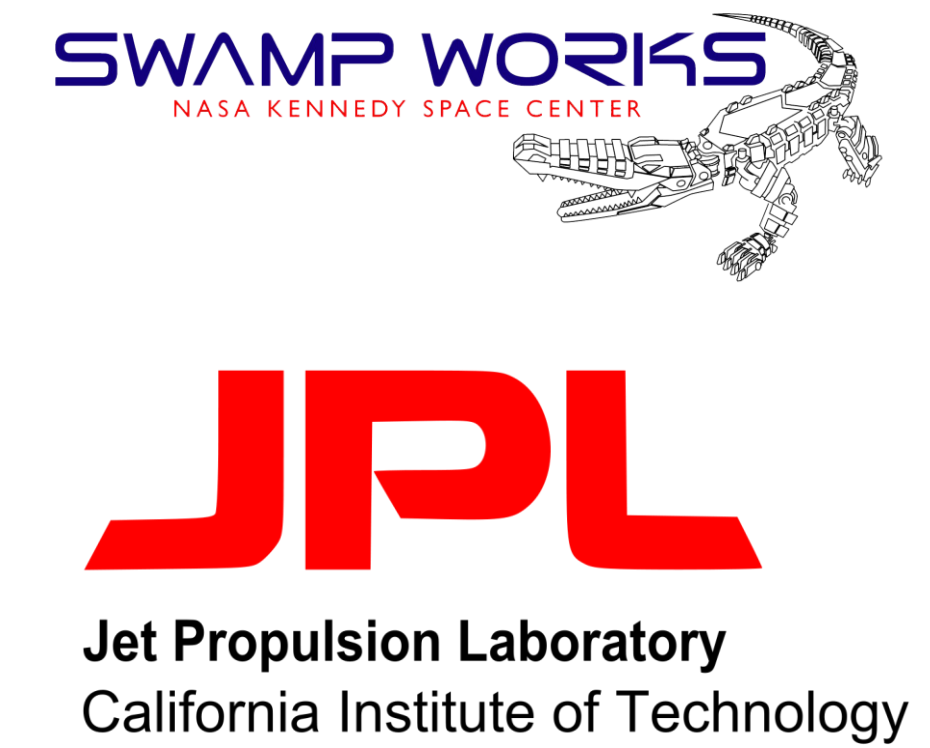
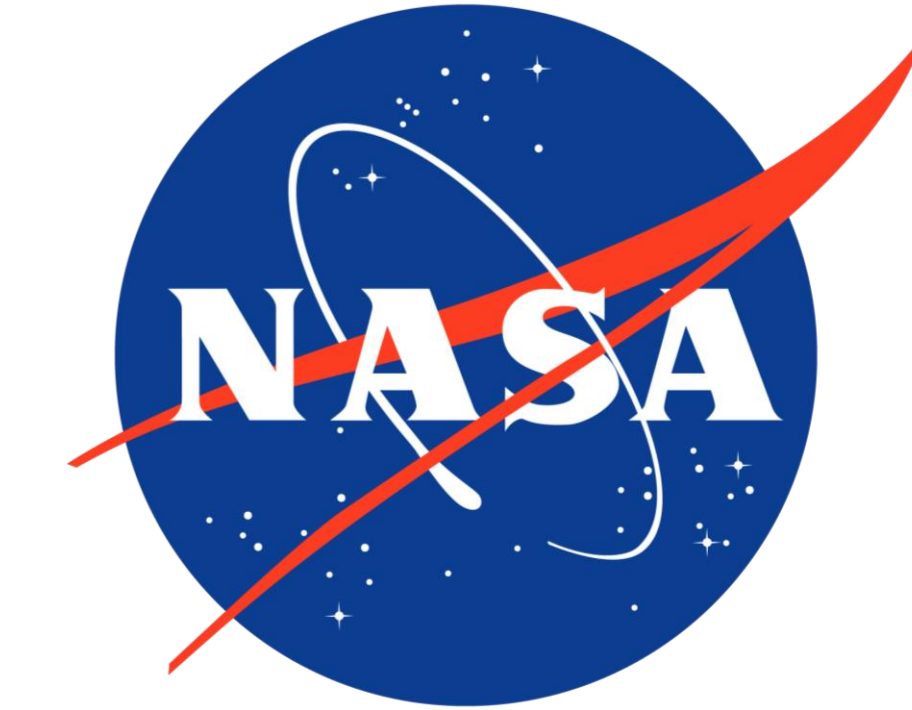


COLDArm Pressure-Sinkage Testing: Implications for Assessing Lunar Trafficability

Poster 2165

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Introduction

- Lunar trafficability is controlled by:
 - Site-specific properties of regolith
 - Rover specifications
- Trafficability is commonly assessed using pressure-sinkage relationships^{1,2}
- Lunar pressure-sinkage testing can be performed with standard exploration hardware (e.g., robotic arms with scoops)

Parameters

- Remote Sensing Pressure-Sinkage Estimates³
 - Lunar Electric Rover (LER) contact patch: 30 cm wide, 15 cm long*
 - Resource Prospector (RP) contact patch: 15 cm wide, 15 cm long*
- *Assumed value - one dimension of bearing plates must be identical^{1,2}
- Reece [1965] Pressure-Sinkage: $P = (k_c + bk_\phi) \left(\frac{z}{b}\right)^n$
- Markov Chain Monte Carlo

To fully describe quantitative estimate, you need: 1) a measure of central tendency; 2) a sense of uncertainty; 3) analysis of assumptions and biases

Discussion and Conclusions

- Reece [1965] fits of COLDArm scoop experiment data are satisfactory
 - Misfits attributed to differences in lunar regolith and terrestrial soils
 - Reece [1965] model is sensitive to ratio of sinkage to plate width
 - Different plate sizes will give different predictions of pressure and sinkage
- COLDArm scoop data show a steep increase in sinkage in the lower pressure ranges
 - Upper layers of simulant are more susceptible to compression
 - Boulder track analyses [3] are not affected by this upper layer
 - Key considerations for low-mass rovers
 - On-site testing is necessary for trafficability and bearing strength assessments

Pressure-Sinkage Experiments



Figure 1. NASA KSC Swamp Works UR10 robotic arm with force-torque sensor in testbed of Exolith Lab Simplified LHS-1 simulant

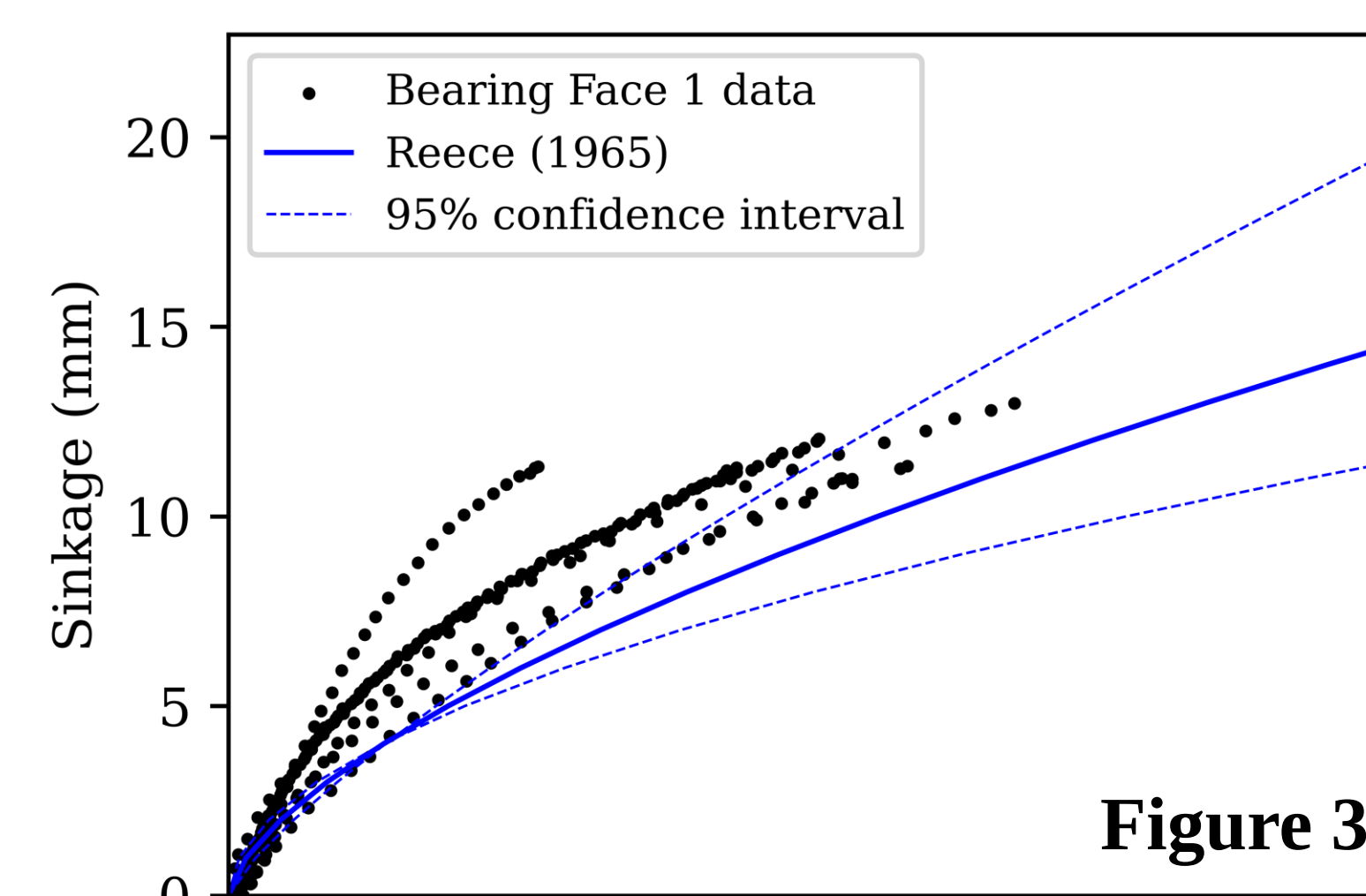


Figure 3

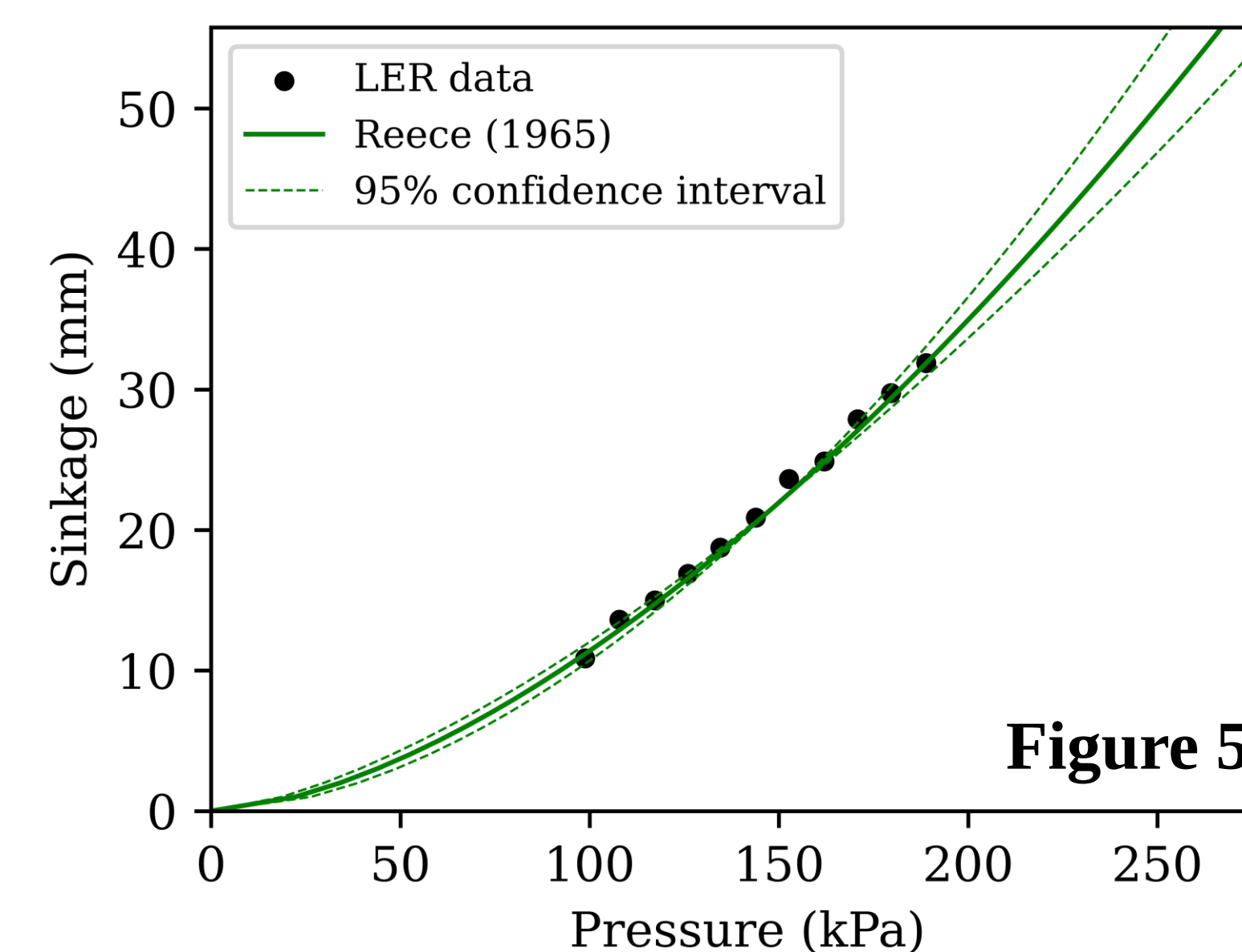


Figure 5

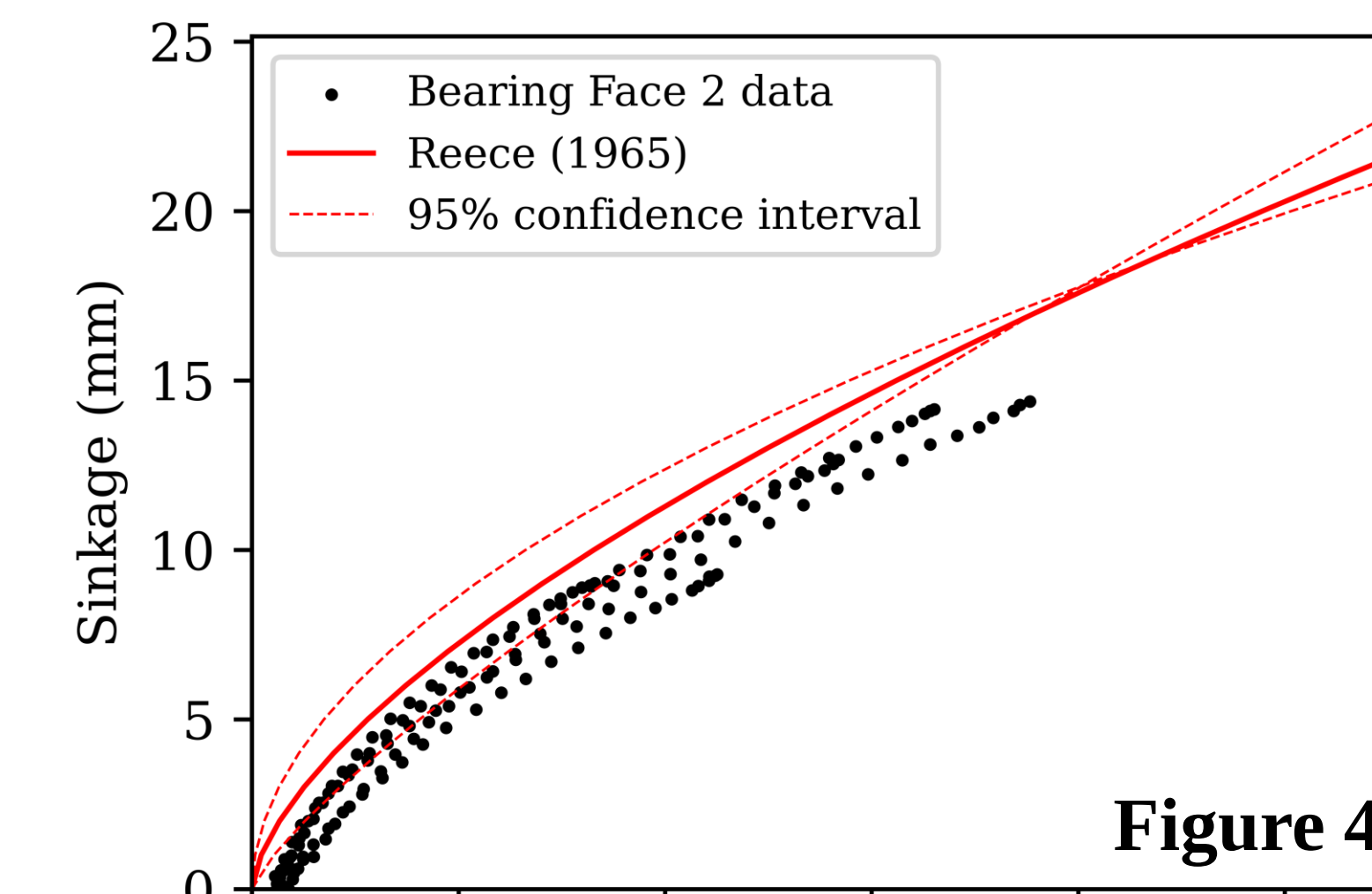


Figure 4

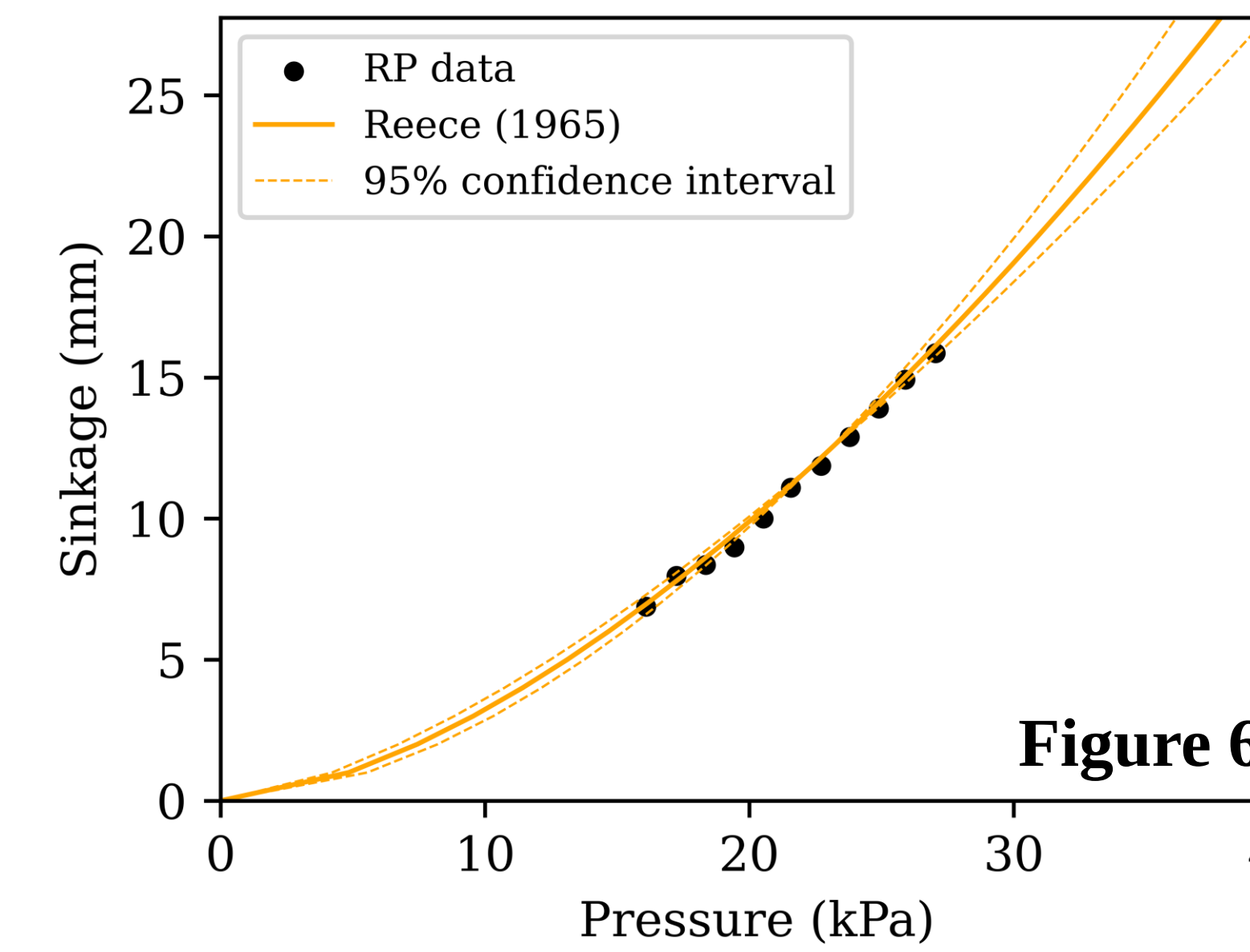


Figure 6

Table 1. Parameter estimates and 95% confidence intervals¹

	COLDArm	Remote Sensing [3]
k_c	-151.49 ± 624.43	-541.10 ± 85.66
k_ϕ	7734.10 ± 19042.84	4323.85 ± 677.56
n	1.56 ± 0.36	0.6185 ± 0.055

Figures 3-6 (above). COLDArm Bearing Face 1 pressure-sinkage data and Reece [1965] best fit; COLDArm Bearing Face 2 pressure-sinkage data and Reece [1965] best fit; LER pressure-sinkage estimates from [3] and Reece [1965] best fit; RP pressure-sinkage estimates from [3] and Reece [1965] best fit.

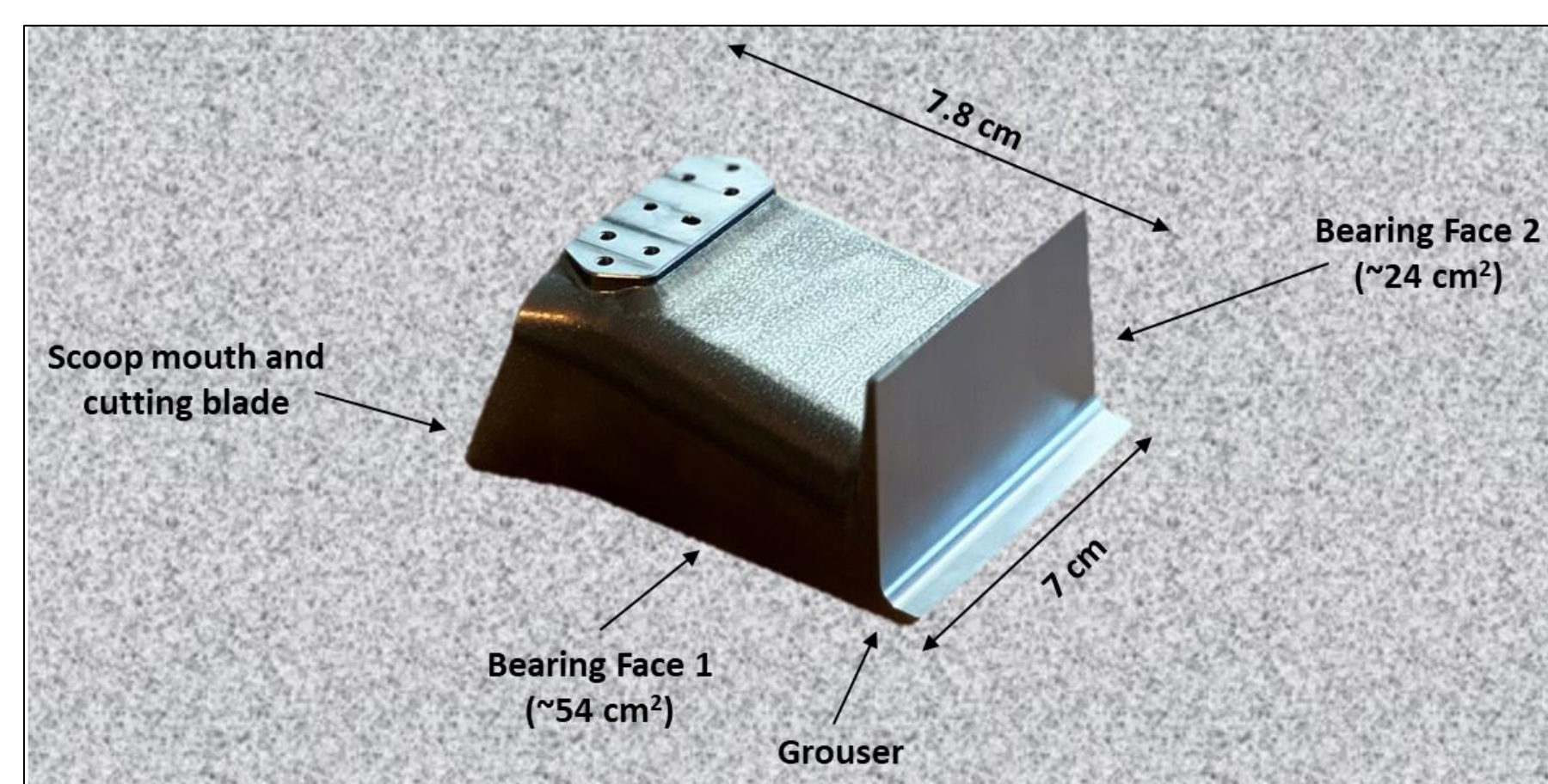


Figure 2. COLDArm geotechnical scoop

Acknowledgements

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