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Impact flux predictions with MASTER

A presentation for the ESA workshop
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Image credit: ESA

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The Columbus module, Image Credit: DLR

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Background

Impact craters on the surface of the Columbus module

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Background

- Based on my work with MASTER during my bachelor thesis „Predictions of impact fluxes on the Columbus module of the ISS"

- How frequent are meteoroid and debris impacts in the Near Earth Environment?

- Goal: Compare flux predictions of different theoretical models (and with data from the impact survey)

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Software

- ESABASE2/debris was used for most flux calculations

- Customization: mission, orbit, spacecraft and debris settings

- Contains various flux models, e.g. Grün meteoroid model, ORDEM and (older) MASTER debris models

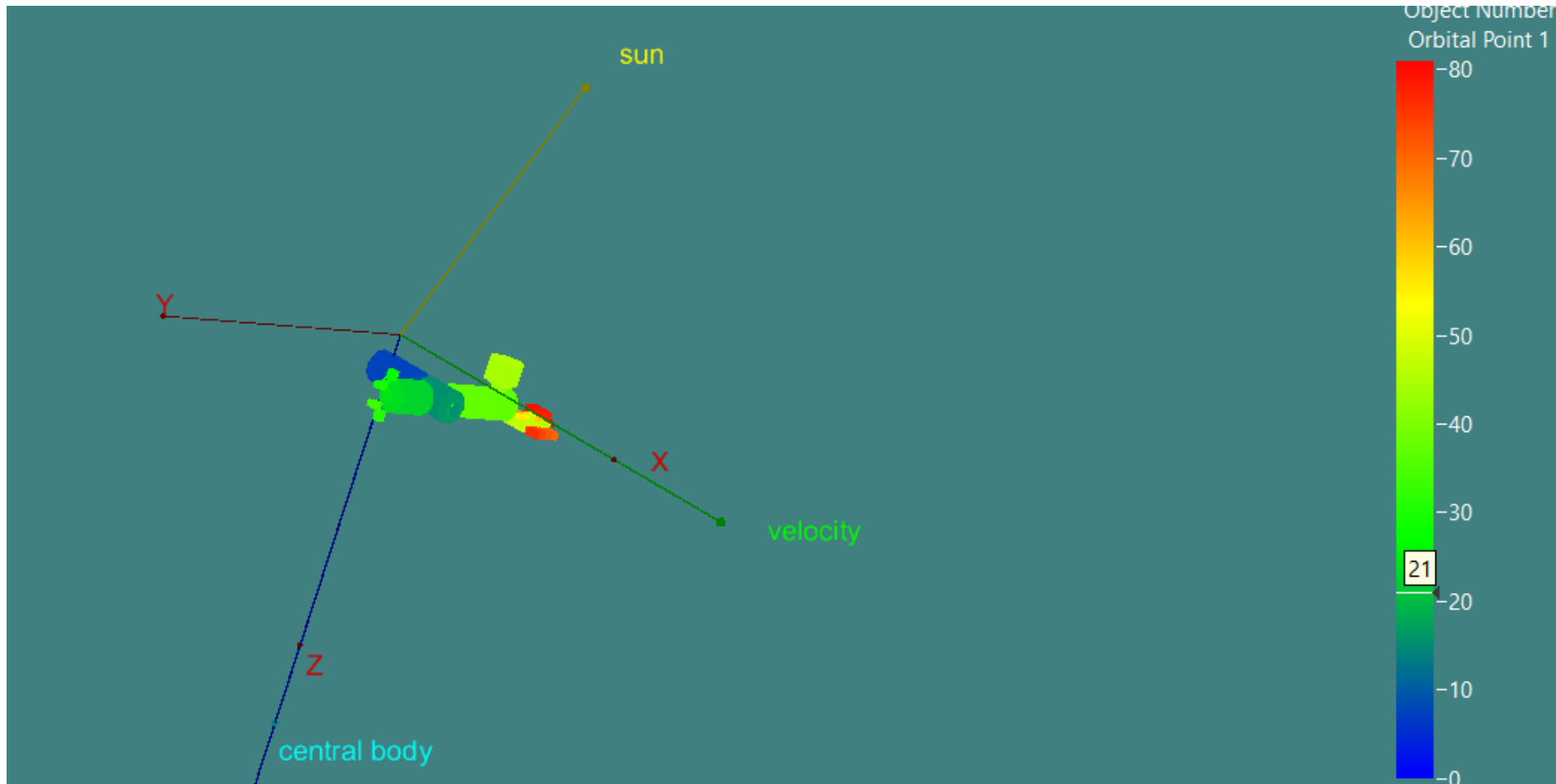- Also used the standalone MASTER software for the most up-to-date version

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Geometrical Analysis

Figure 1: The geometry editor in ESABASE2/debris

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Geometrical Analysis
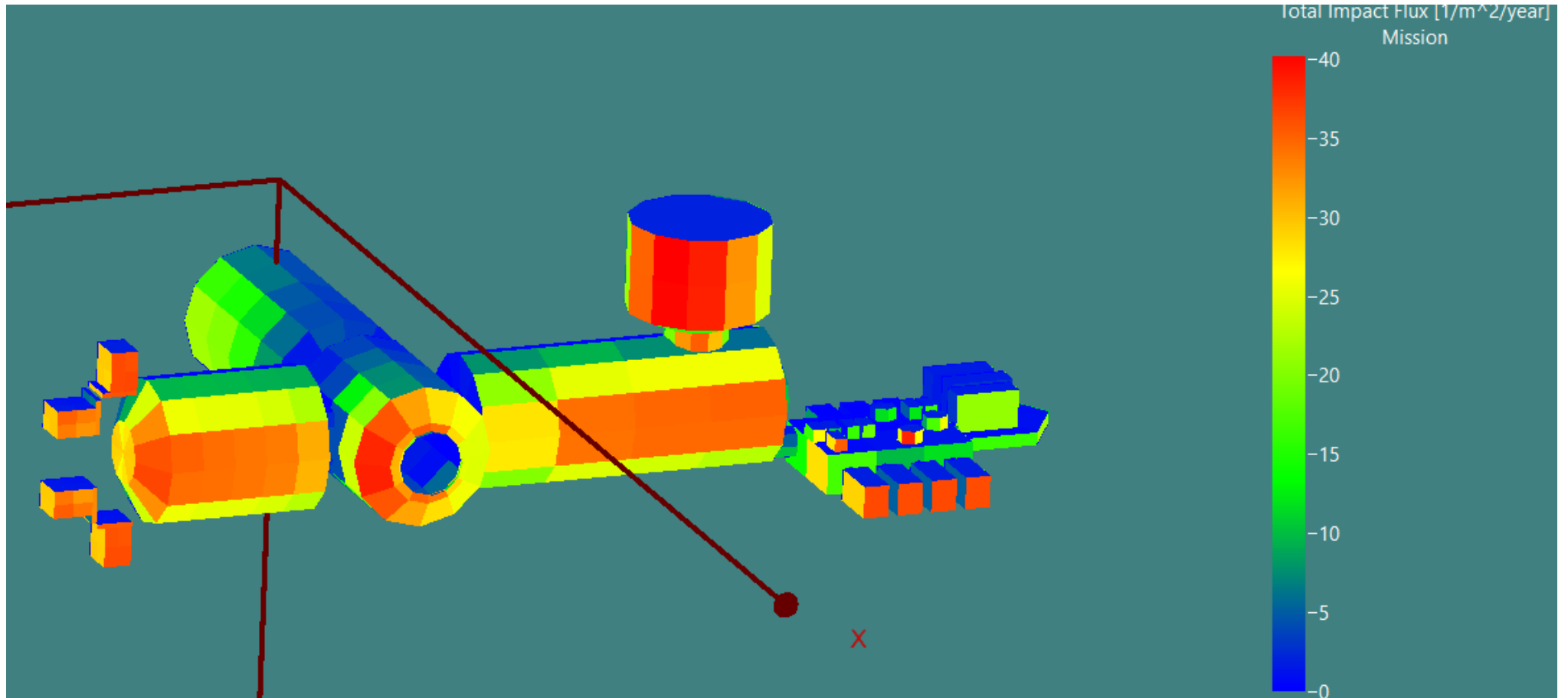
Figure 2: Debris flux $/m^2/year$ for the MASTER 2009 model, with 0.01 cm minimum particle diameter

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Non-Geometrical Analysis

- Square plate in Earth orbit with 1 m^2 per side

- Plate is oriented, with the surface normal pointing in flight direction

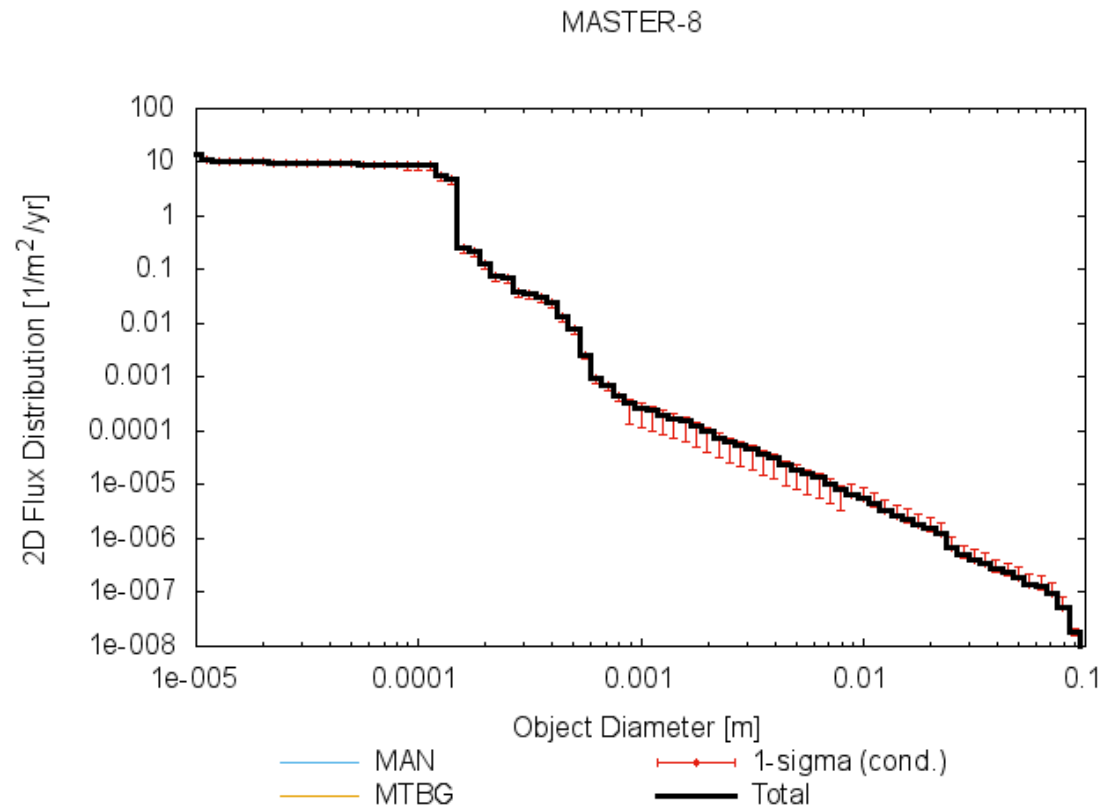- ESABASE2, as well as the MASTER standalone software were used

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Non-Geometrical Analysis

Figure 3: Impact flux for the MASTER model for a RAM-oriented plate in ISS-like orbit

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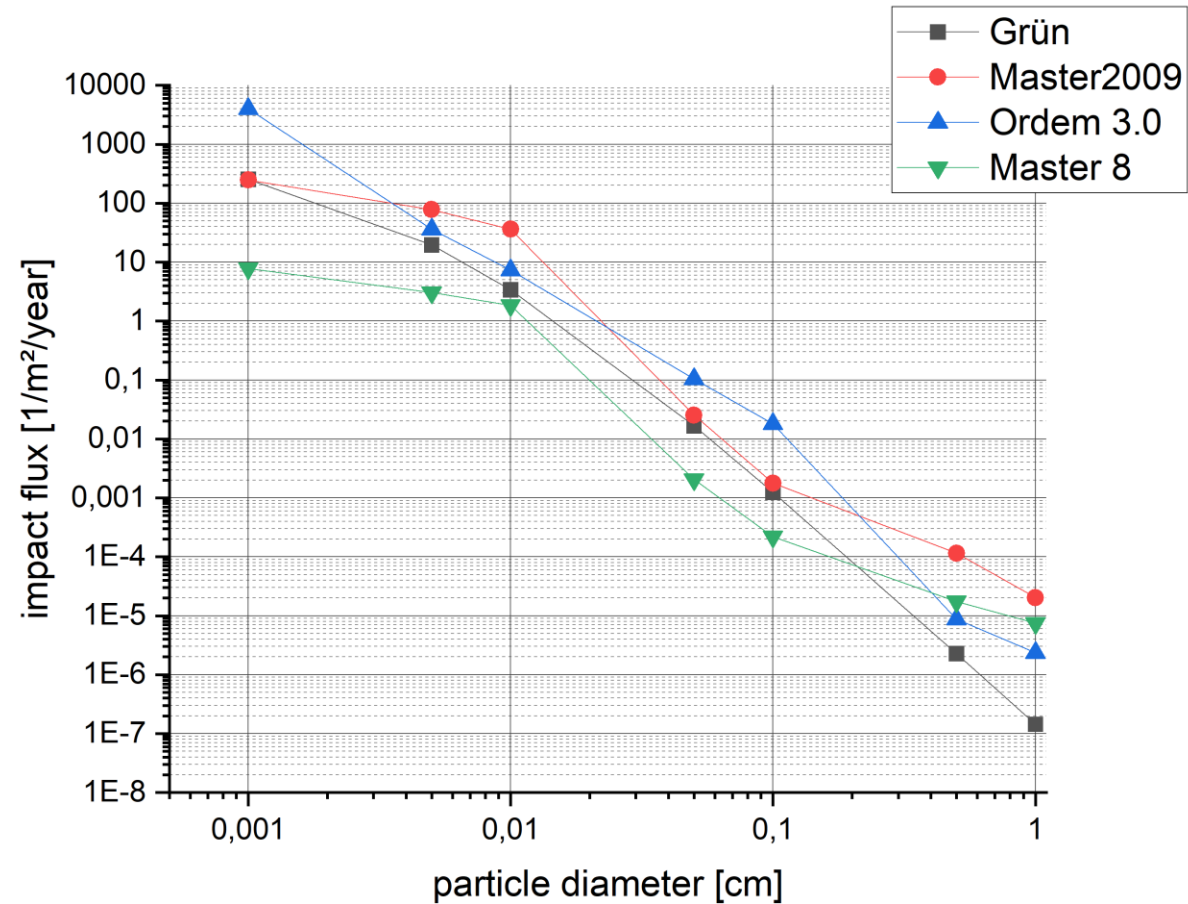Max Klaß, Universität Oldenburg

Non-Geometrical Analysis

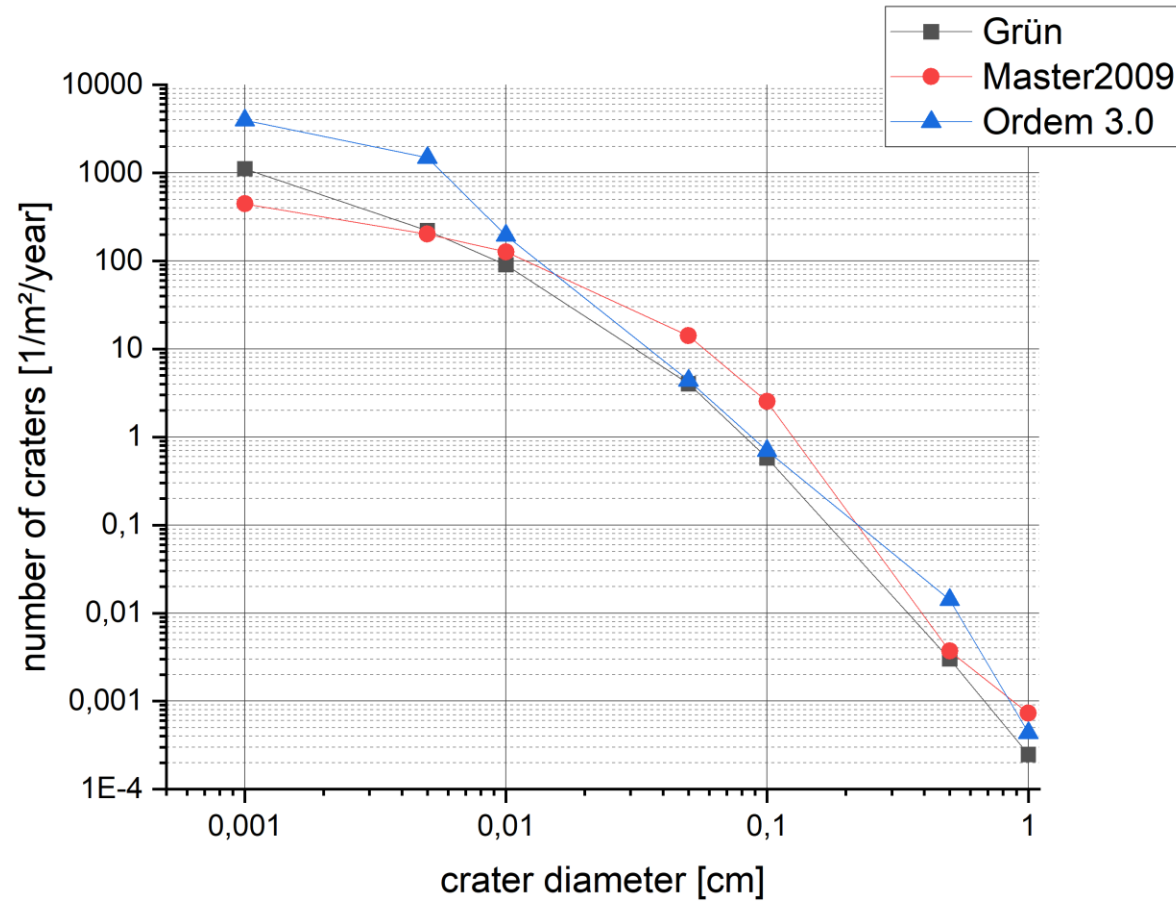Figure 4: Impact flux for the different space environment models for a RAM-oriented plate in ISS-like orbit

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Non-Geometrical Analysis

Figure 5: Number of expected craters on the front facing surface of the RAM-oriented plate for different models

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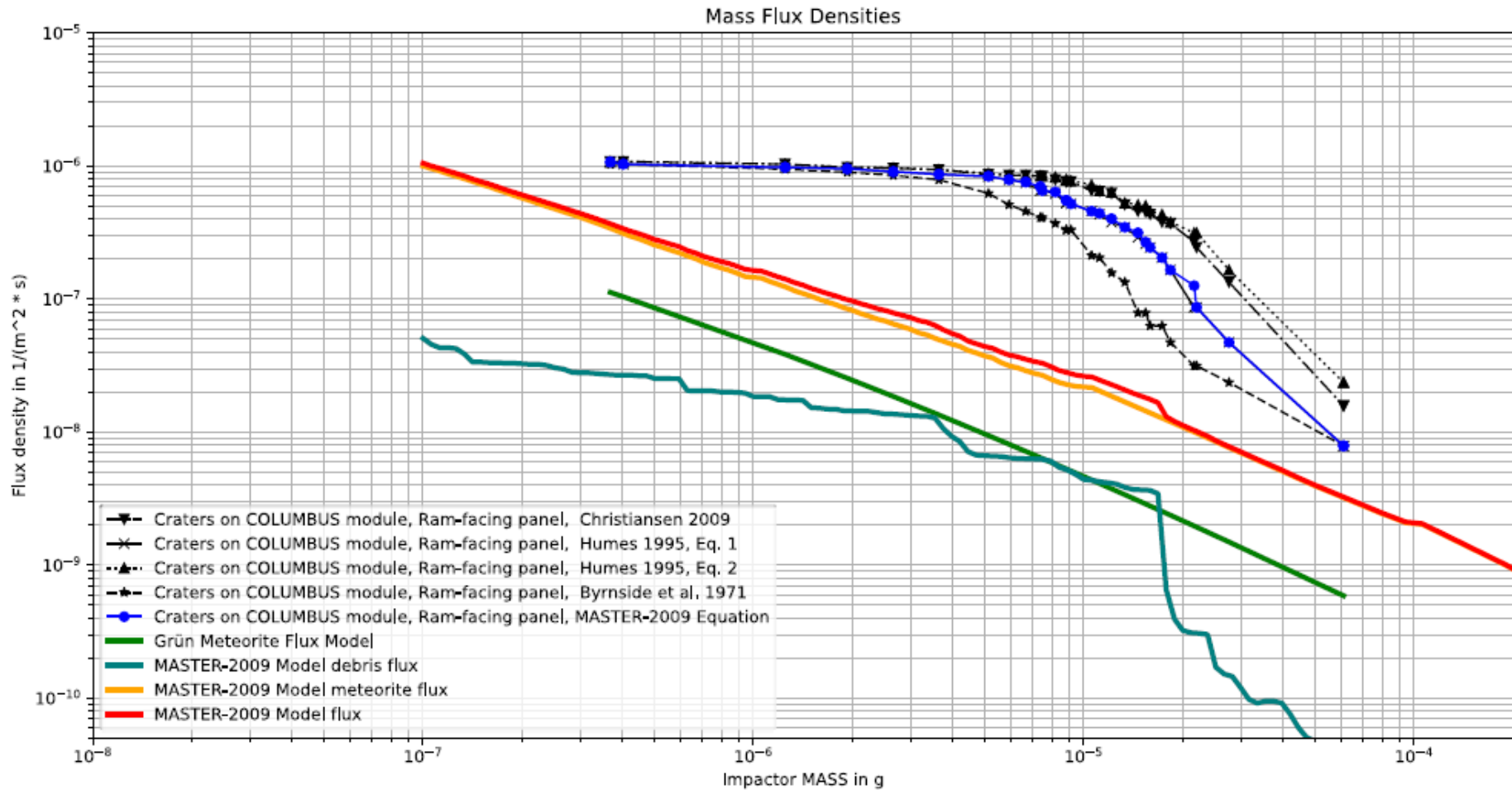Max Klaß, Universität Oldenburg

Comparison with impact survey data

Figure 6: Impact flux densities on a RAM-facing panel of the Columbus module. Source: Lee/Kellner

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Conclusion

- The story is not over: More impact survey data is going to be analysed

- MASTER standalone provides an intuitive and handy GUI, however less features than ESABASE2/debris

- Data can be easily visualized and/or exported to be analysed further

- Integration into ESABASE2 would add useful functionality and make it easier to compare debris models

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Thank you for your time!

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