



<https://tinyurl.com/Bennett-Skinner-CASCA2024>

Water as a Potential Sculptor of the M Dwarf Radius Valley



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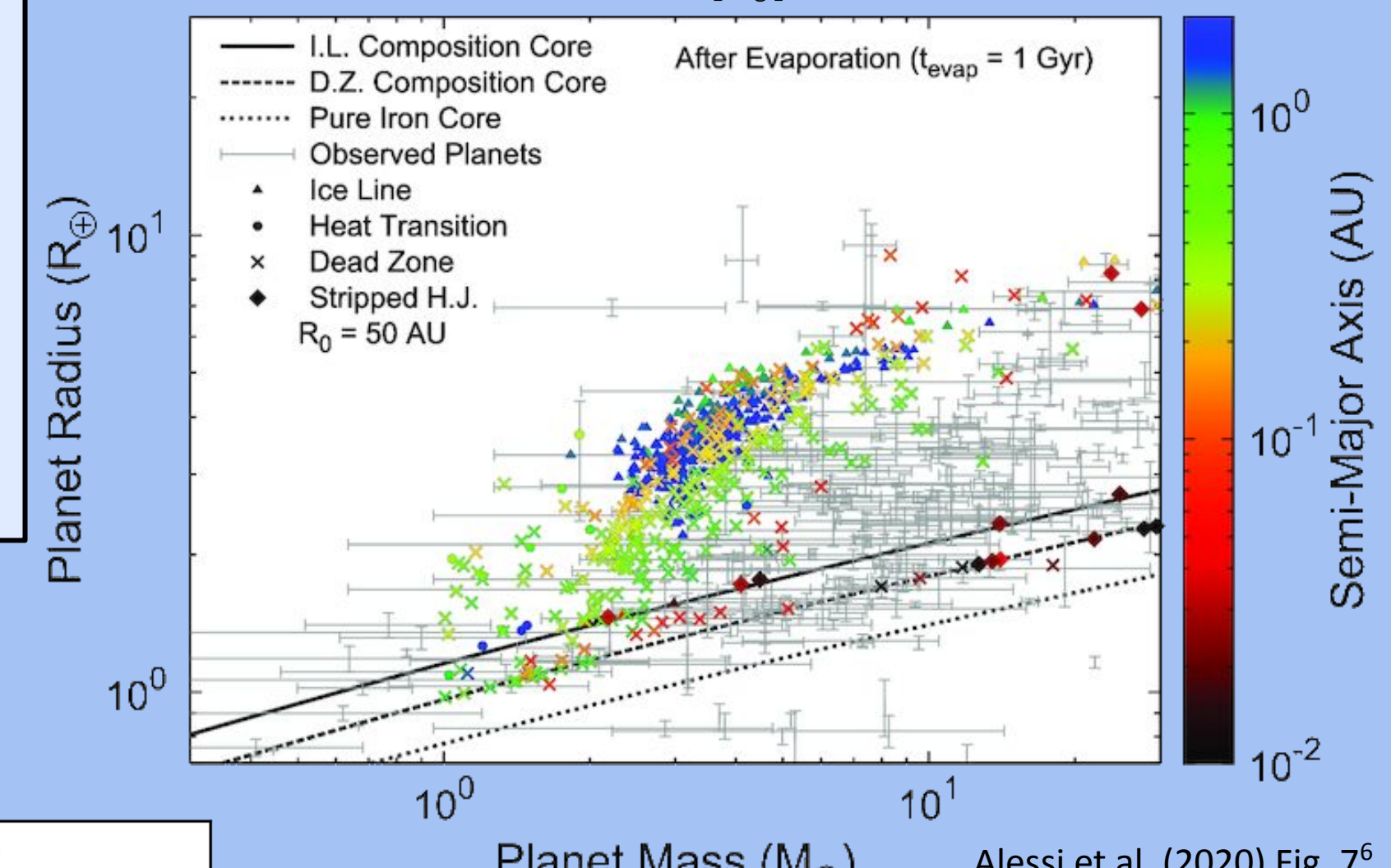
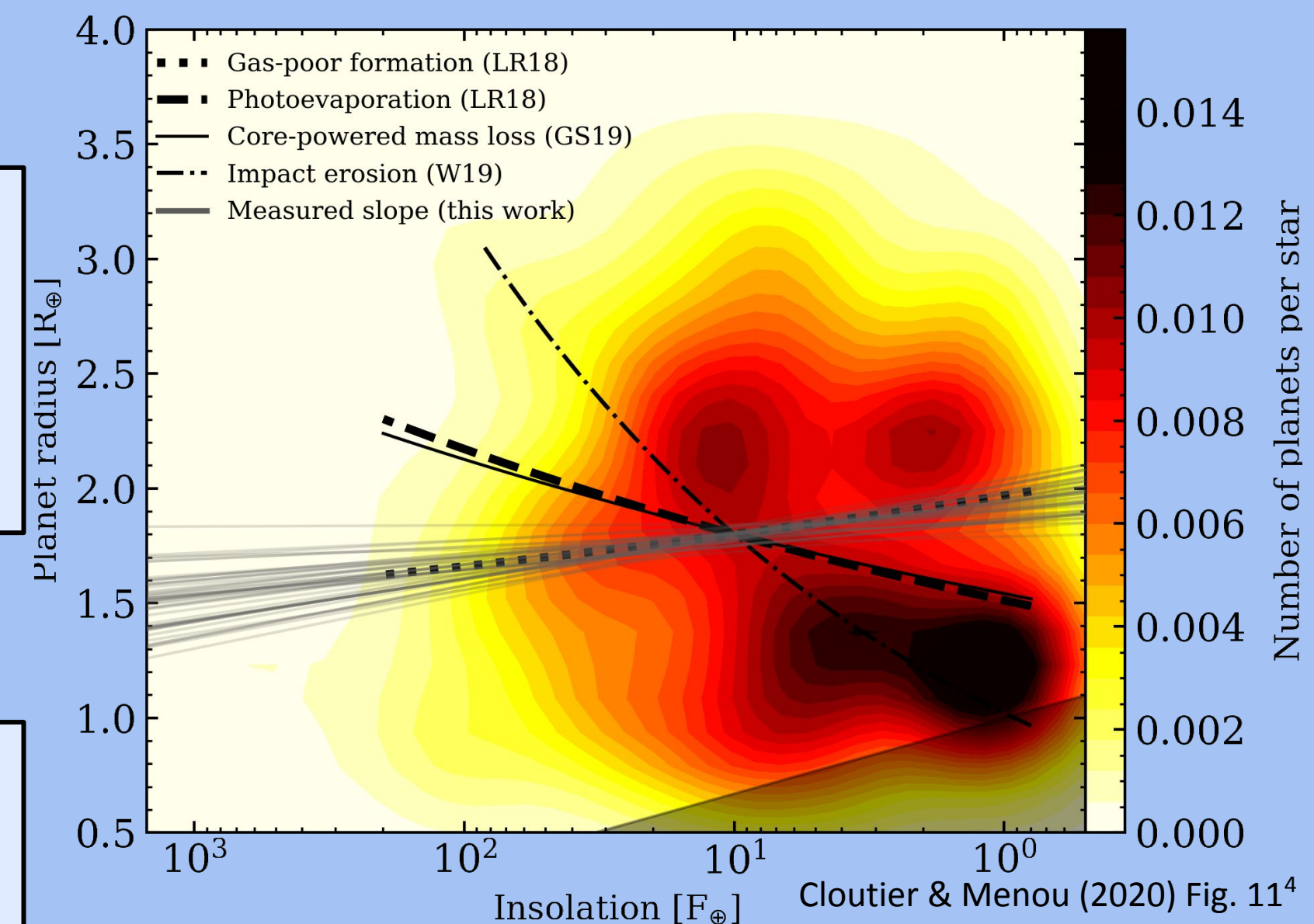
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Background

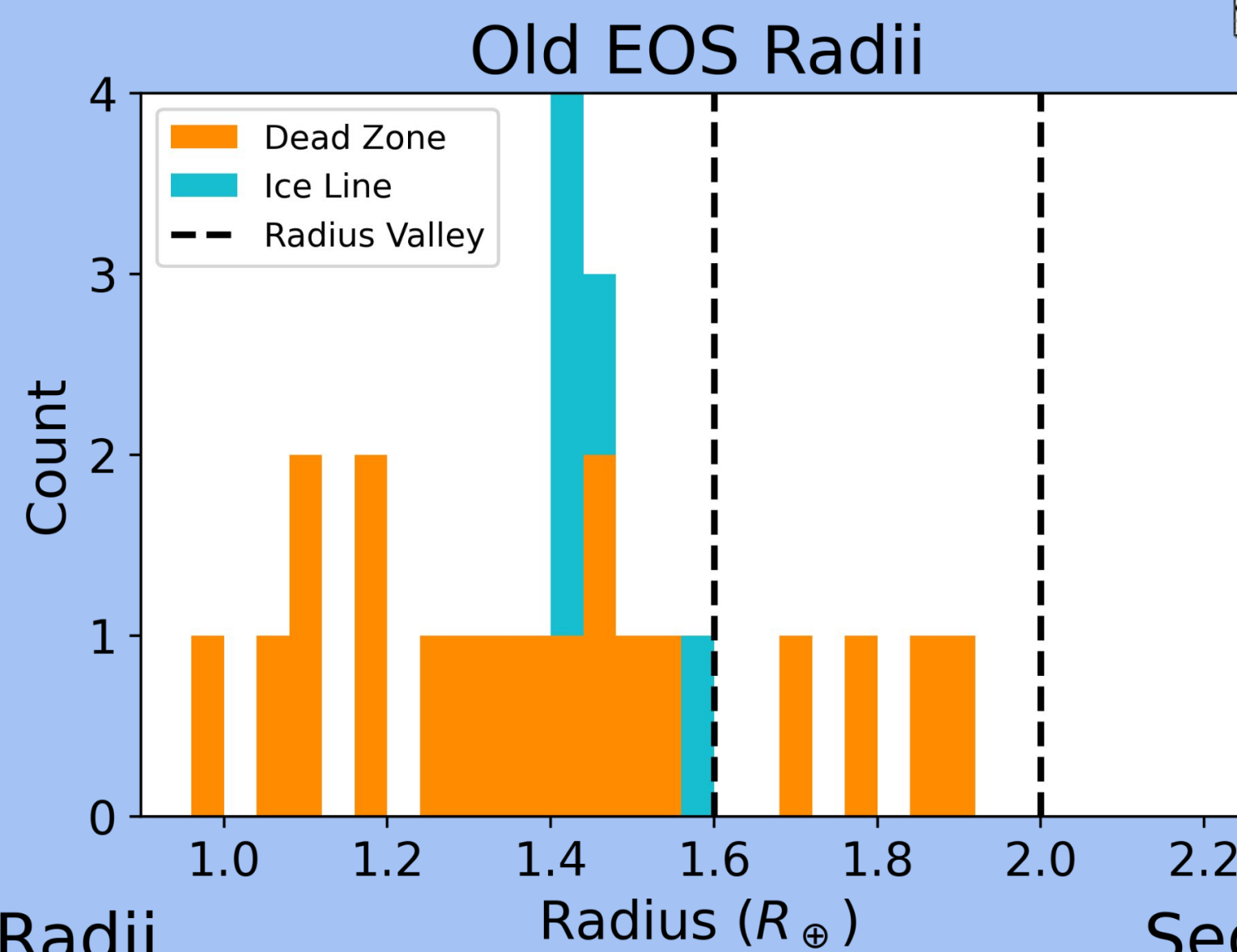
- Distribution of planetary radii is bimodal – “Radius Valley”¹
 - Slope w/ instellation implies atmospheric escape^{2,3}
- Slope different around M v. FGK stars⁴
 - Different formation mechanism? – Water worlds?⁵

The Project

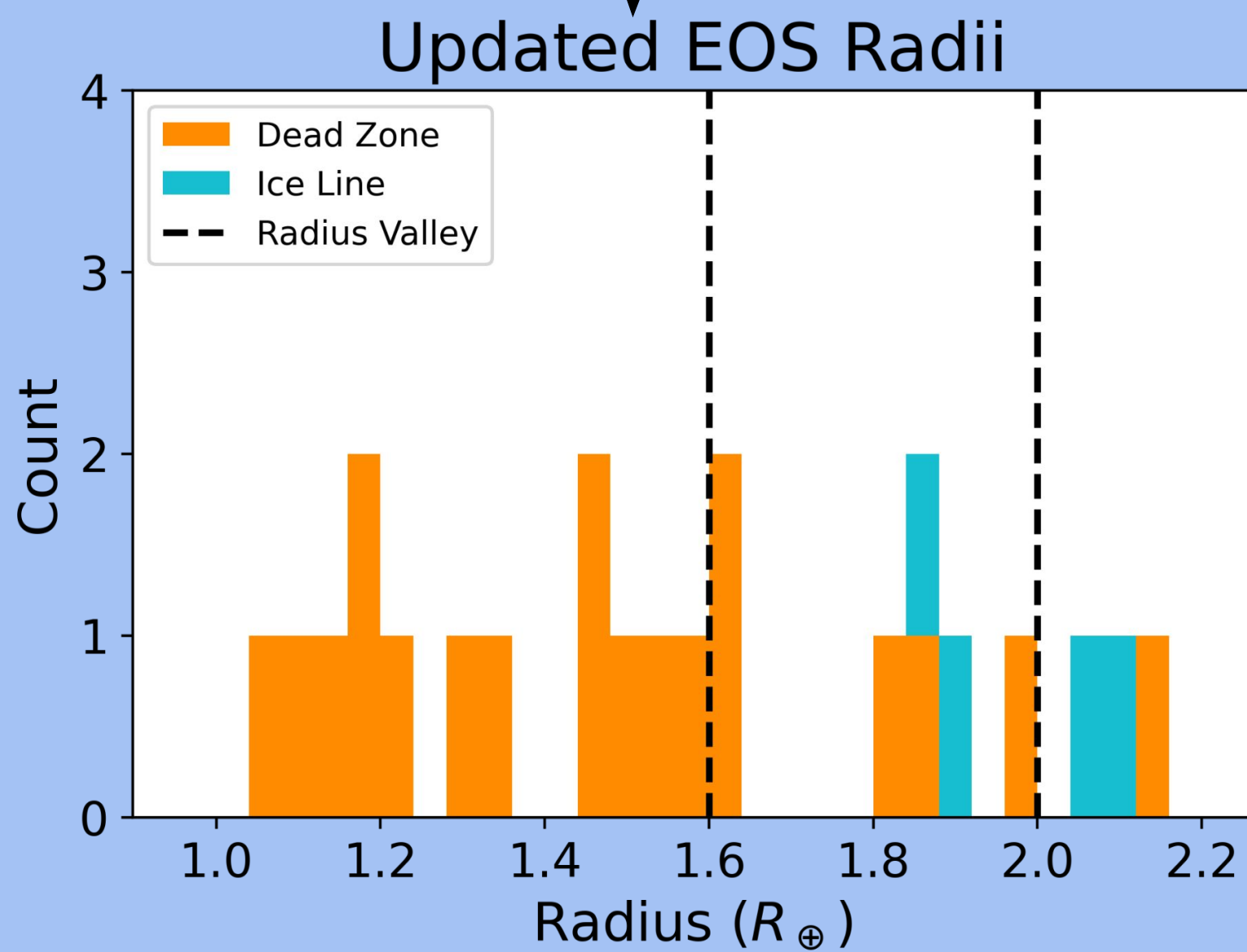
- McMaster Planet Population Synthesis model⁶
 - Planetesimal accretion in disk around FGK star
 - Planets form in planet traps at dead zone, ice line, and heat transition
 - Disks chemically evolve
- Recalculate planet radii w/ new advances
 - New Equations of State (EOS) for water⁷, iron⁸, silicates⁹, opacities¹⁰
 - Sequestration of water into planetary interior¹¹
- **Can radius valley be replicated solely w/ water?**



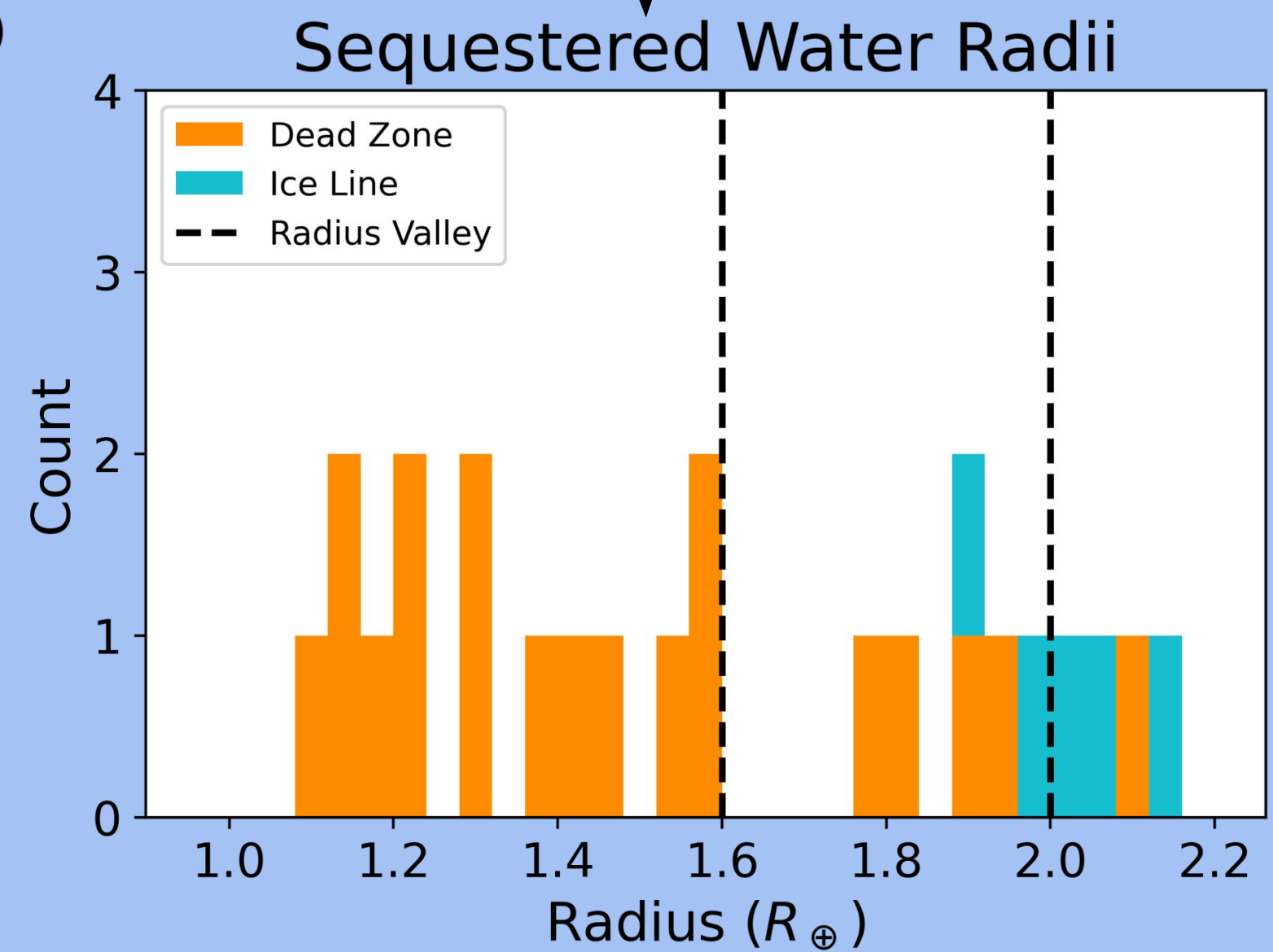
Data



Update EOS



Sequester Water



Results

- Updated EOS and sequestration separate water and dry worlds
 - Water does NOT solely replicate radius valley, but could contribute
 - Some water worlds in the valley

Future Work

- Update McMaster Planet Population Synthesis model for M stars
- Increase sample size by running more simulations
- Take advantage of disk chemistry tracking to improve mantle model

Acknowledgements & References

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