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### 2<sup>nd</sup> International Conference and Exhibition on

# **Satellite & Space Missions**

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### Size distribution of particles in Saturn's rings from aggregation and fragmentation

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**S** aturn's rings consist of a huge number of water ice particles, with a tiny addition of rocky material. They form a flat disk, as the result of interplay of angular momentum conservation and the steady loss of energy in dissipative interparticle collisions. For particles in the size range from a few centimeters to a few meters, a power-law distribution of radii, ~ r-q with  $q\approx3$ , has been inferred; for larger sizes, the distribution has a steep cutoff. It has been suggested that this size distribution may arise from a balance between aggregation and fragmentation of ring particles, yet neither the power-law dependence nor the upper size cutoff have been established on theoretical grounds. Here, we propose a model for the particle size distribution that quantitatively explains the observations. In accordance with data, our model predicts the exponent q to be constrained to the interval  $2.75 \le q \le 3.5$ . Also an exponential cutoff for larger particle sizes establishes naturally with the cutoff radius being set by the relative frequency of aggregating and disruptive collisions. This cutoff is much smaller than the typical scale of microstructures seen in Saturn's rings.

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#### Studying hydrological processes in dry land landscapes: Can satellites help in data-poor regions?

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Dry lands occupy one third of the Earth's surface and are home to around 400 million people, yet the water resources of these regions are often poorly understood because of a lack of fundamental hydrological data. Thus fundamental questions of (eco) hydrological function of these river systems cannot be understood at a detailed scale. Earth observation satellites have been proved to provide data and information on water cycle in multiple spatio-temporal scales. This research project aims to develop remotely-sensed data approaches in order to improve our understanding of hydrological processes in data-sparse dry land landscapes. Four objectives were investigated: (i) to evaluate the accuracy and effectiveness of satellite derived altimetry data for estimating flood water depths in low-gradient, multi-channel rivers; (ii) to detect and map flood extents and optimize the trade-off between image frequency and spatial resolution using Landsat and MODIS satellites imagery; (iii) to assess satellite-based Digital Elevation Models (DEMs) accuracy for hydrodynamic modeling; and (iv) to use a hydrodynamic model supported by satellite-derived data to investigate flood water transmission loss. This research concluded that it is now possible to realistically constrain water balances in data-sparse dry land rivers using hydrodynamic models in combination with satellite-derived data to address limitations in the availability of conventional hydrological datasets. This research has implications for the opportunities, limitations, and future directions of using remotely-sensed data to better understand water balance and hydrodynamics of data-sparse regions. This knowledge is imperative for improved management of the limited water resources in dry land, both in Australia and around the world.

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