Predicting Martian Winds for a Smarter Path Towards Colonization

Process Paper

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With work towards a manned mission to Mars already underway, led by SpaceX and NASA, hopes for Mars colonization are closer than ever before. In this proposal, our team suggests locations best fit for aerosol dispersal based on dust density data collected from NASA's Mars Climate Sounder [MCS]. This data is vital to any effort to terraform Mars through greenhouse gasses, as the gasses would need to flow from the localized area throughout the red planet. This data is also helpful in determining the future locations of any large Martian settlements, as areas with low dispersal could be prone to localized air pollution, which could harm the settlements long term outcomes.

The dataset used was raw text data from the MCS and recorded a significant amount of information, most of which was not necessary to us. After writing scripts to download and parse the data into a usable .CSV file for our purposes, we worked to find correlations in the data through plotting the Mar's coordinates and assigning color values to data samples.

By overlaying this over a Mercator projection of the Martian terrain, we could analyze the affect the Martian terrain has on dust formations. Looking at the data day-by-day reveals more, since the MCS will pass near the same location after multiple orbits, we were able to recognize what areas have stagnant dust coverage and what areas have heavy wind flow. These locations are heavily dependent on the Martian terrain below, as to be expected.

This has allowed us to predict Martian wind movements from pre-existing Mars dust data. With more time and people on this project, we believe this data could further be used to predict, with high accuracy the speed and directions of wind patterns on Mars.

We deployed time series model on the dataset, using monthly data from April 2015, which was recorded secondly. We applied resampling on variable 'Dust Density' by minutes to regroup the data, it improves model running time and model accuracy. ARIMA(3,0,4) was apply in this case, we were able to achieve 0.003 prediction errors, with an upward trending prediction of dusty density. Just by looking at April 2015, the Martian wind movements are stronger during the month, weaker at the beginning and the end of April.

Based the on the dust and wind predictions, combined with existing data on ideal habitable locations on Mars, we believe that the Utopia Planitia Plains located at 46.7N, 117.5E and the Mars 6 Landing Site located at 23.9S, 19.4W would be the best places for both colonization and greenhouse gas dispersal. From the data we analyzed, these locations lie in areas with heavy wind and dust movement, making them more ideal for human colonization than other proposed sites.