**Analysis: Francalanci Model**

**Method of running model**

1. Read in Van Melkebeke dataset.
2. Calculate additional required variables:
   1. Surface area of equivalent sphere
   2. mP surface area
   3. Equivalent spherical volume
   4. mP mass
   5. Corey Shape factor
   6. Relative density
   7. Projected area of volume equivalent sphere
3. For each particle:
   1. Calculate the reference diameter
   2. Calculate the dimensionless particle size
   3. Calculate the coefficient
   4. Calculate the coefficient
   5. Calculate the coefficient
   6. Calculate the exponent
   7. Calculate the dimensionless settling velocity
   8. Calculate the terminal settling velocity
4. For each output file:
   1. Calculate the average error:
   2. Calculate the root mean squared error:

**Results and discussion**

Chart, scatter chart

Description automatically generated

Chart, scatter chart

Description automatically generated

Considering all the datapoints, the model overestimates the terminal settling velocity of all particles.

Chart, scatter chart

Description automatically generated

Considering only the mPs with fragment morphology, the model overestimates the settling velocity of all fragments.

Chart, scatter chart

Description automatically generated

Considering only the fibrous mPs, the model greatly overestimates the settling velocity of the mPs.

Chart, scatter chart

Description automatically generated

Considering only the films, the model greatly overestimates the terminal settling velocity of film mPs.

Chart, scatter chart

Description automatically generated

The particle terminal settling velocity increases as particle size increases. The fragments have the largest volume equivalent spherical diameter.

Diagram

Description automatically generated

The fragment mPs have the highest CSF.

Summary table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Shape** | **m** | **R2** | **AE (%)** | **RMSE (%)** |
| All | 1.8839 | 0.8871 | 128.31 | 15.11 |
| Fragment | 1.8280 | 0.9295 | 95.48 | 10.26 |
| Fibre | 2.5770 | -0.0224 | 176.13 | 19.34 |
| Film | 2.3790 | -0.0561 | 170.05 | 20.04 |

Based on the values of m, the model predicts the settling velocity of fragment most accurately. The average error is high for all shapes. Overall, the model overestimates the terminal settling velocity of all the mP particles. In Francalanci’s paper their model also overestimates the data in Van Melkebeke.

**Conclusion**

* Model performs best for fragments.
* Model predictions are not very accurate with high errors.
* Model overestimates the settling velocity considerably.