ÓMICAS

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Use of NDVI as a tool to estimate N_2O emissions in sugarcane crops.

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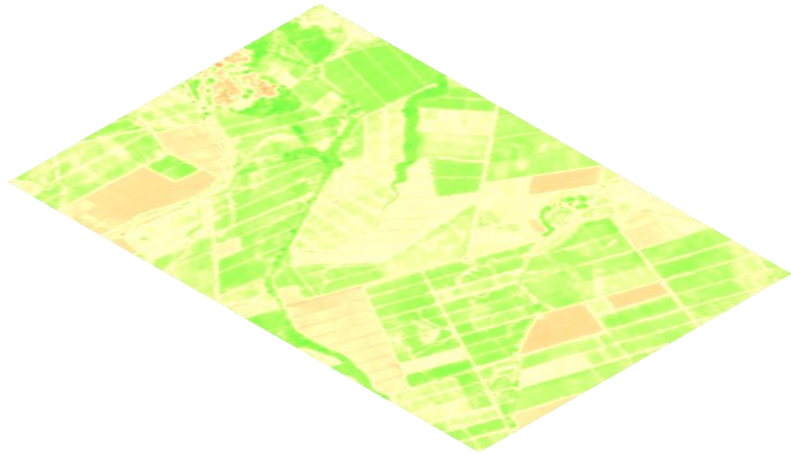
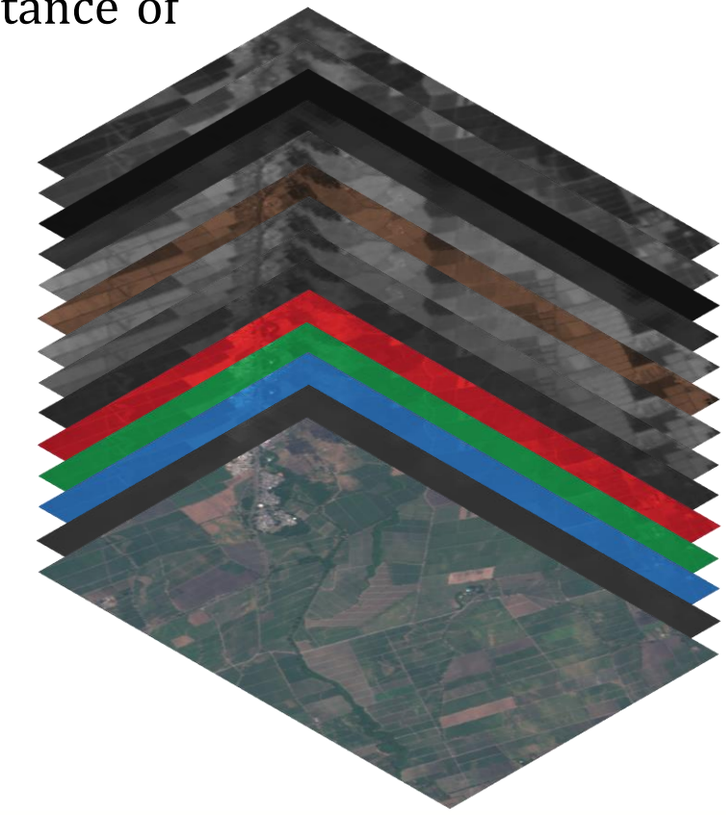
CONTENT

- Introduction
- Materials and methods
- Results

Which is the Normalized difference vegetation index (NDVI)?

Mathematical model to determine the quantity, **quality and development of vegetation**, from the relationship between absorbance and reflectance of bands of the **electromagnetic spectrum** on a surface





$$NDVI = \frac{(IR_{Near} - Red)}{(IR_{Near} + Red)}$$

IR_{Near} = spectrum near infrared, Red = spectrum of red

Introduction.

Why Oxide nitrous (N_2O)?

- Greenhouse gas.
- Capacity to absorb infrared radiation is ~310 times greater than that of CO_2 over a period of 100 years.
- It degrades stratospheric ozone.
- It is a chemical compound that can be stable in the atmosphere for up to ~114 years.

~27 % of direct N_2O emissions are of anthropogenic origin.

<u>~80 % of anthropogenic emissions are the result of inefficient use of nitrogen fertilizers.</u>

Why Surgarcane?

in 2018, ~27'684.787 hectares of sugarcane were cultivated in the world (FAO, 2020).

In 2019, ~500,100 hectares were reported in Colombia (MinAgriculture, 2020).

50% of the area (~250.000 ha) is planted in the Cuaca River Valley. In this region an intensive model predominates in which it is recommended to apply, generally, **<u>> 100 N kg ha^{-1} cultivated</u>**.

Materials and methods.

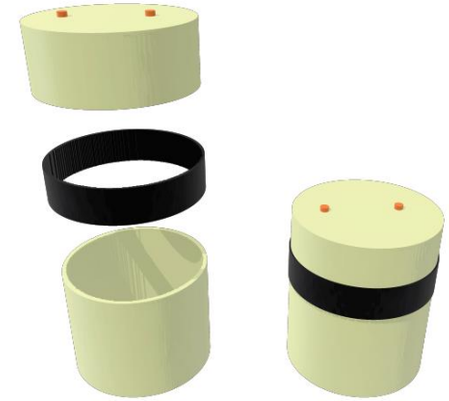
Ubication
("-76.28315 W-3.67431 N" and "-76.28450 W-3.67039 N"**)**

Time period
August 20, 2019 - March 30, 2020

Software

QGIS® trademark

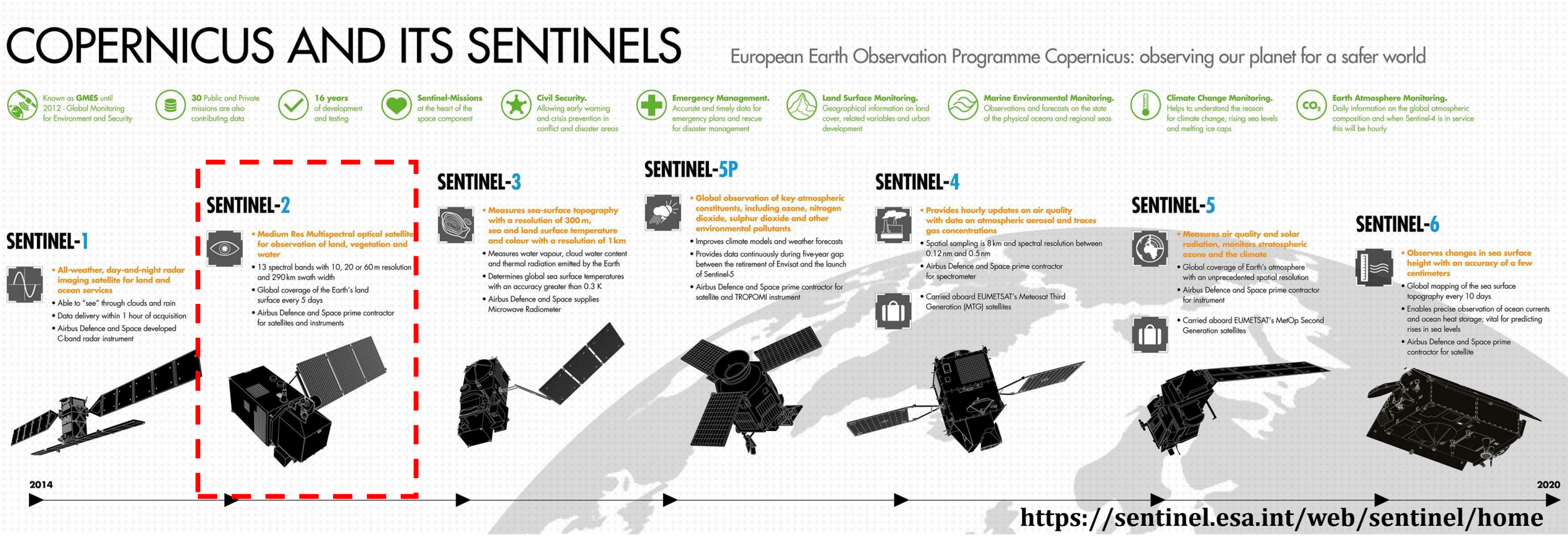
N_2O cumulative emission data



Direct field measurement
(Manual Static Chambers)

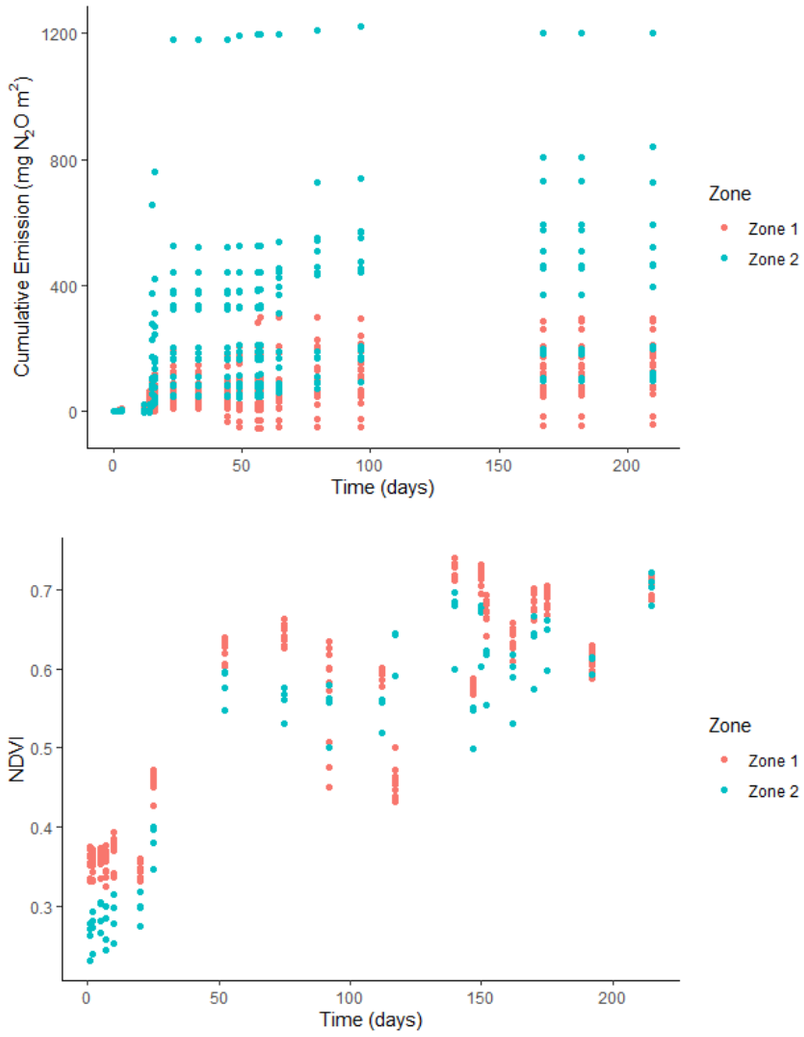
Laboratory analysis
(Gas chromatograph)

Multispectral data.



https://sentinel.esa.int/web/sentinel/home

Results.



Model for NDVI	Zone 1		Zone2	
	R^2	p-value	R^2	p-value
Cubic	0.8004	< 2.22e-16	0.9212	< 2.22e-16
Quadratic	0.7873	< 2.22e-16	0.8919	< 2.22e-16
Potential	0.7661	< 2.22e-16	0.8726	< 2.22e-16
Exponential	0.7389	< 2.22e-16	0.8439	< 2.22e-16
Logarithmic	0.7339	< 2.22e-16	0.814	< 2.22e-16
Linear	0.7338	< 2.22e-16	0.7918	< 2.22e-16
Sigmoidal	0.3287	< 2.22e-16	0.4096	< 2.22e-16
Inverse	0.3067	< 2.22e-16	0.3718	< 2.22e-16

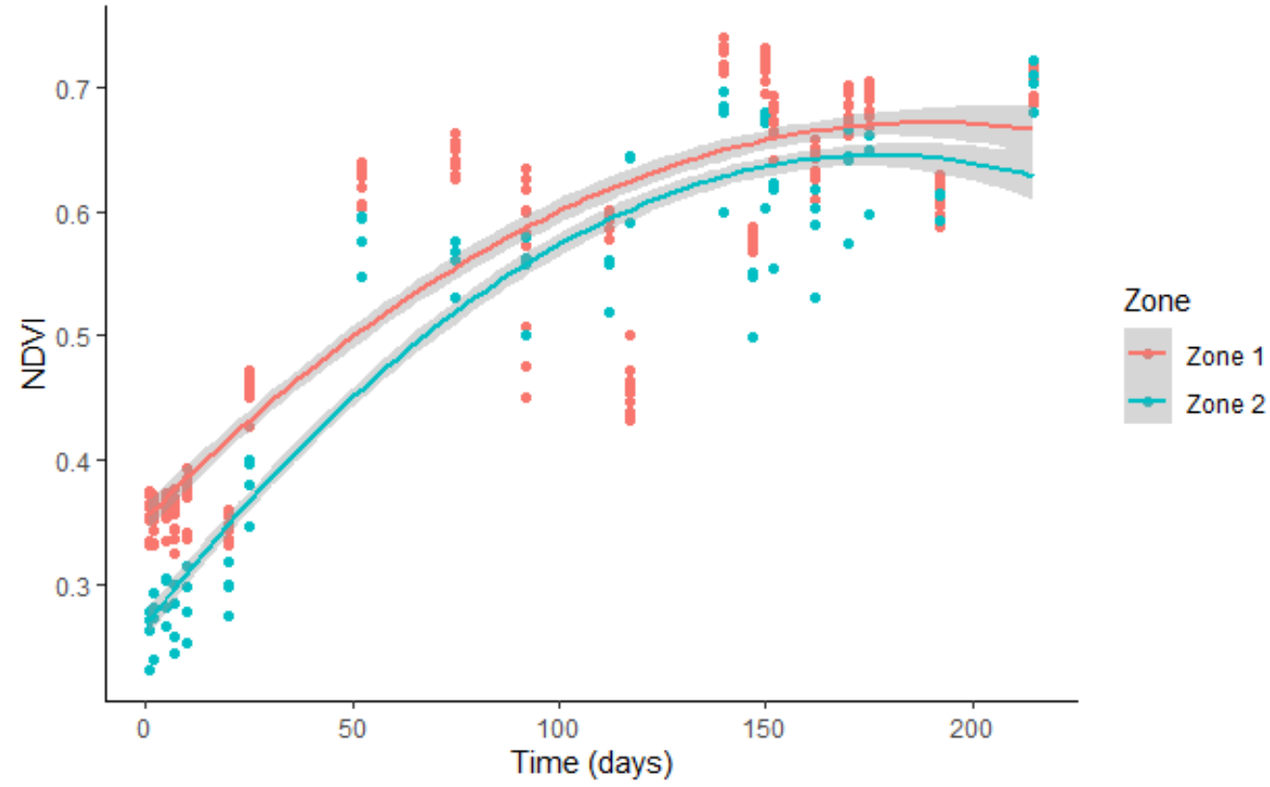
Results.

$$NDVI_{(Zone1)} = 0.35 + (3.35^{-3} * Time) + (-8.85^{-6} * Time^2)$$

$$NDVI_{(Zone2)} = 0.27 + (4.25^{-3} * Time) + (-1.2^{-5} * Time^2)$$

Zone	R^2	R^2 ajusted	Statistician-F	p-value
1	0.79	0.79	849.6	5.09E-155
2	0.89	0.89	1373.9	1.321E-161

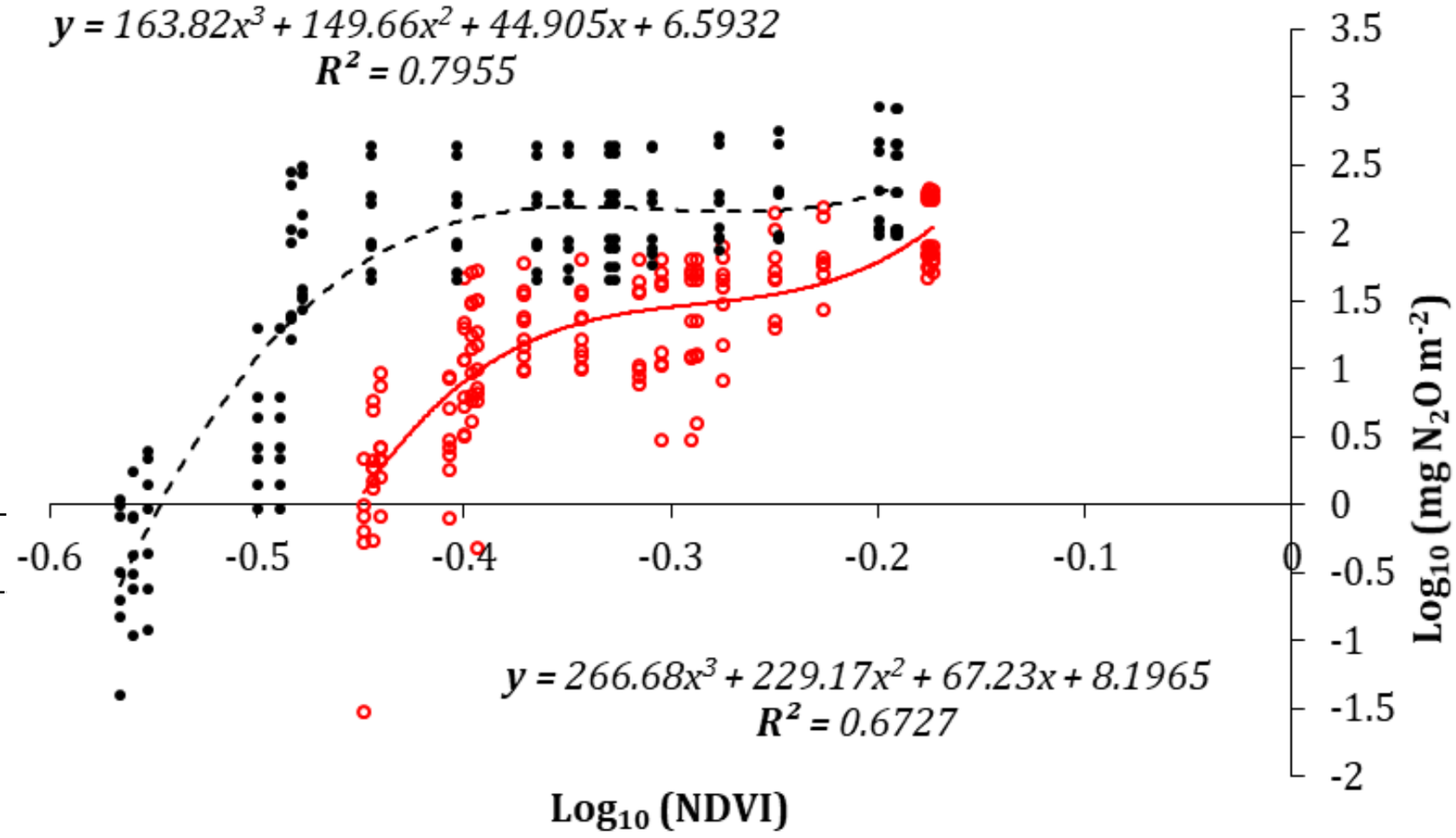
Zone	Variables	n	Spearman	p-value
1	N_2O-NDVI(t)	190	0.53	<0.0001
2	N_2O-NDVI(t)	152	0.75	<0.0001



Results.

Model_Z1	R^2	p-value
Cubic	0.6727	< 2.22e-16
Quadratic	0.6344	< 2.22e-16
Linear	0.6013	< 2.22e-16
Inverse	0.5018	< 2.22e-16
Sigmoidal	0.3838	< 2.22e-16

Model_Z2	R^2	p-value
Cubic	0.7955	< 2.22e-16
Quadratic	0.7507	< 2.22e-16
Linear	0.5573	< 2.22e-16
Inverse	0.3555	1.6218e-15
Sigmoidal	0.1977	1.2986e-07



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