

# Calibrating the WSA velocity in EUHFORIA based on PSP observations



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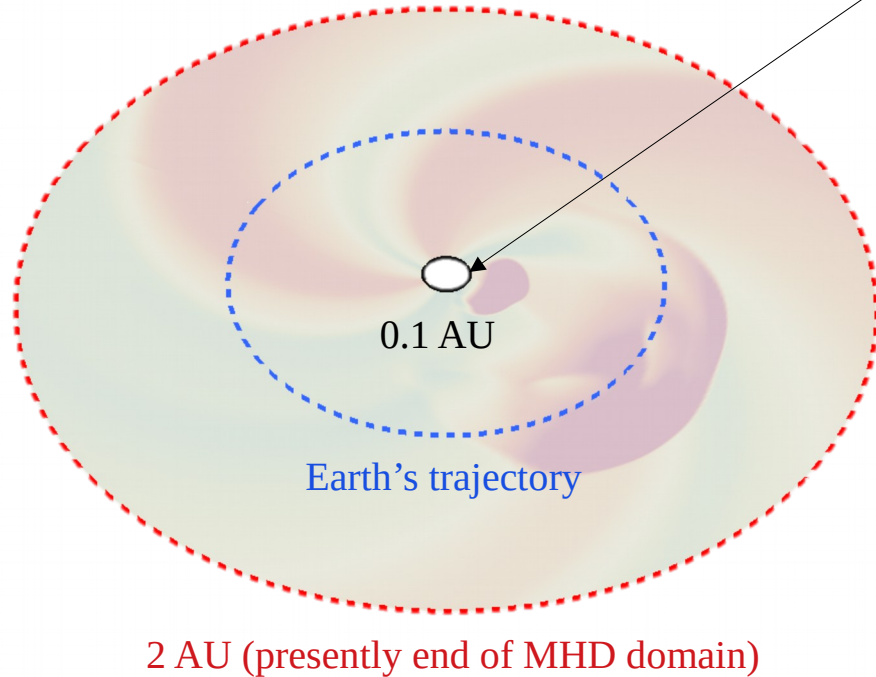
*in collaboration with*

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# Motivation

EUFORIA's domain (*Pomoell & Poedts, 2018*)



(Image credits: Jens Pomoell)

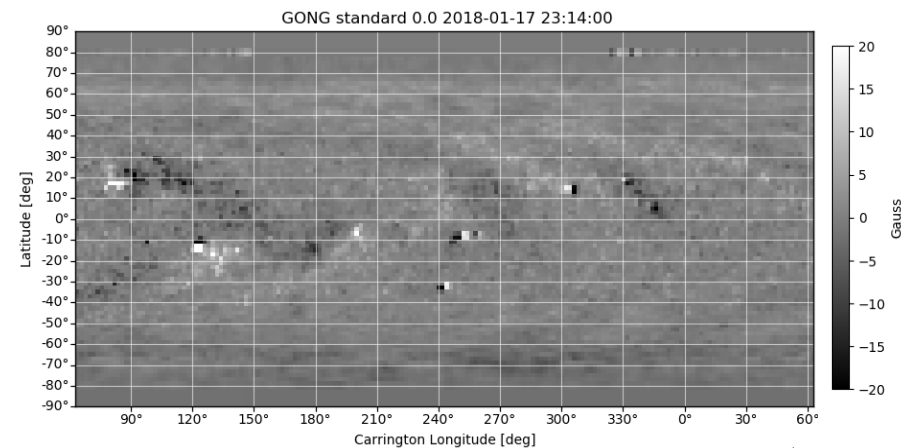
## WSA model

$$u_{1 \text{ AU}} = 240 + \frac{675 \{1 - 0.8 e^{[-(\frac{\theta_b}{0.02})^{1.25}]} \}^3}{(1 + f_s)^{1/4.5}}$$

(*Arge et al., 2003/2004; Van der Holst et al., 2010*)

## How was this relationship derived?

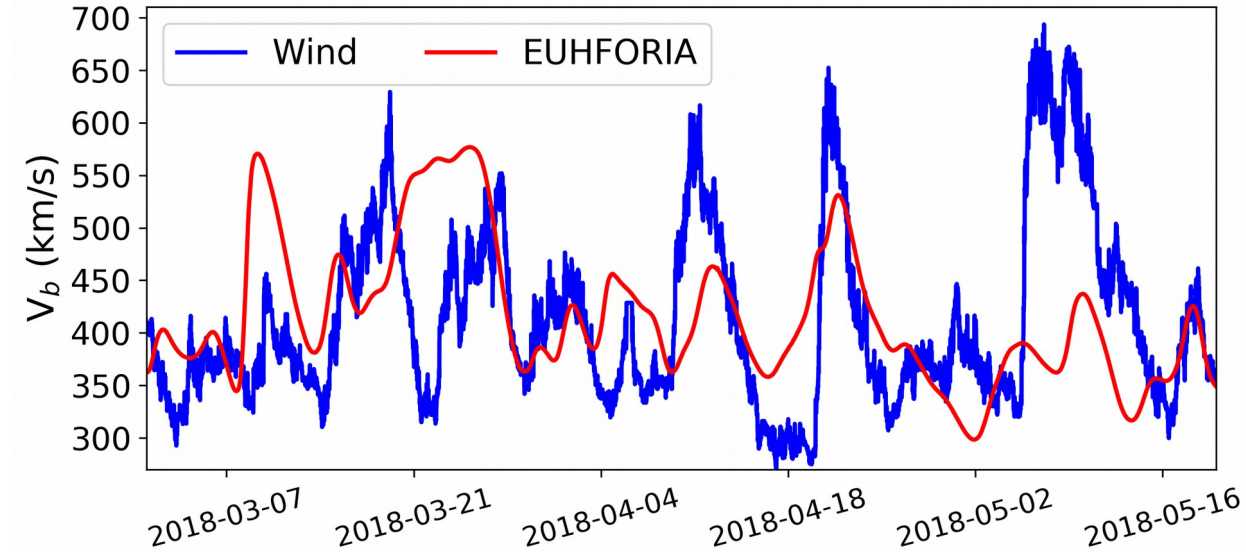
- 1) Ballistic propagation until 1 AU
- 2) GONG magnetograms



(Image credits: GONG database)

# Motivation

## Current status of solar wind modeling with EUHFORIA



(For more details on the solar wind performance with EUHFORIA see Hinterreiter et al., 2019, *Sol. Phys.*; Samara et al., 2022, *ApJ*)

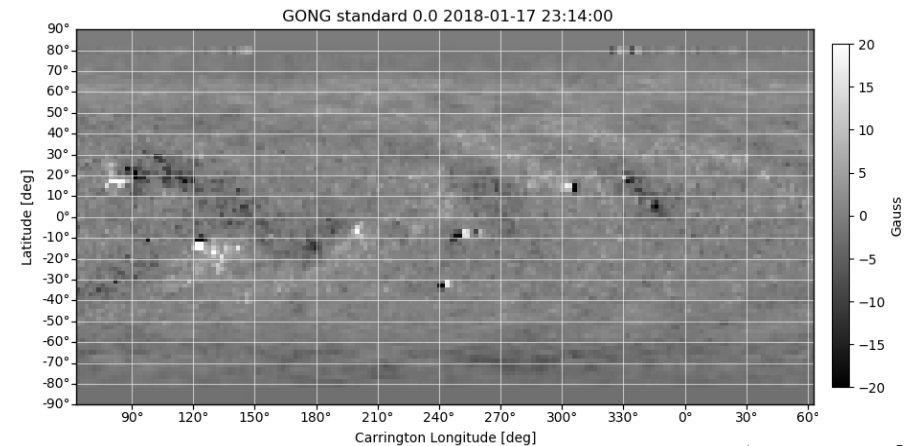
## WSA model

$$u_{1 \text{ AU}} = 240 + \frac{675 \{1 - 0.8e^{[-(\frac{\theta_b}{2.8})^{1.25}]\}^3}{(1 + f_s)^{1/0.02}}$$

(Arge et al., 2003/2004; Van der Holst et al., 2010)

## How was this relationship derived?

- 1) Ballistic propagation until 1 AU
- 2) GONG magnetograms

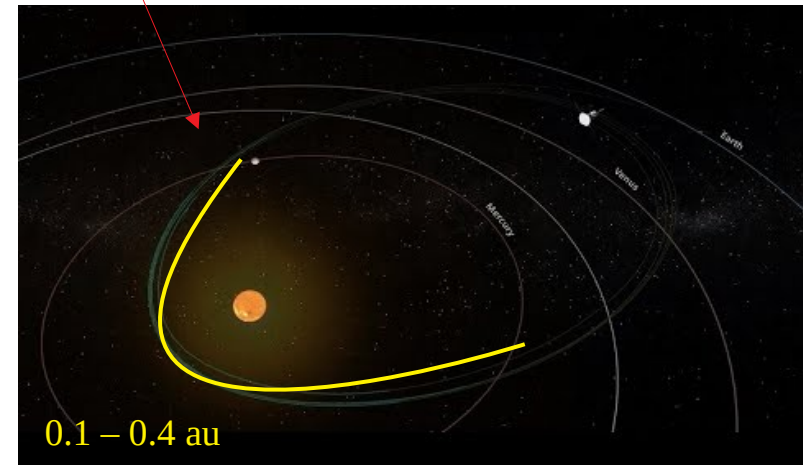
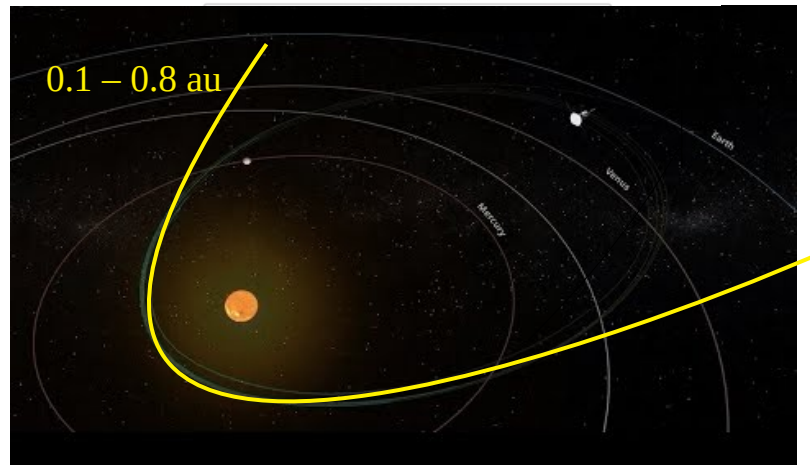
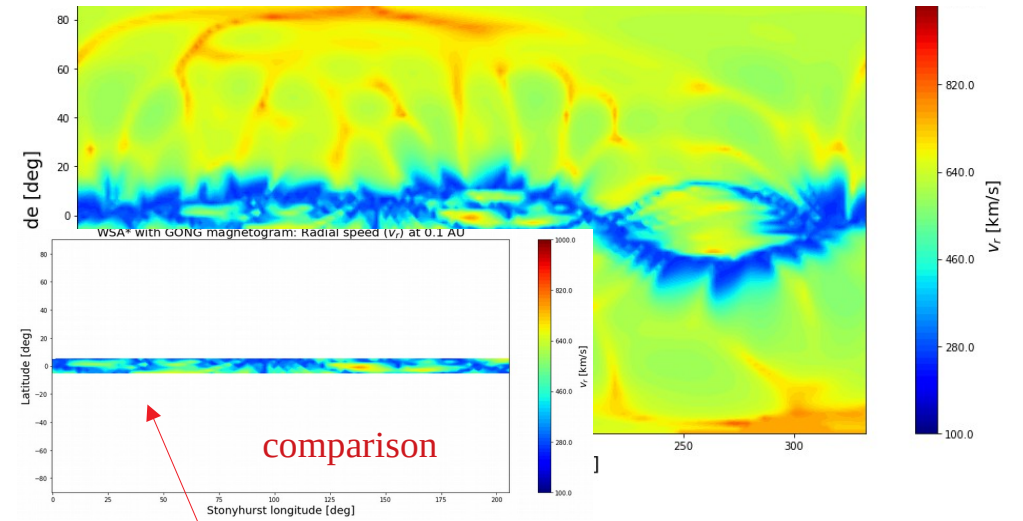
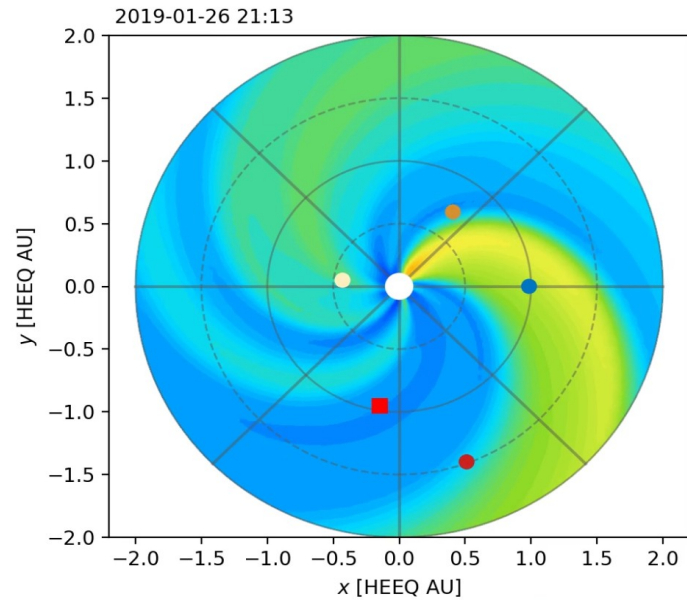


(Image credits: GONG database)

# Two ways to go

1) PSP modeled vs observed speeds (0.1 – 0.8 au)

2) WSA speeds vs PSP speeds (0.1 - 0.4 au)

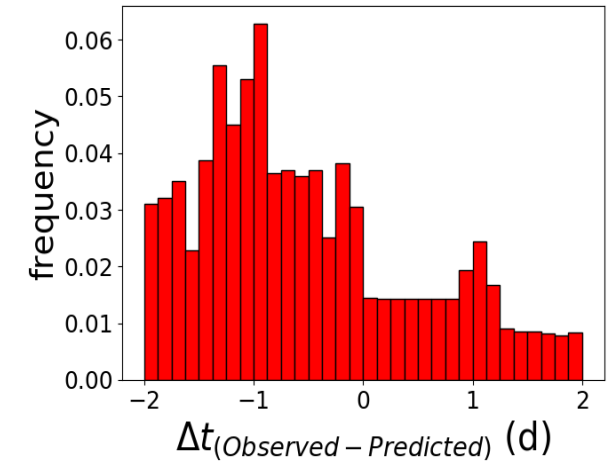
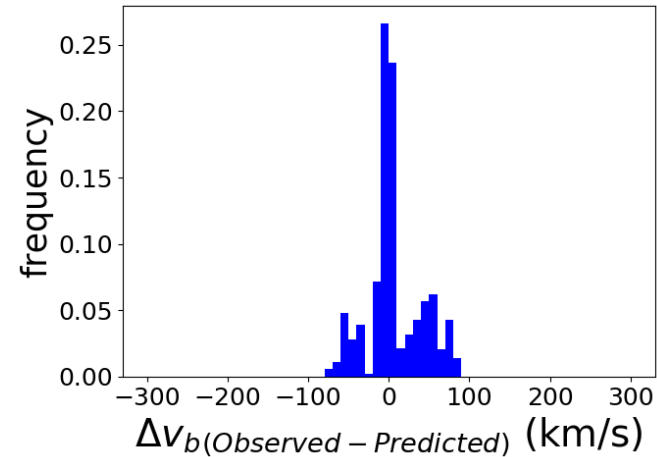
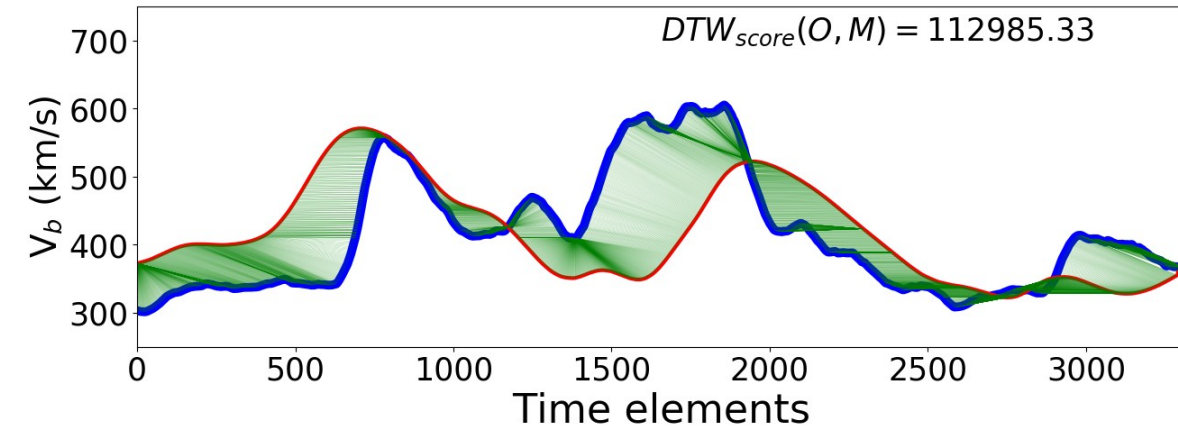


# Summary of results – evaluation with DTW

(Samara et al., 2022, ApJ)

2018-10-31 to 2018-11-23

$DTW_{score}(O, M) = 112985.33$



Definition of a **skill score** metric by employing an "ideal" and a "reference" prediction scenarios, as follows:

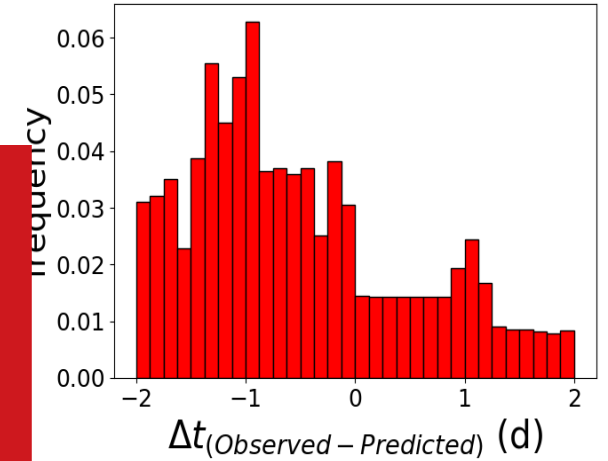
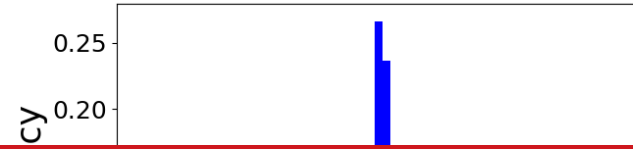
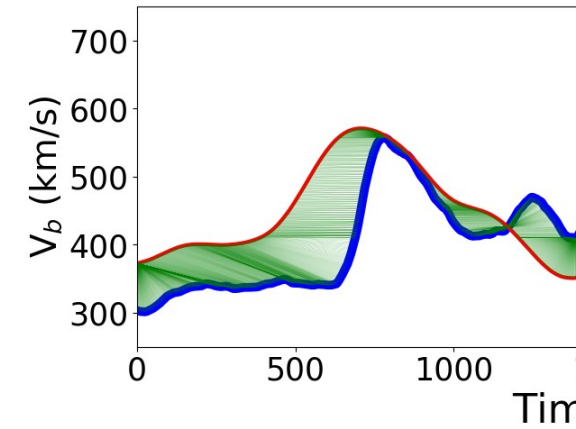
$$SSF \text{ (Sequence Similarity Factor)} = \frac{DTW_{cost}_{(Obs.vsModeled)}}{DTW_{cost}_{(Obs.vsReference)}}, \text{ } SSF = [0, 1]$$

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