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Sun flare activity may solve unknown source of helium-3 in the atmosphere

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Supplementary Information

The Supplementary Information includes:

- Weighted Averages and Errors Equations
- Tables S-1 and S-2
- Supplementary Information References

Weighted Averages and Errors Equations

The weighted averages ($\bar{x}_{wtd}$) for each run of repeated measurements and their internal error (σ_i) have been calculated using classical equations (Taylor, 1997):

Weighted average ($\bar{x}_{wtd}$) on (i = 1 to n) repeated measurements (x_i):

$$\bar{x}_{wtd} = \frac{\sum_{1=1}^{n} \frac{x_i}{\left(\frac{\sigma_i}{x_i}\right)^2}}{\left(\frac{\sigma_i}{x_i}\right)^2} \qquad \text{(Eq. S-1)}$$

$$\sigma_i = \sqrt{\frac{1}{\sum_{i=1}^{n} \frac{1}{\sigma_i^2}}} \qquad \text{(Eq. S-2)}$$

Supplementary Tables

Table S-1 Atmospheric helium isotopes observed from January 1st, 2020 to January 14th, 2021.

Sample Code	Date	First Run		Second Run		Third Run		Average
		$\delta^3He/^4He$ (‰)	2σ error	$\delta^3He/^4He$ (‰)	2σ error	$\delta^3He/^4He$ (‰)	2σ error	$\delta^3He/^4He$ (‰)
310-5	1/1/2020	-2.6	3.1	-2.8	2.5	2.9	3.5	-0.8
310-8	4/1/2020	-0.4	4.1	1.9	2.8	1.1	2.9	0.9
311-4	7/1/2020	-3.0	3.2	-2.7	2.6	2.5	3.1	-1.1
309-5	10/7/2020	-2.1	4.1	2.3	2.6	-2.6	3.0	-0.8
309-7	1/14/2021	-2.7	3.0	3.0	3.8	-0.4	3.4	0.0

Table S-2 Atmospheric helium isotopes variation observed at Solar flare on September 8th, 2017.

Sample Code	Date	First Run		Second Run		Third Run		Average
		$\delta^3He/^4He$ (‰)	2σ error	$\delta^3He/^4He$ (‰)	2σ error	$\delta^3He/^4He$ (‰)	2σ error	$\delta^3He/^4He$ (‰)
A038	8/30/2017	-3.7	3.7	2.0	3.2	-2.9	3.3	-1.5
A001	9/4/2017			2.0	3.5	1.1	3.8	1.6
A035	9/13/2017			8.4	3.4	6.4	4.1	7.4
A130	9/20/2017	4.8	3.1	5.2	3.0			5.0
A134	9/27/2017	2.8	2.5	5.5	3.3			4.2
A037	10/4/2017	-5.6	3.1	-0.2	2.9			-2.9
B031	10/11/2017	0.3	2.9	-0.3	3.1	1.3	3.2	0.4
B023	10/18/2017			0.4	3.2	-1.0	3.1	-0.3

Supplementary Information References

Taylor, J. (1997) Introduction to Error Analysis, the Study of Uncertainties in Physical Measurements. 2nd Edition. University Science Books, Sausalito, California.