ACKNOWLEDGEMENTS:

Michael J. Mumma1,4, Geronimo L. Villanueva1,2, Robert E. Novak3
1 Goddard Center for Astrobiology – NASA GSFC, 2 Catholic University of America,
3 Iona College, 4 University of Maryland College Park


“Mars – The Cutting Edge Today”

Trace Gases: CH₄, CO, O₂, O₃, H₂O, HD₄, H₂O₂ etc.
3-D spatial: longitude, latitude, & vertical
1-D temporal: (diurnal, seasonal, & inter-annual)
High resolution (spectral & spatial)

Orbiters & Rovers
MGGS, MRO, Mars Express, Maven, ExoMars 2016
Curiosity, ExoMars 2018, Mars 2020

Ground-based
Keck [NASA-IRTF] VLT
ALMA
SOFIA

Webster et al. Science 2015; updated 17 Sept 2015

Methane, O₂ & Water – Curiosity 2013 - 2015

Curiosity – Methane

TLS CH₄ vs. Time

TLS CH₄ vs. Ls

Curiosity – Methane

TLS CH₄ vs ChemCam H₂O

TLS CH₄ vs ChemCam O₃

Webster et al. Science 2013

Mapping the Methane Plumes on Mars

Methane release: Northern summer

Water and Methane Behave Differently on Mars!

Additional Checks are Satisfied

A terrestrial artifact will always appear the same red position (row/number)
The hill 1-1’ area marks the expected position where Mars is at its highest
No strong residual line appears on the hill, even when Mars is at its highest

Latitude

Longitude

Curiosity – TLS CH₄ abundance observed in 2013

Maximum CH₄ abundance observed in 2006

Maximum CH₄ abundance recorded 2013–2015

Table 1

<table>
<thead>
<tr>
<th>Table 1</th>
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<tr>
<td>Methane (CH₄)</td>
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<td>2004-05</td>
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<td>February</td>
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