

Constraining Earth's spectral longwave feedback parameter using FORUM

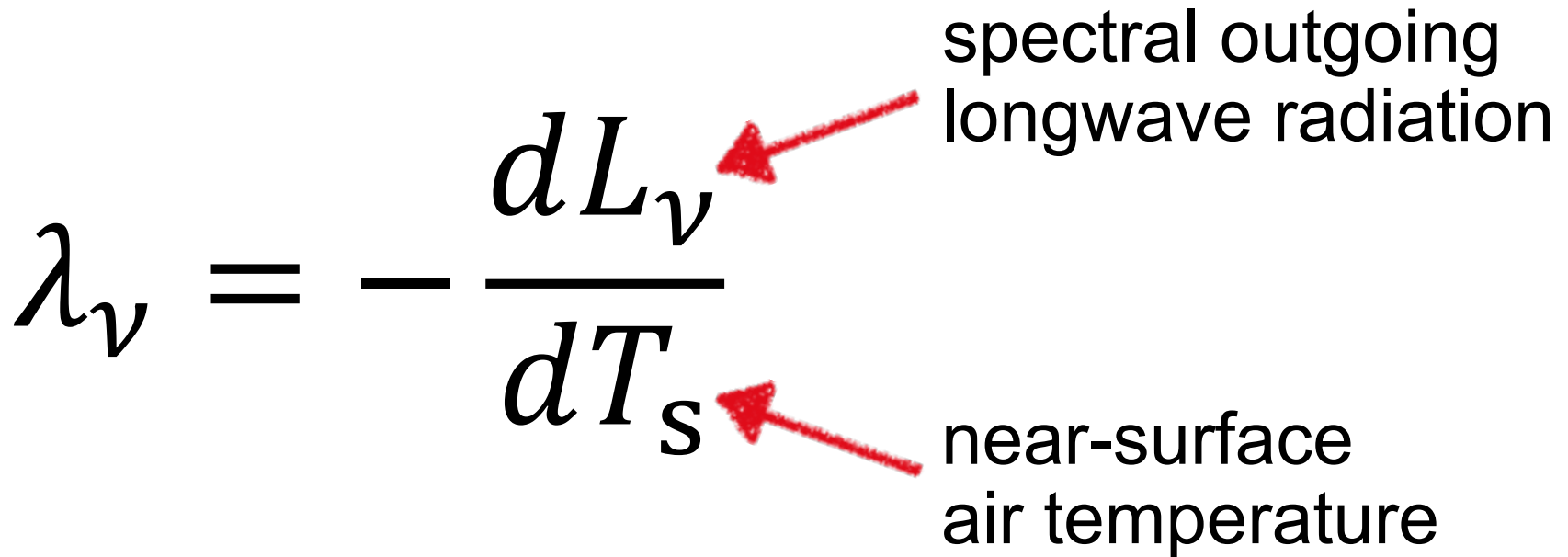
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Manfred Brath, Lukas Kluft, and Viju O. John

Spectral longwave feedback parameter

$$\lambda_{\nu} = - \frac{dL_{\nu}}{dT_s}$$

spectral outgoing
longwave radiation

near-surface
air temperature

The diagram shows the equation $\lambda_{\nu} = - \frac{dL_{\nu}}{dT_s}$. A red arrow points from the text 'spectral outgoing longwave radiation' to the variable dL_{ν} in the numerator. Another red arrow points from the text 'near-surface air temperature' to the variable dT_s in the denominator.

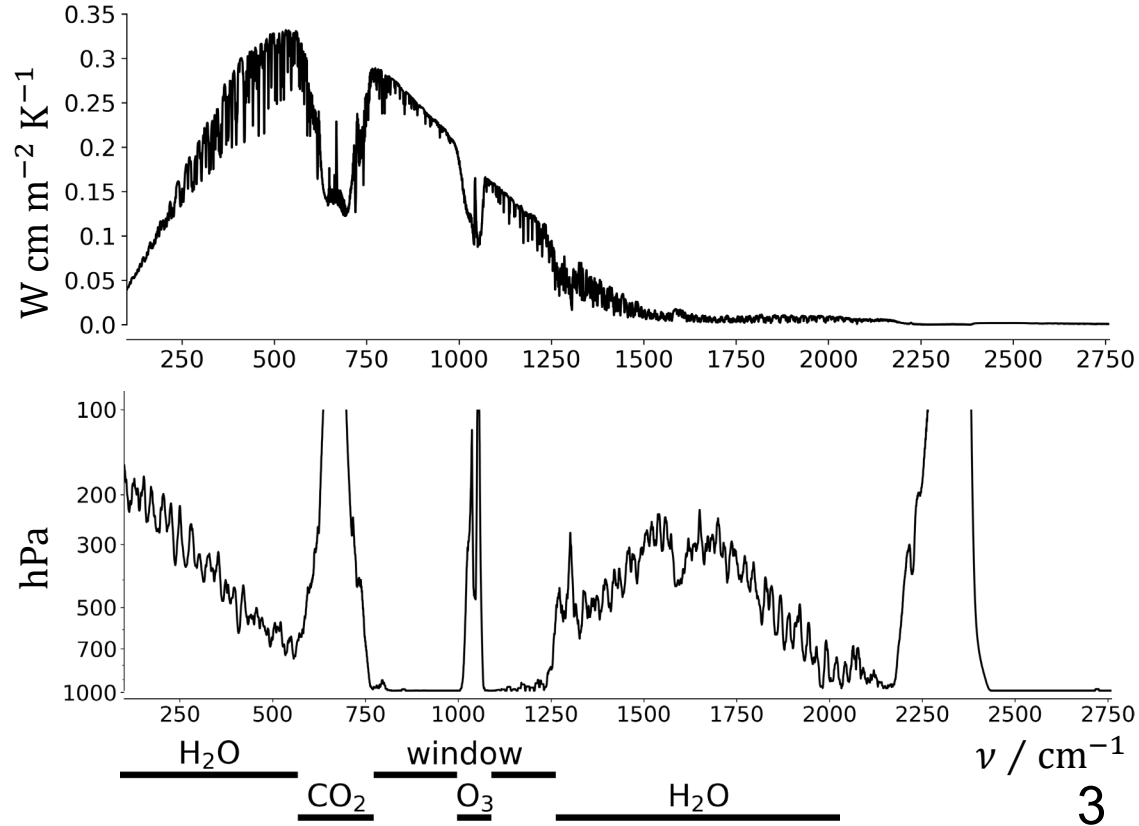
Background

spectral outgoing
longwave radiation





$$L_{\nu}$$

emission level

$$p_{em}$$

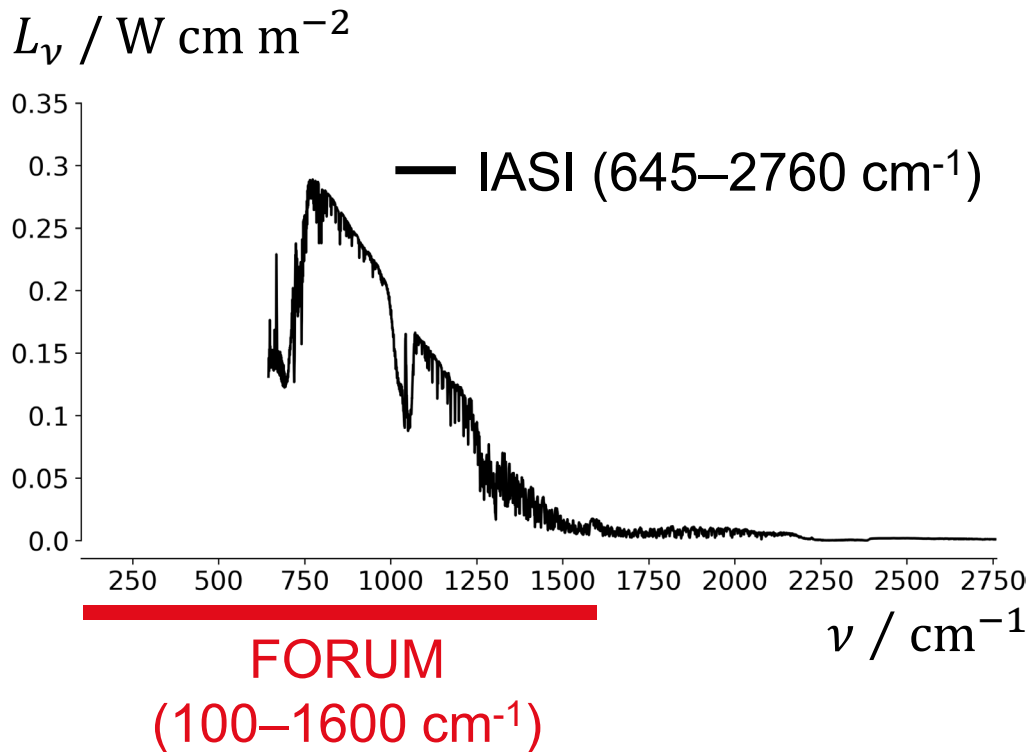


Status quo

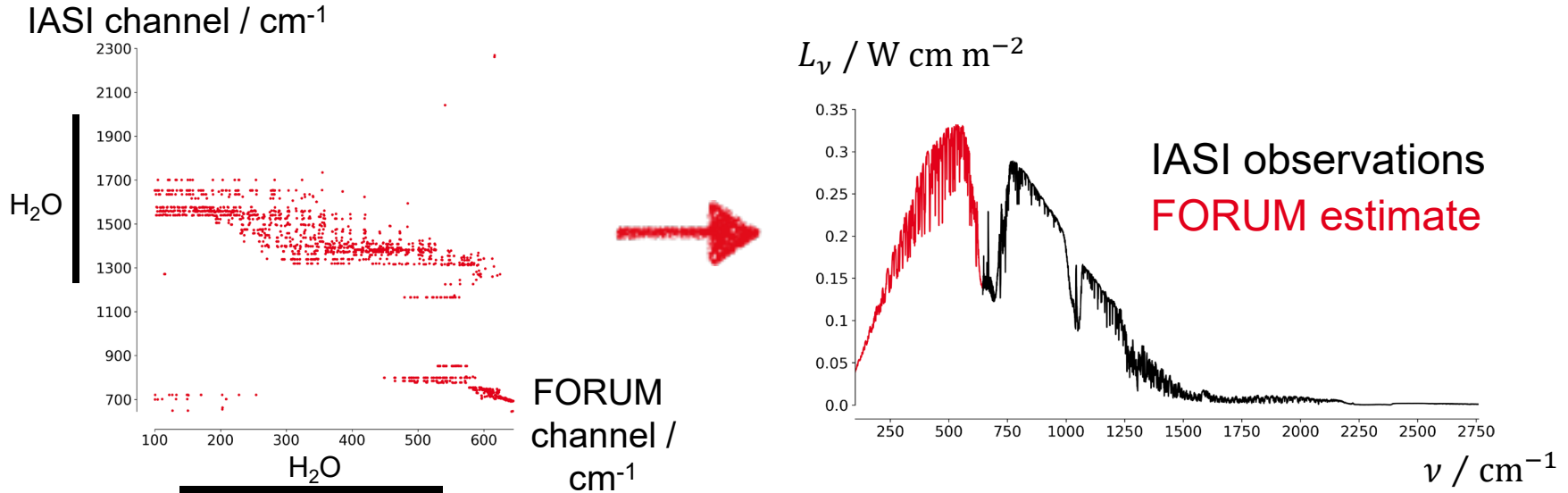
	integrated λ	spectral λ_ν
models	 E.G., GREGORY ET AL. (2004)	 E.G., JEEVANJEE ET AL. (2021)
observations	 E.G., DESSLER (2013)	

Direct observations

- global monthly all-sky L_ν calculated from IASI observations (07/2007–03/2020)
- global monthly T_s from ERA5



Estimating FORUM observations

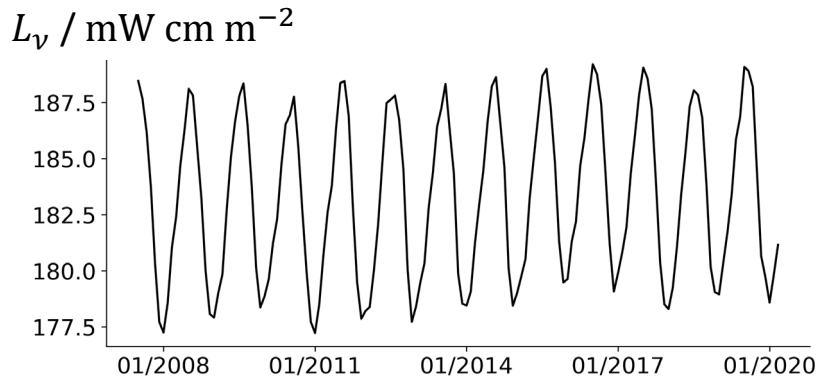


➤ predictor: highest correlated IASI channel

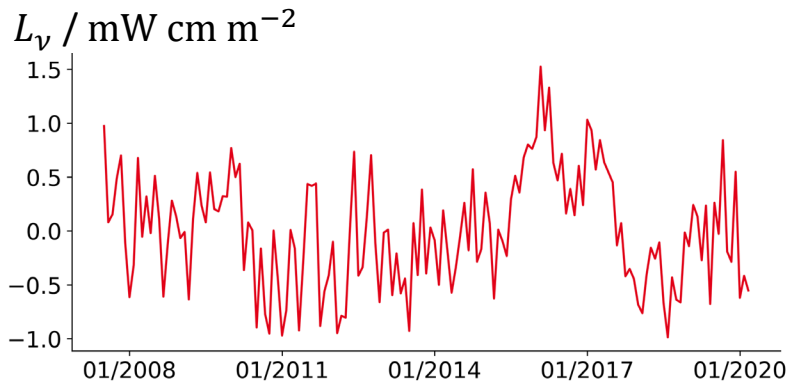
$$\text{➤ } \ln(L_{\nu, \text{FORUM}}) = a + b \ln(L_{\nu, \text{predictor}})$$

Method for inferring λ_ν

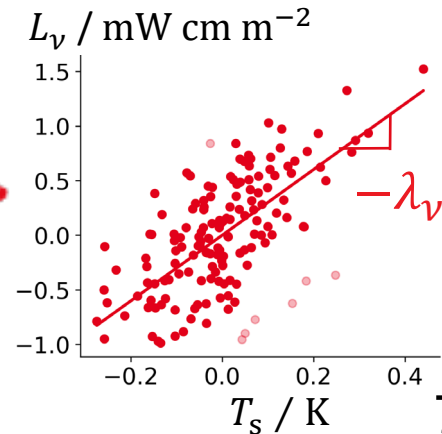
full
signal



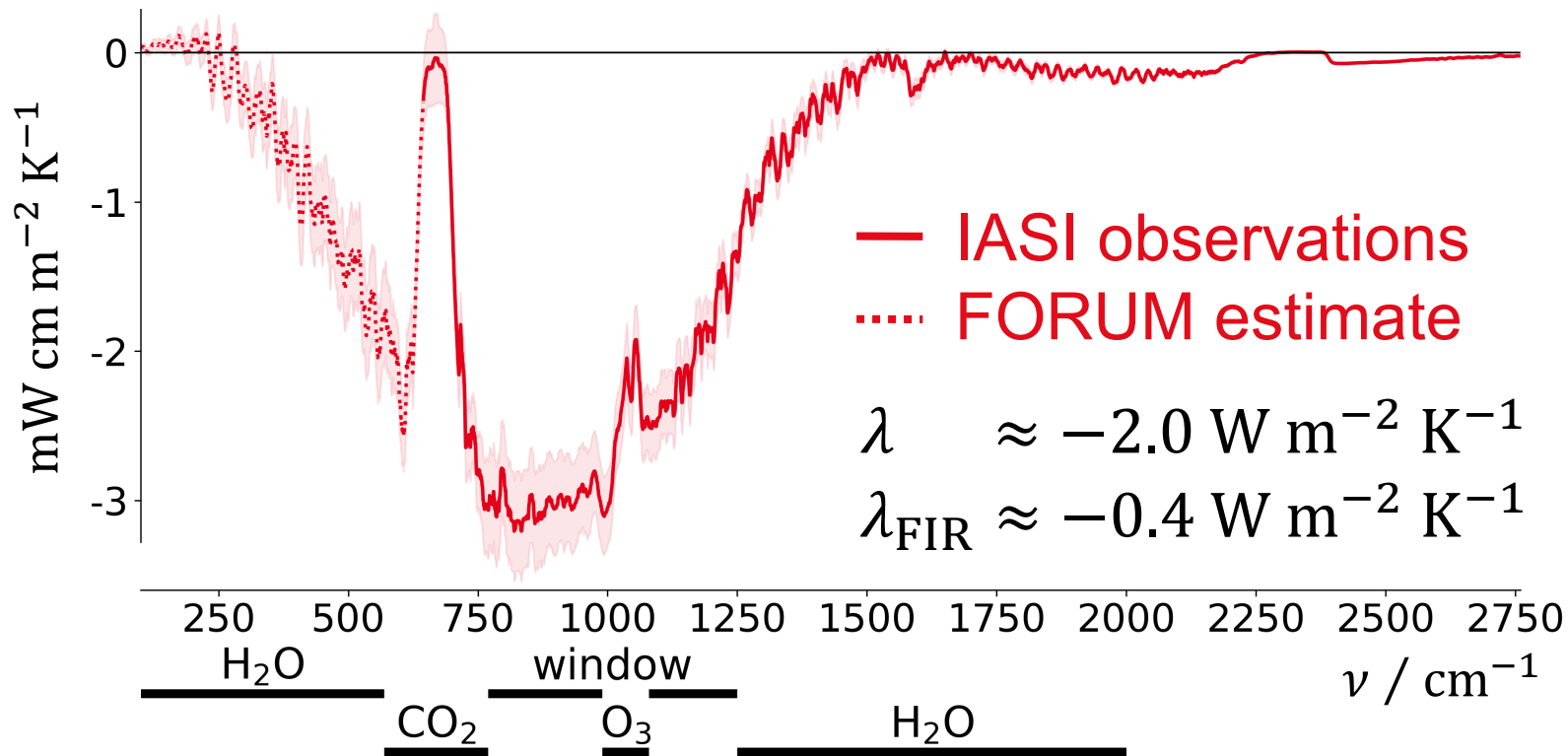
interannual
variability



➤ F. E. Roemer, S. A. Buehler, M. Brath, L. Kluff, and V. O. John (submitted): “Earth’s spectral longwave feedback parameter can be directly observed”. *Nature Geoscience*.



λ_ν from interannual variability



Take-home messages

- 1) λ_v can be directly observed by IASI
 - 2) FIR contributes substantially to total λ
 - 3) FORUM can help constrain λ_v in FIR
- F. E. Roemer, S. A. Buehler, M. Brath, L. Kluft, and V. O. John (submitted): “Earth’s spectral longwave feedback parameter can be directly observed”. *Nature Geoscience*.

References

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