

A background network diagram consisting of numerous interconnected nodes and lines, rendered in shades of brown and gold, creating a complex web-like structure.

Past and Future Fire Emission  
Trajectories &  
Aerosol Radiative Forcing

Douglas Hamilton,  
Jessica Wan, Noah Liguori-Bills,  
Matt Kasoar, Stijn Hantson  
and many more  
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# Have Northern Hemisphere Fires Increased or Decreased?

Hamilton et al. (2019) PNAS and Wan et al. (2021) GRL

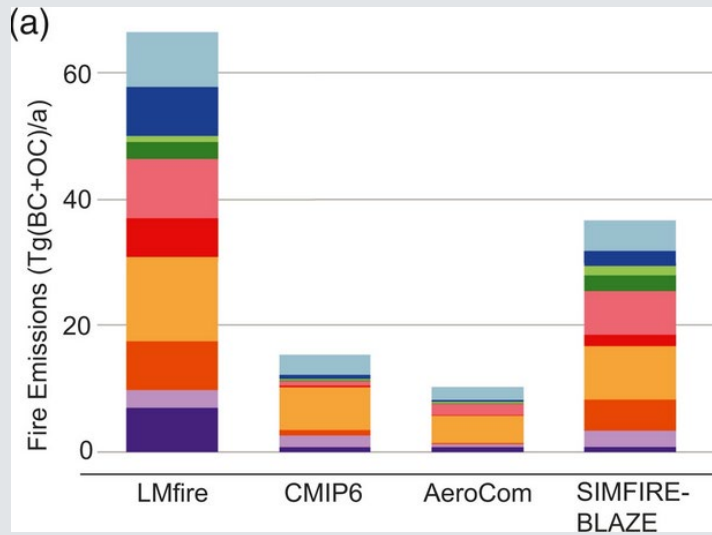
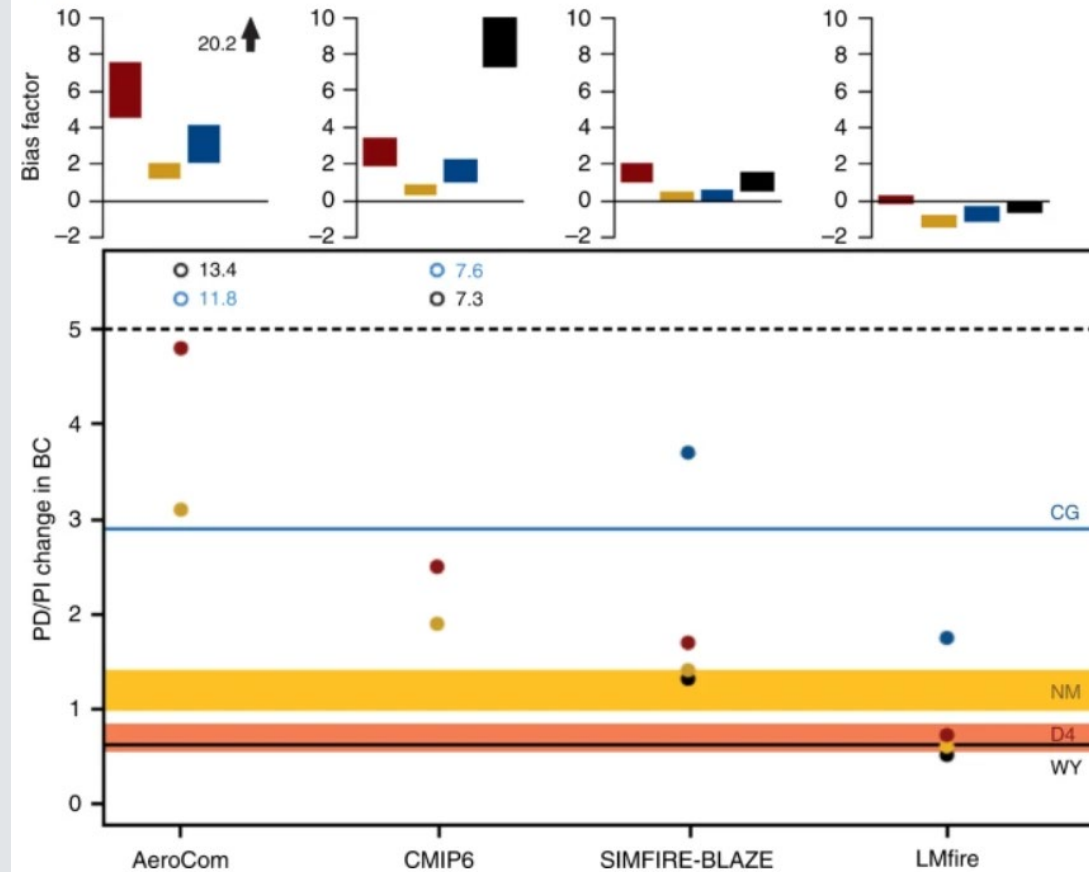


Fig. 2



For model M and ice-core observation O:

The symmetric bias factor was calculated as:

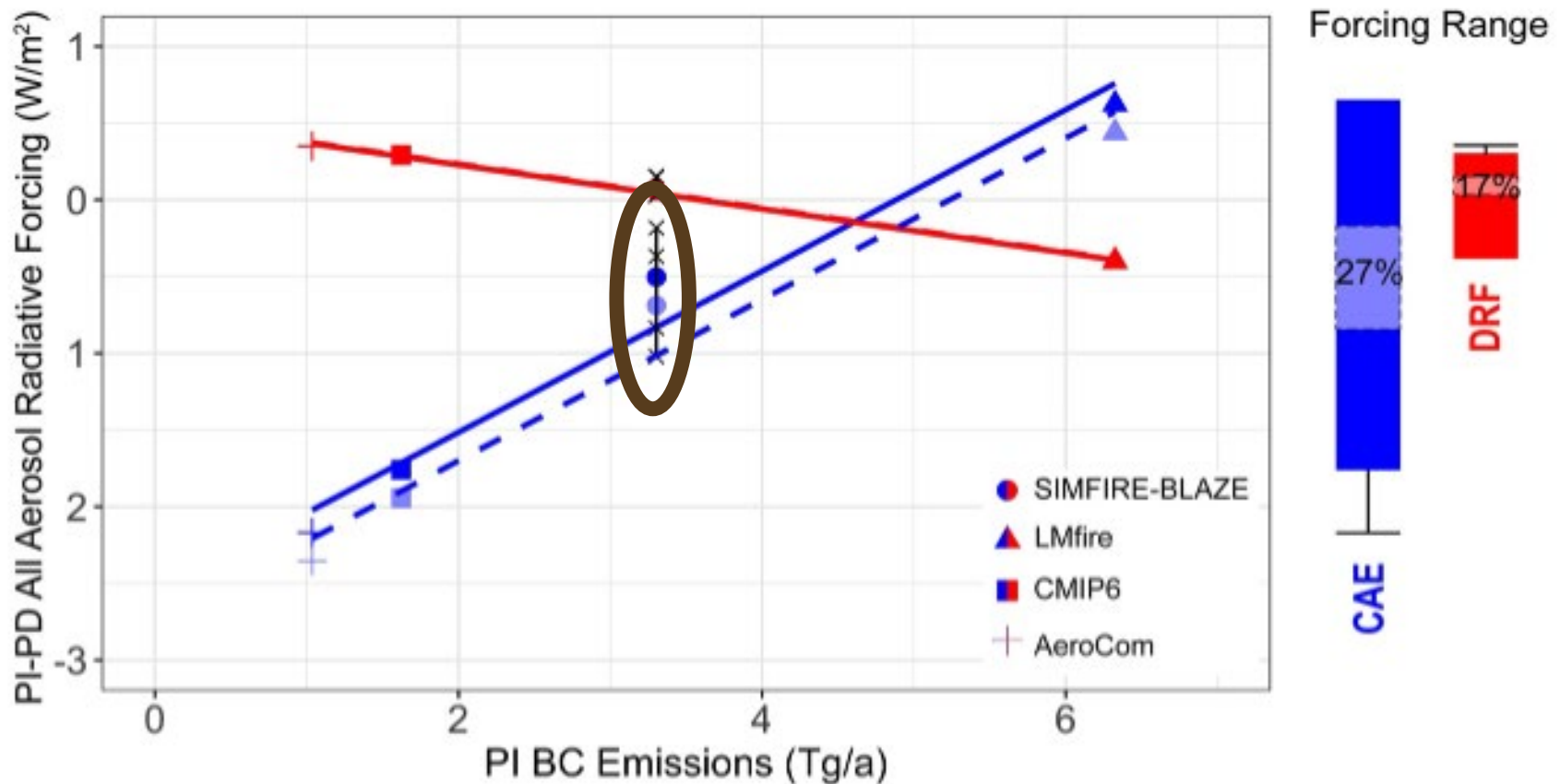
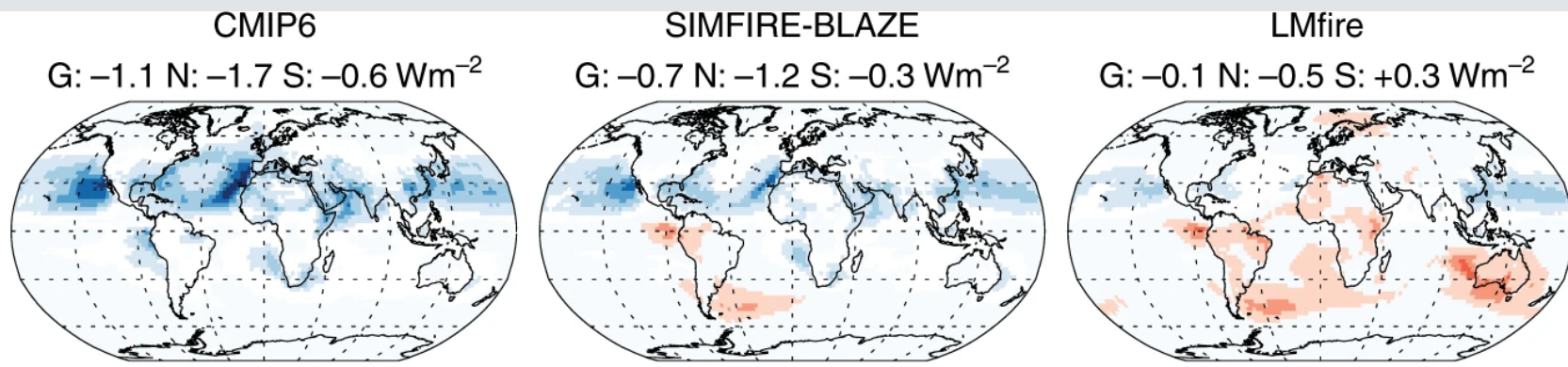
For  $M > O$ :  $(M/O) - 1$   
 For  $O > M$ :  $-(O/M) + 1$

Dot = Model Ratio  
 Line = Ice Core Ratio

CG = Colle Gnèffi (Alps)  
 NM = NEEM (Greenland)  
 D4 = D4 (Greenland)  
 WY = Wyoming (USA)

# Why should we care?

Cloud albedo forcing

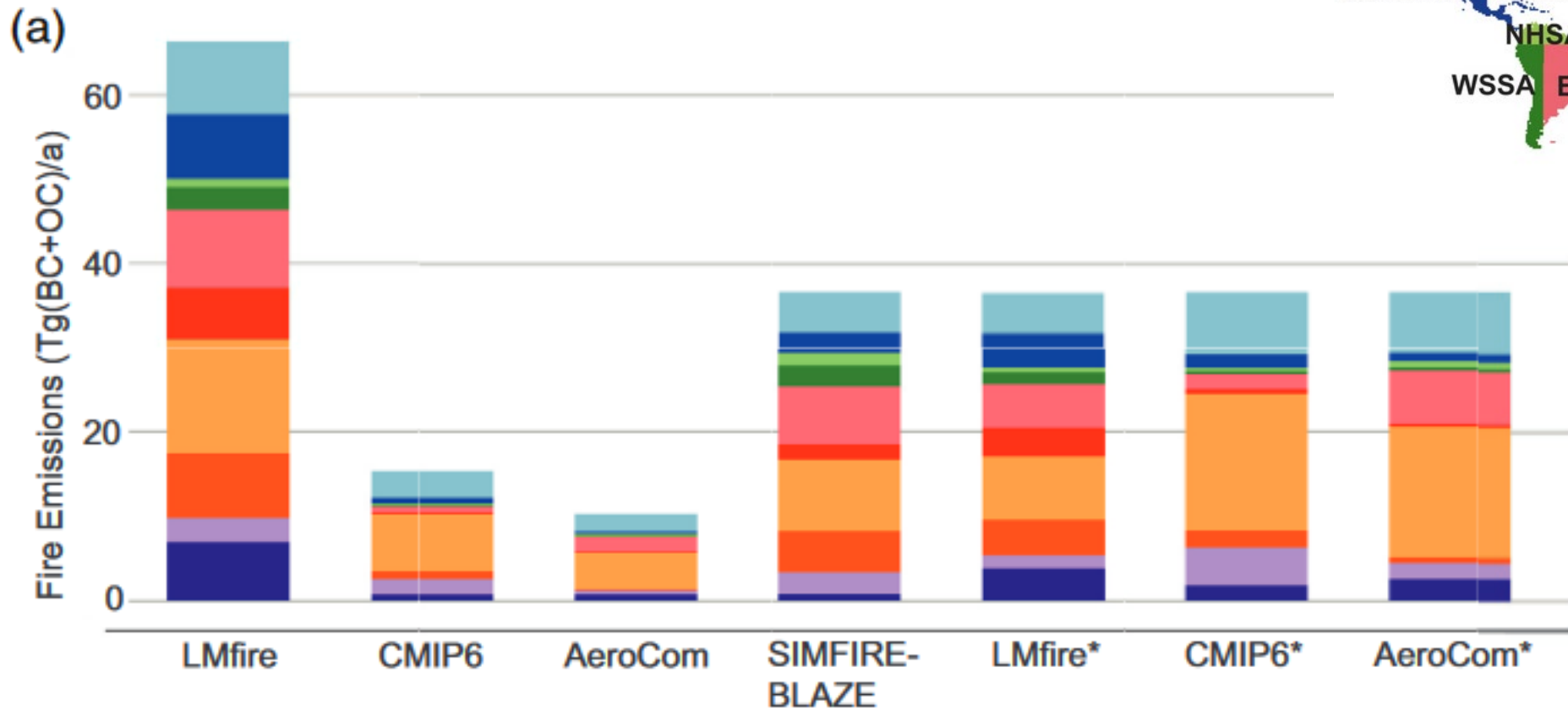


**GLOMAP (CTM)**  
 Hamilton et al. (2019)  
 ~1 W m<sup>-2</sup> Uncertainty in  
 Pre-industrial-Present Day  
 Cloud Albedo Effect

**CESM1-CAM5 (ESM)**  
 Wan et al. (2021)  
 ~2 W m<sup>-2</sup> Uncertainty in  
 Pre-industrial-Present Day  
 Cloud Albedo Effect

# Have Northern Hemisphere Fires Increased or Decreased?

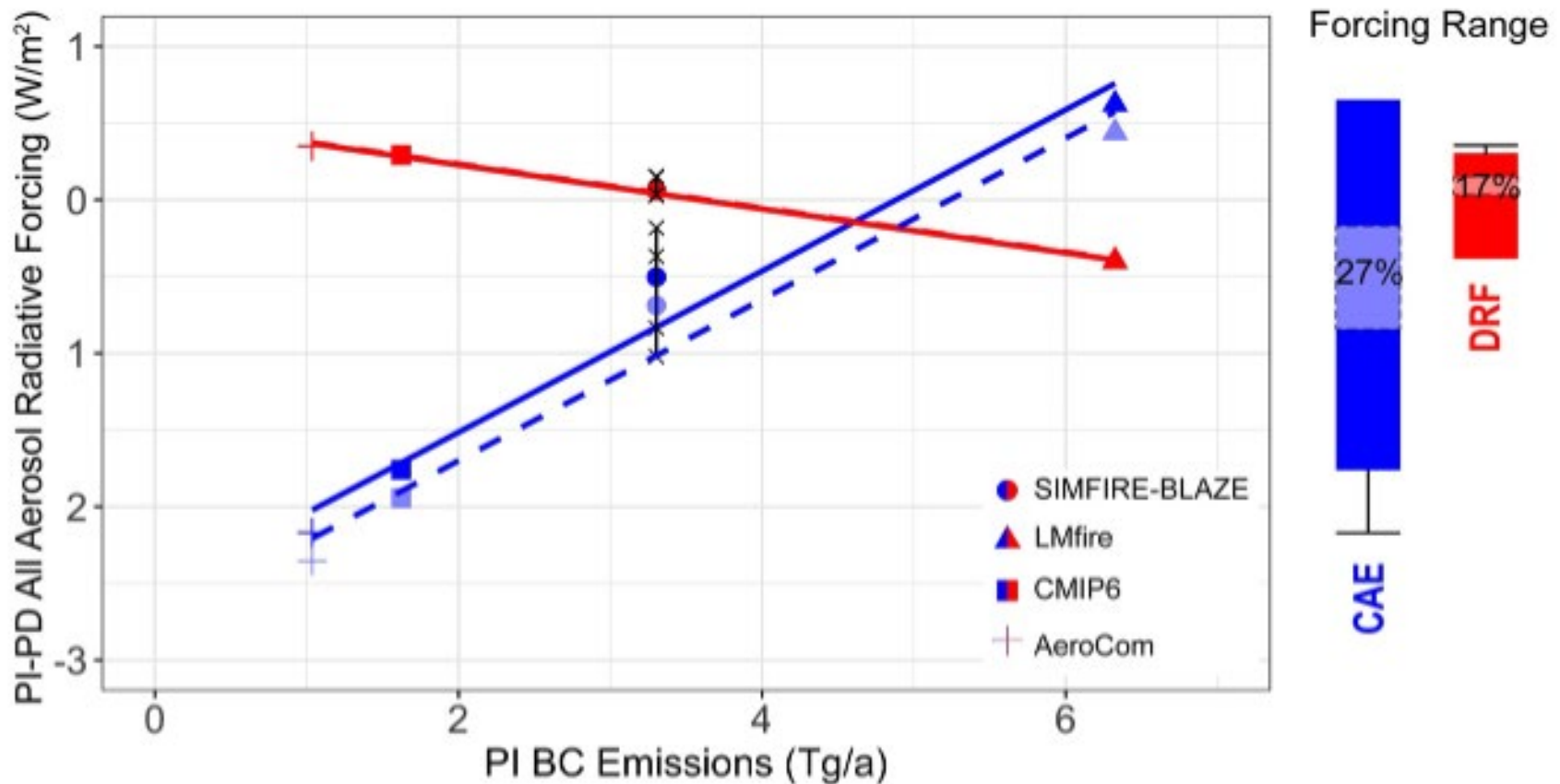
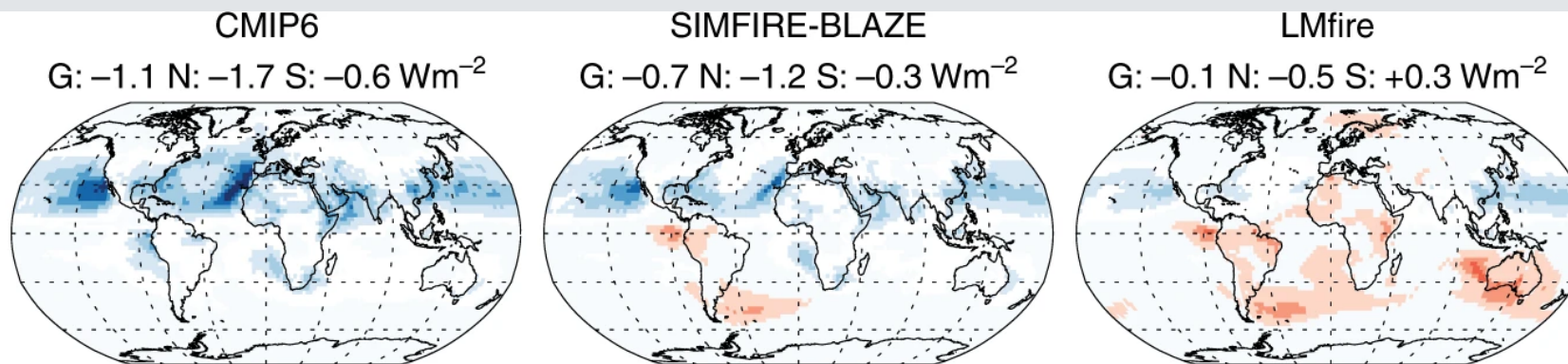
Wan et al. (2021)





# Why do we care?

Cloud albedo forcing



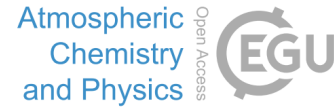
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 Cloud Albedo Effect

**CESM1-CAM5 (ESM)**  
 Wan et al. (2021)  
 ~2  $\text{W m}^{-2}$  Uncertainty in  
 Pre-industrial-Present Day  
 Cloud Albedo Effect

+ 27% Spatial Uncertainty  
 In PI Fire Emissions

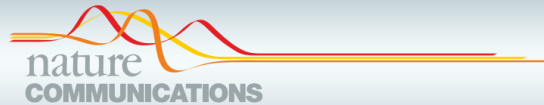
# Other Studies

Atmos. Chem. Phys., 20, 10937–10951, 2020  
<https://doi.org/10.5194/acp-20-10937-2020>  
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## Tropospheric ozone radiative forcing uncertainty due to pre-industrial fire and biogenic emissions

Matthew J. Rowlinson<sup>1,2</sup>, Alexandru Rap<sup>1</sup>, Douglas S. Hamilton<sup>4</sup>, Richard J. Pope<sup>1,3</sup>, Stijn Hantson<sup>5,6</sup>, Steve R. Arnold<sup>1</sup>, Jed O. Kaplan<sup>7</sup>, Almut Arneth<sup>3</sup>, Martyn P. Chipperfield<sup>1,3</sup>, Piers M. Forster<sup>8</sup>, and Lars Nieradzik<sup>9</sup>



ARTICLE

DOI: 10.1038/s41467-018-03838-0

OPEN

## Reduction in global area burned and wildfire emissions since 1930s enhances carbon uptake by land

Vivek K. Arora<sup>1</sup> & Joe R. Melton<sup>2</sup>

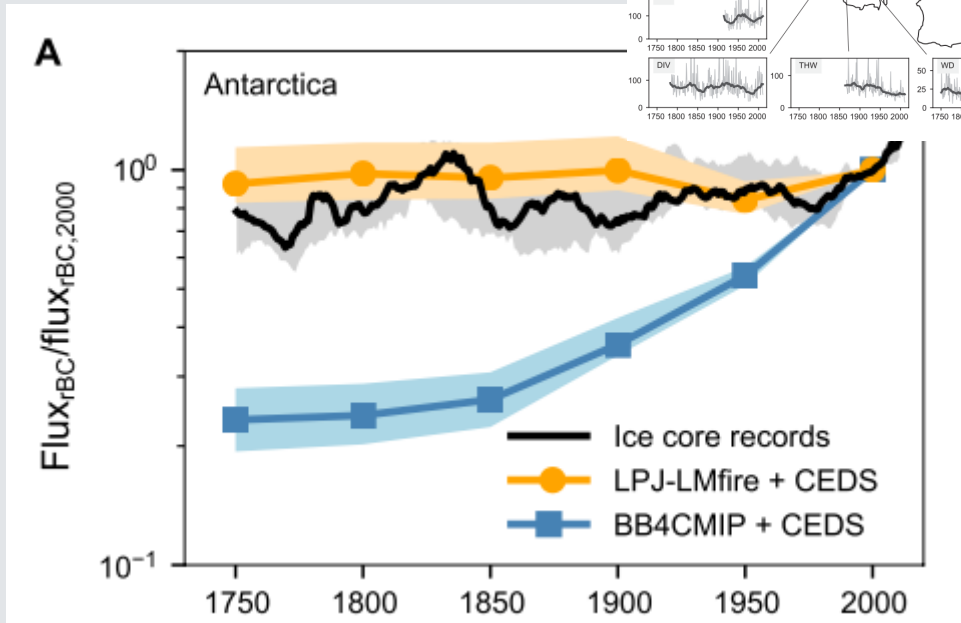
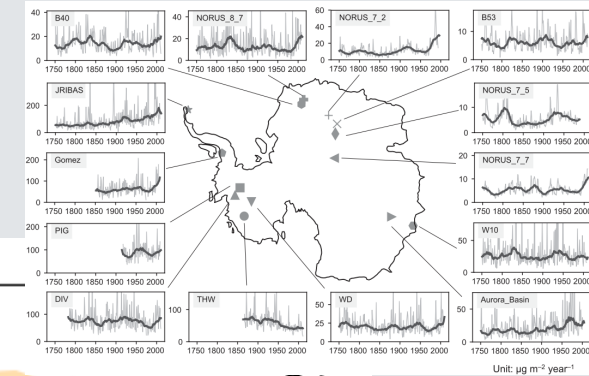
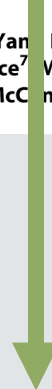
ATMOSPHERIC SCIENCE

## Improved estimates of preindustrial biomass burning reduce the magnitude of aerosol climate forcing in the Southern Hemisphere

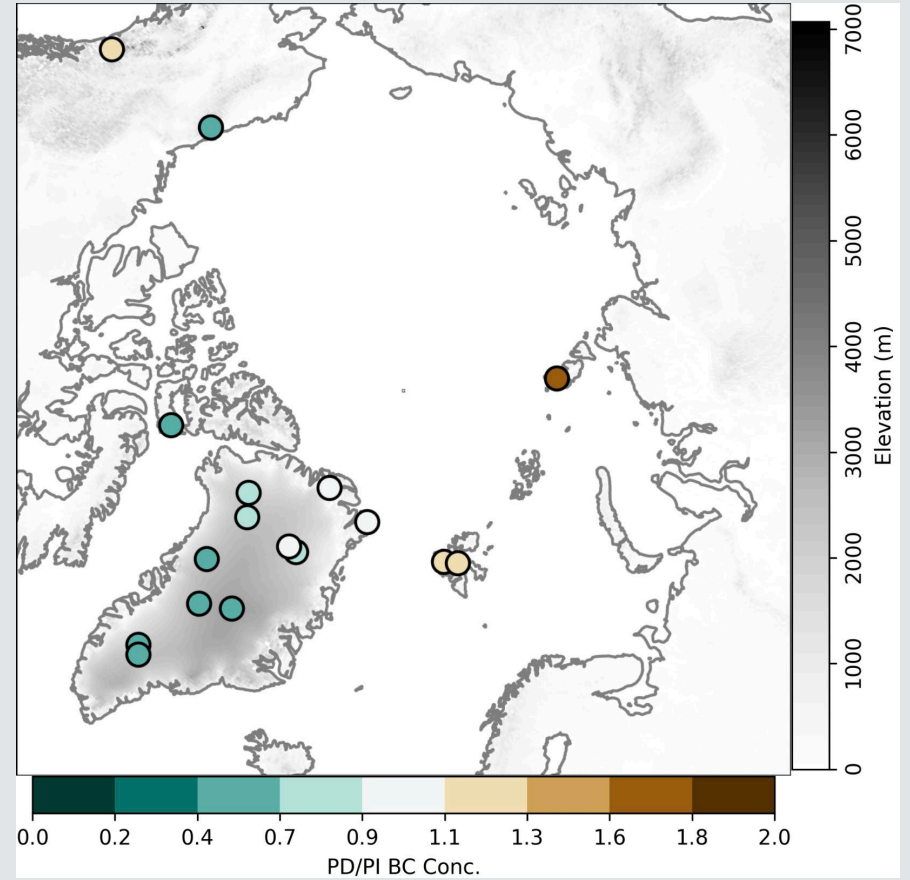
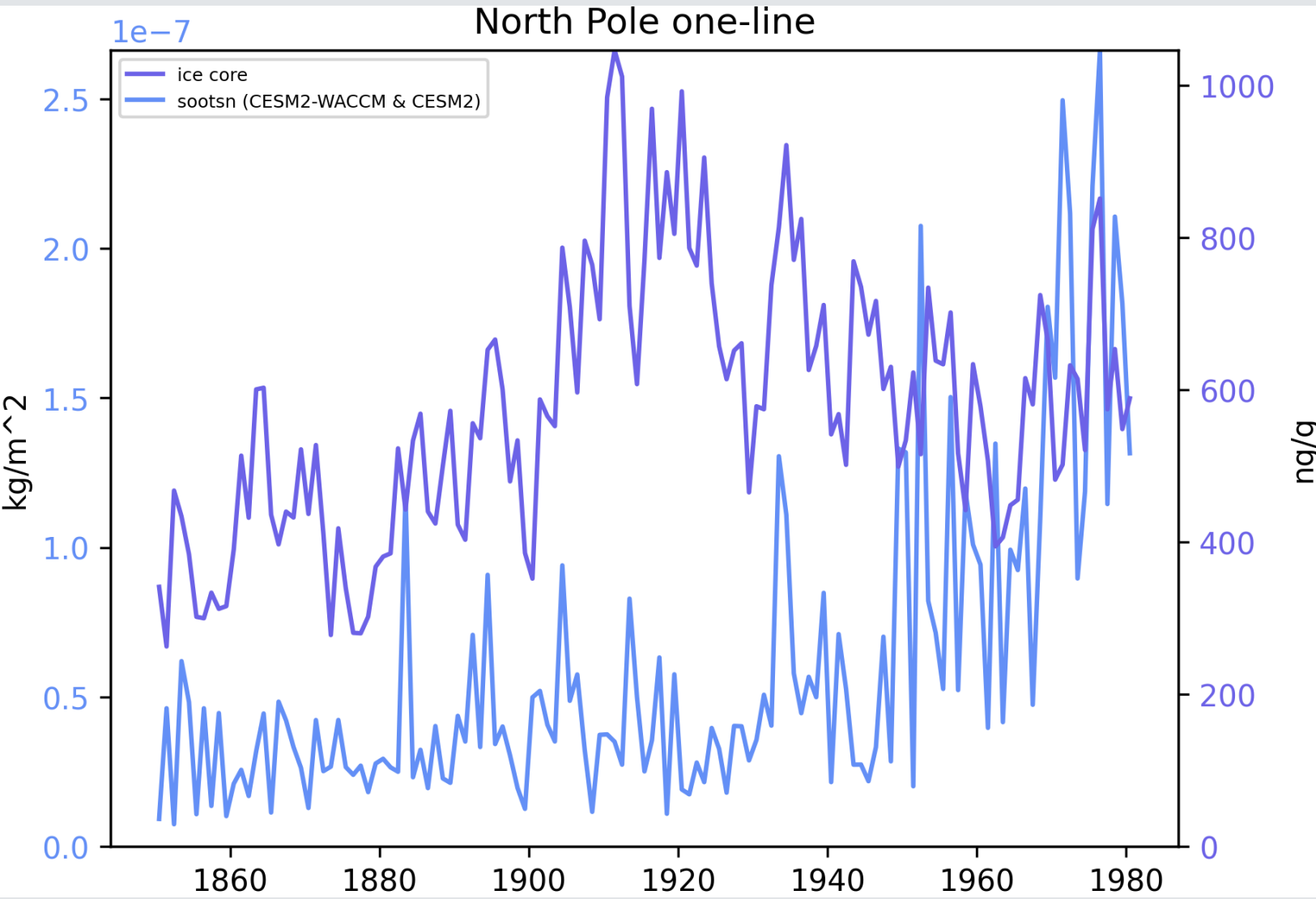
Pengfei Liu<sup>1,2\*</sup>, Jed O. Kaplan<sup>3</sup>, Loretta J. Mickley<sup>1</sup>, Yan Li<sup>1,4</sup>, Nathan J. Chellman<sup>5</sup>, Monica M. Arienzo<sup>5</sup>, John K. Kodros<sup>6</sup>, Jeffrey R. Pierce<sup>7</sup>, Michael Sigl<sup>8,9</sup>, Johannes Freitag<sup>10</sup>, Robert Mulvaney<sup>11</sup>, Mark A. J. Curran<sup>12</sup>, Joseph R. McConnell<sup>5,13</sup>

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30% reduction in Southern Hemisphere fires over 20<sup>th</sup> C

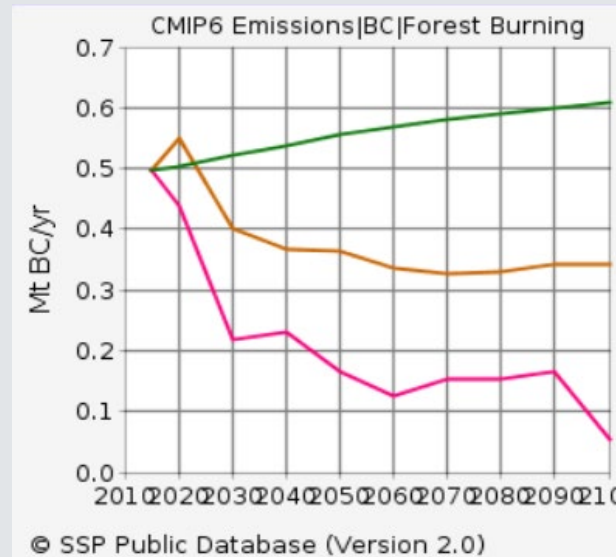
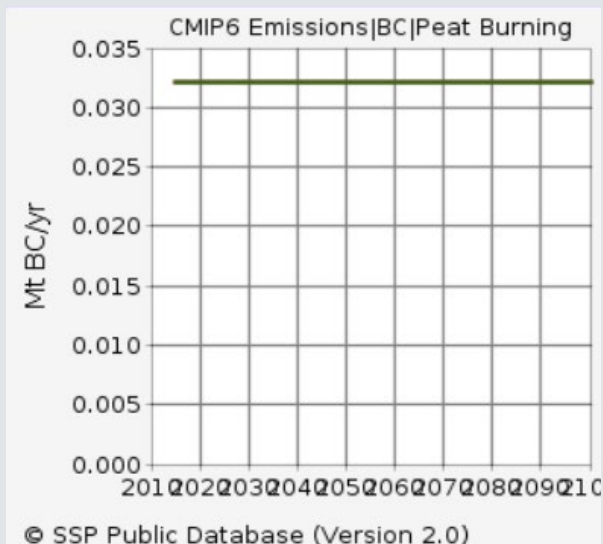
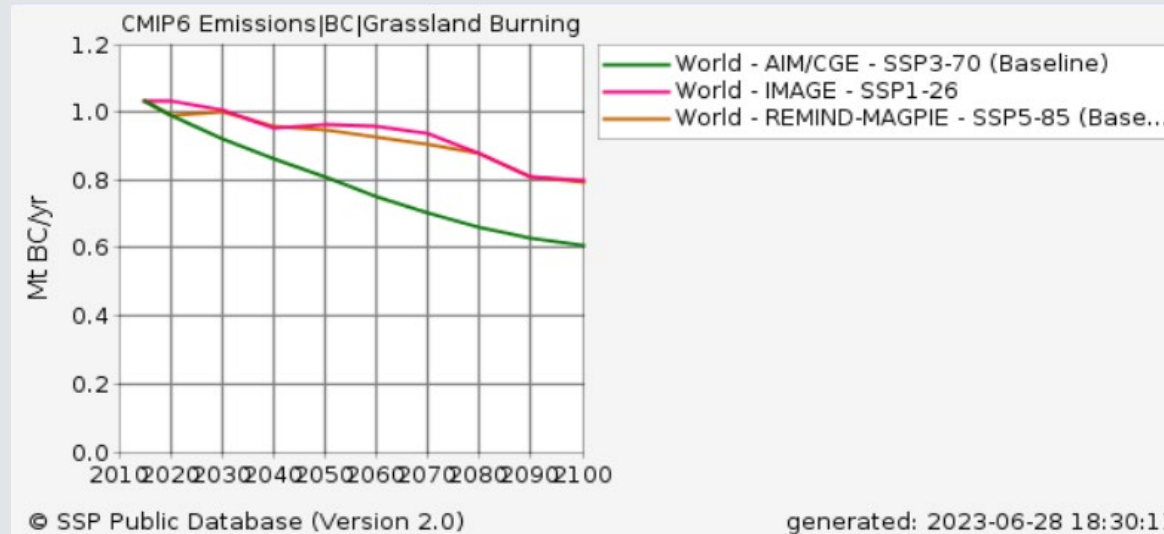
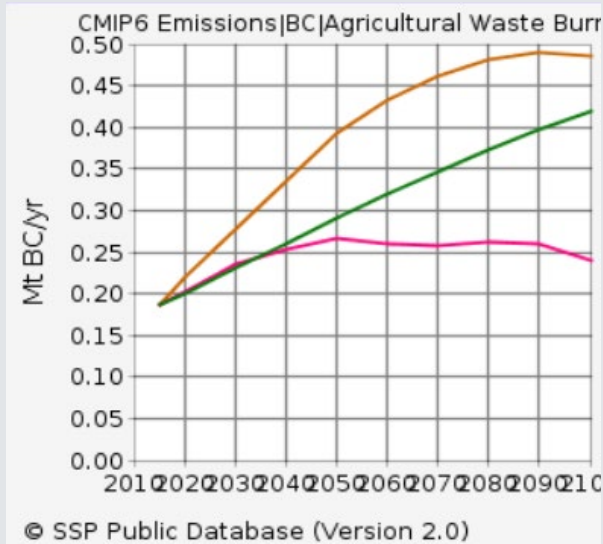


# What can we do?



Figures: Noah Liguori-Bills

# SSP 21<sup>st</sup> C Projections of BC from FIRE sources



Overall results in a decrease in fire emission across all SSP scenarios



# Climate Model Projections

Hamilton and Kasoar et al. (2024) *Preprint*

Please see: <https://www.researchsquare.com/article/rs-4567012/v1>

Due to potential for embargo issues, figures removed from this presentation.

(Also feel free to email myself or Matt Kasoar.)

Past and Future Fire Emission Trajectories Are Uncertain

Trends Possibly OPPOSITE What Is In CMIP6/CMIP7

Aerosol Radiative Forcing Is Sensitive to Both  
Fire Emission and Model Structure Uncertainties  
– Need for a MIP?

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