

Supplement

Historical greenhouse gas concentrations for climate modelling (CMIP6)

Malte Meinshausen^{1,2,3}, Elisabeth Vogel^{1,2}, Alexander Nauels^{1,2}, Katja Lorbacher^{1,2}, Nicolai Meinshausen⁴, David M. Etheridge⁵, Paul J. Fraser⁵, Stephen A. Montzka⁶, Peter J. Rayner², Cathy M. Trudinger⁵, Paul B. Krummel⁵, Urs Beyerle⁷, Josep G. Canadell⁸, John S. Daniel⁹, Ian G. Enting¹⁰, Rachel M. Law⁵, Chris R. Lunder¹¹, Simon O'Doherty¹², Ron G. Prinn¹³, Stefan Reimann¹⁴, Mauro Rubino^{5,15}, Guus J. M. Velders¹⁶, Martin K. Vollmer¹⁴, Ray H. J. Wang¹⁷, and Ray Weiss¹⁸

¹Australian-German Climate & Energy College, The University of Melbourne, Parkville, Victoria, Australia

²Department of Earth Sciences, The University of Melbourne, Parkville, Victoria, Australia

³Potsdam Institute for Climate Impact Research, Potsdam, Germany

⁴Seminar for Statistics, Swiss Federal Institute of Technology (ETH Zurich), Zurich, Switzerland

⁵CSIRO, Oceans and Atmosphere, Aspendale, Victoria, Australia

⁶NOAA, Earth System Research Laboratory, Global Monitoring Division, Boulder, Colorado, USA

⁷Institute for Atmospheric and Climate Science, Swiss Federal Institute of Technology (ETH Zurich), Zurich, Switzerland

⁸Global Carbon Project, CSIRO Oceans and Atmosphere, Canberra, ACT, Australia

⁹NOAA, Earth System Research Laboratory, Chemical Sciences Division, Boulder, Colorado, USA

¹⁰The University of Melbourne, Victoria, Australia (retired)

¹¹Norwegian Institute for Air Research, Kjeller, Norway

¹²University of Bristol, Bristol, United Kingdom

¹³MIT, Cambridge, MA, USA

¹⁴Empa, Swiss Federal Laboratories for Materials Science and Technology, Laboratory for Air Pollution and Environmental Technology, Switzerland

¹⁵Dipartimento di matematica e fisica, Seconda Università degli studi di Napoli, Caserta, Italy

¹⁶National Institute for Public Health and the Environment (RIVM), Bilthoven, Netherlands

¹⁷School of Earth and Atmospheric Sciences, Georgia Institute of Technology, Atlanta, Georgia, USA

¹⁸Scripps Institution of Oceanography, La Jolla, CA, USA

Correspondence to: Malte Meinshausen (malte.meinshausen@unimelb.edu.au)

1 Supplement A:

Factsheets of GHGs other than CO₂, CH₄ and N₂O

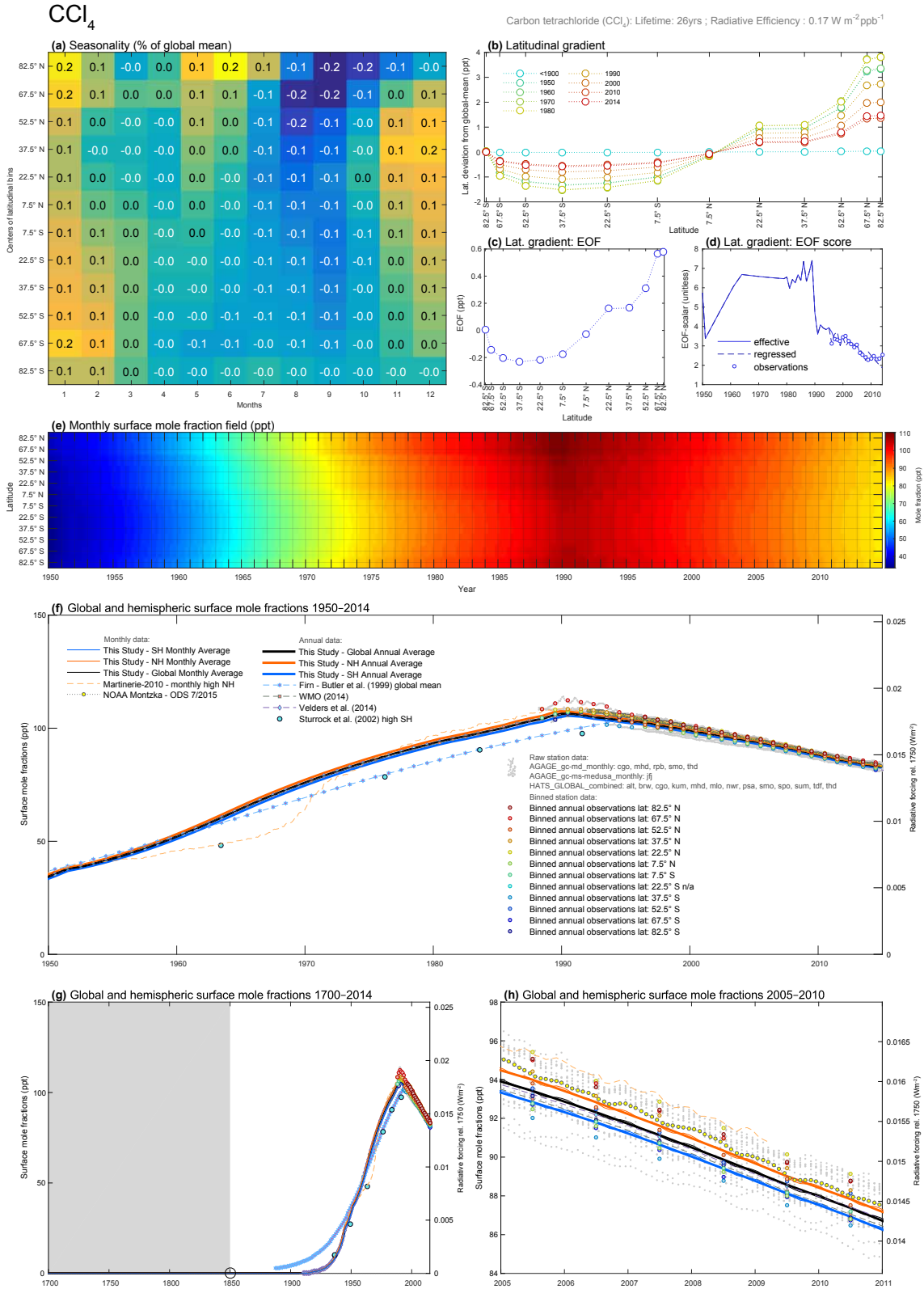


Figure S1. CCl₄ Factsheet

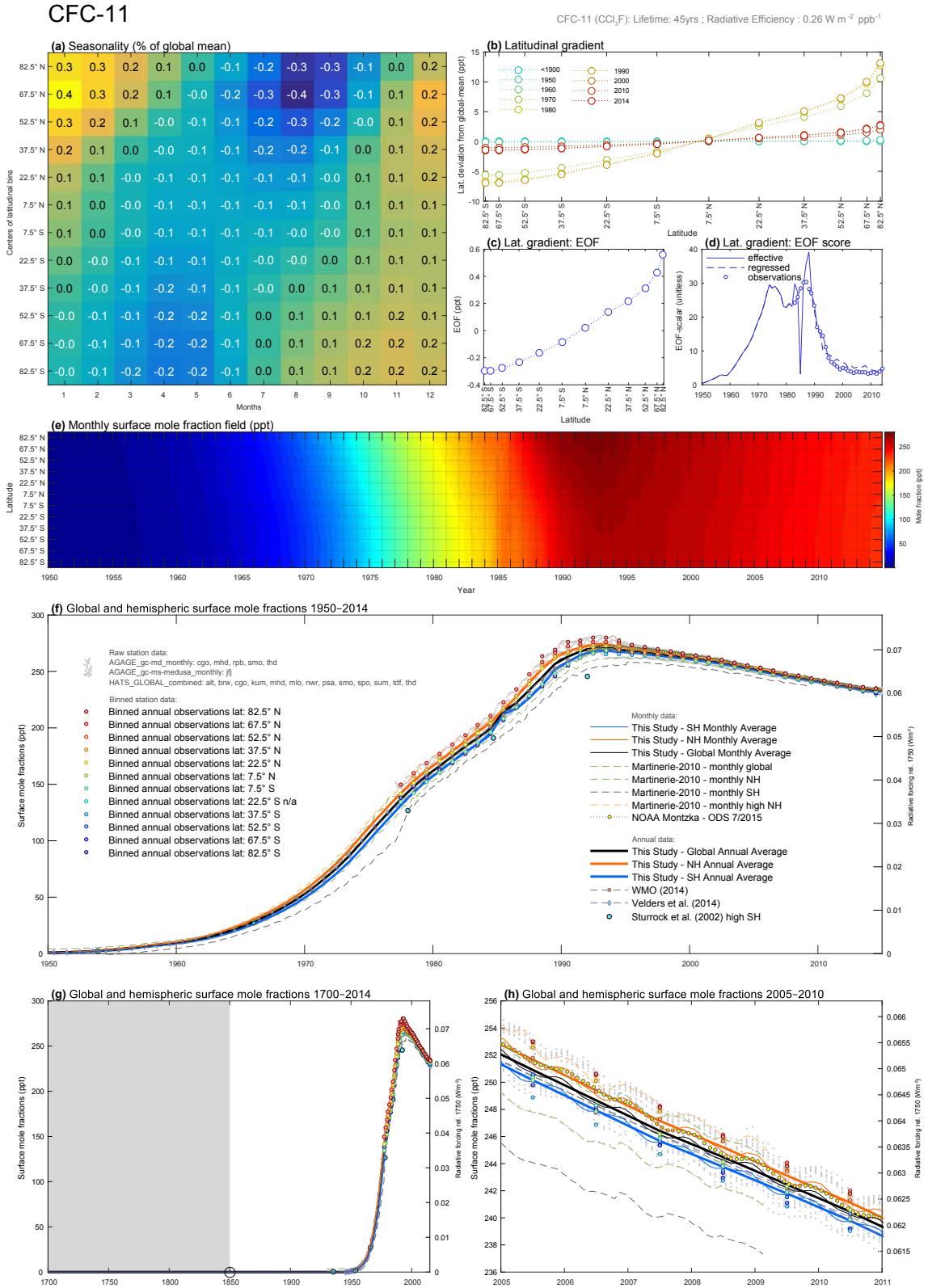


Figure S2. CFC-11 Factsheet

CFC-12

CFC-12 (CCl₂F₂): Lifetime: 100yrs ; Radiative Efficiency : 0.32 W m⁻² ppb⁻¹

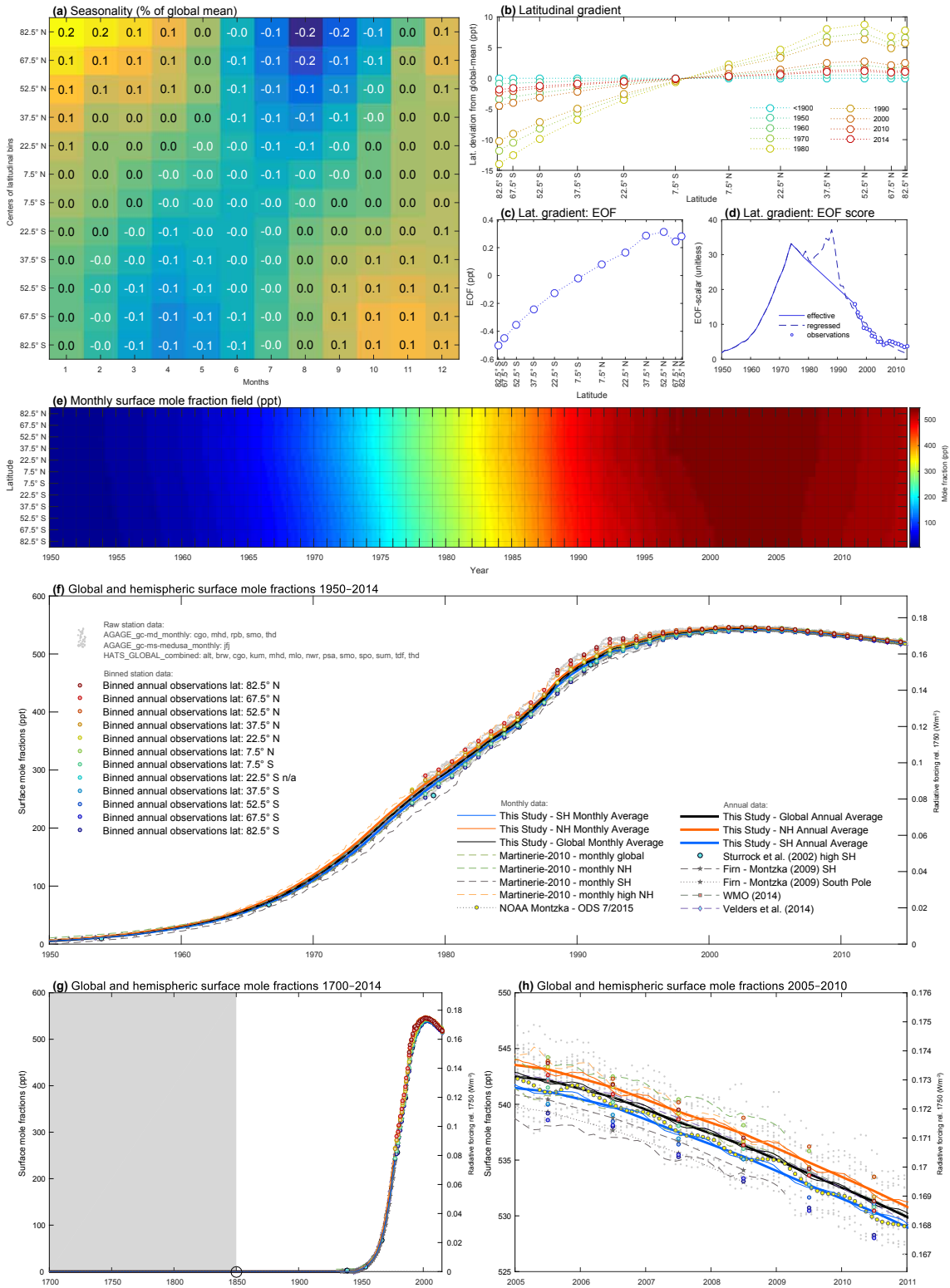


Figure S3. CFC-12 Factsheet

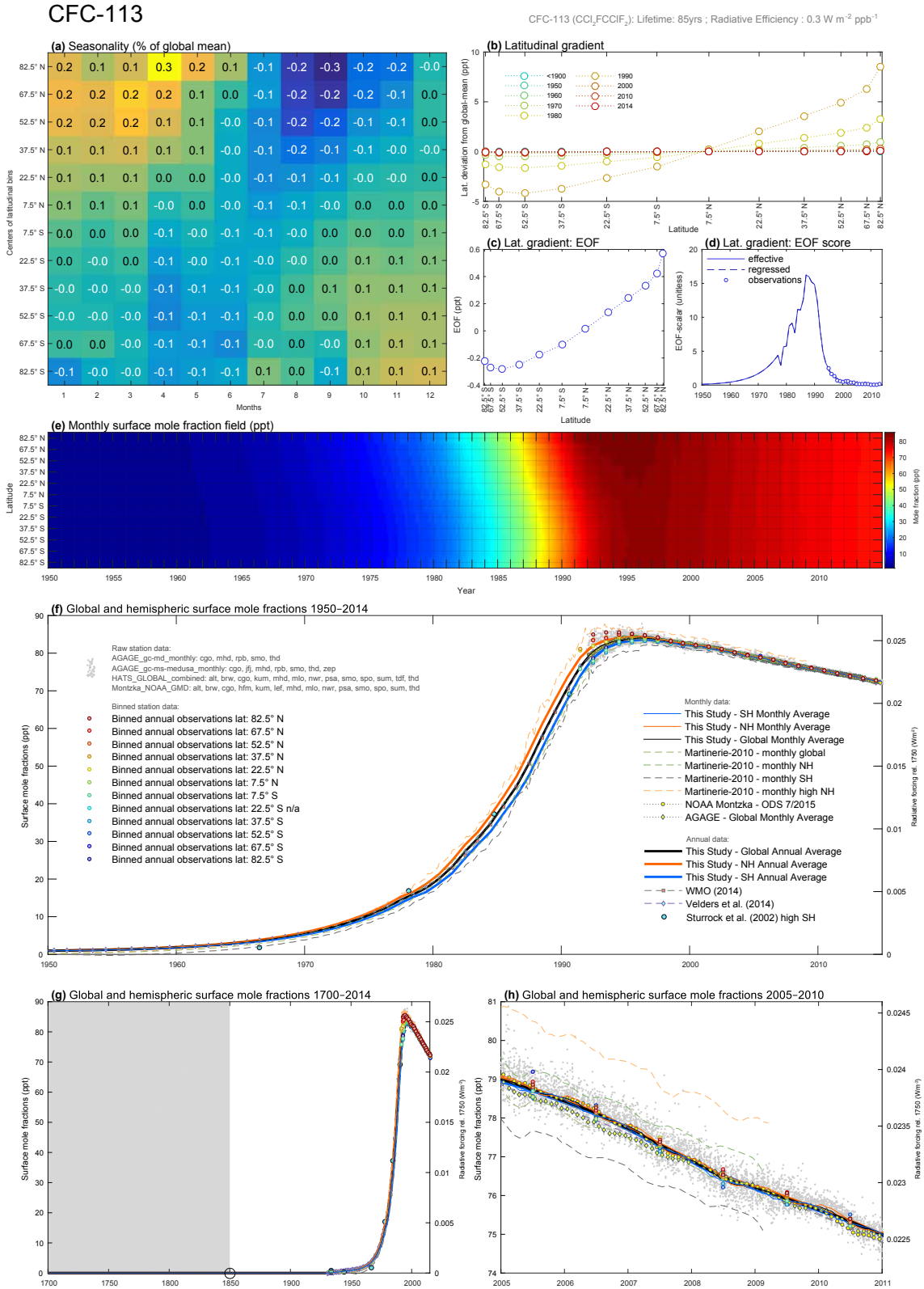


Figure S4. CFC-113 Factsheet

CFC-114

CFC-114 (CCIF₂CCIF₂): Lifetime: 190yrs ; Radiative Efficiency : 0.31 W m⁻² ppb⁻¹

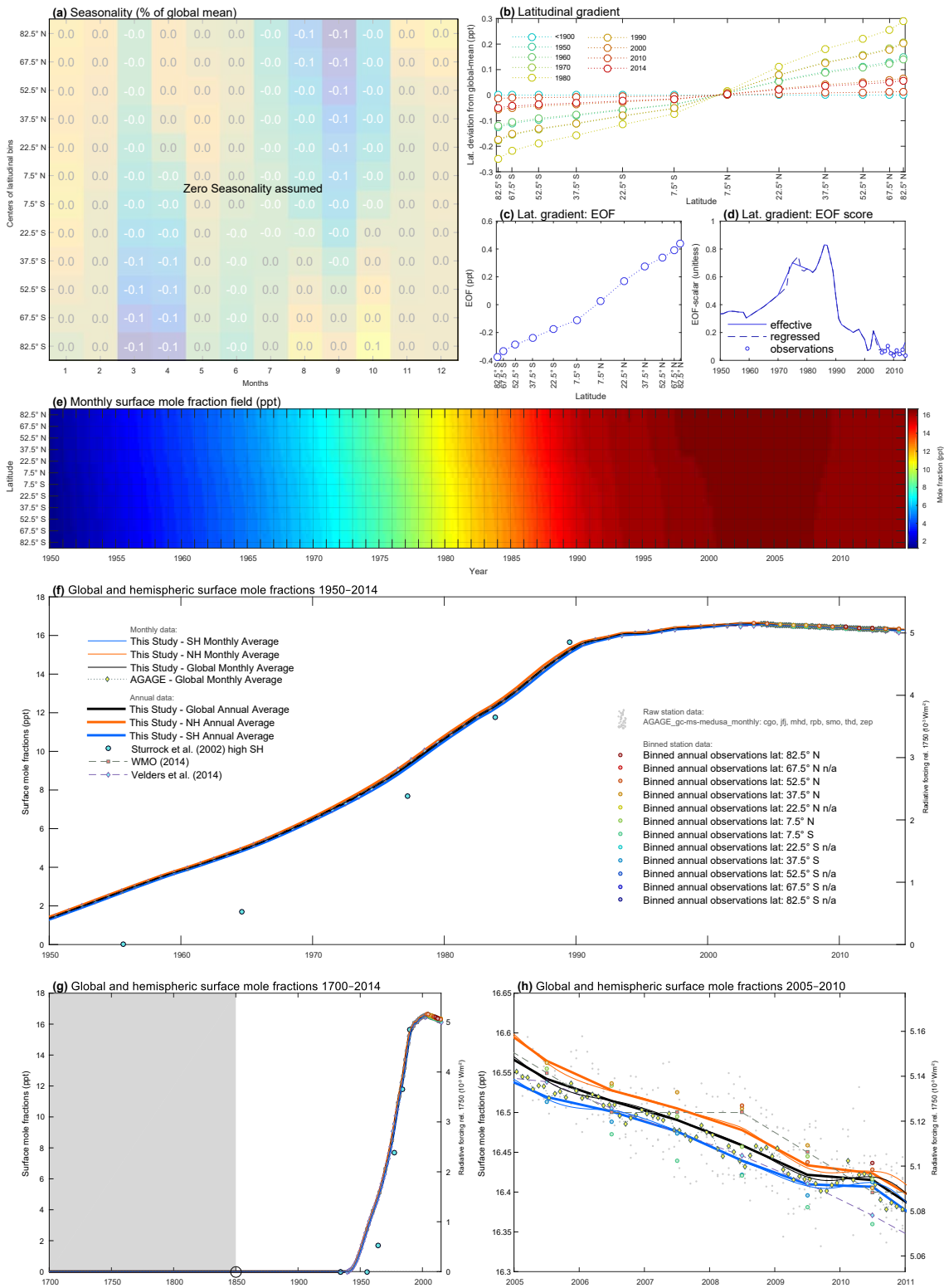


Figure S5. CFC-114 Factsheet

CFC-115

CFC-115 (CCIF₂CF₃): Lifetime: 1020yrs ; Radiative Efficiency : 0.2 W m⁻² ppb⁻¹

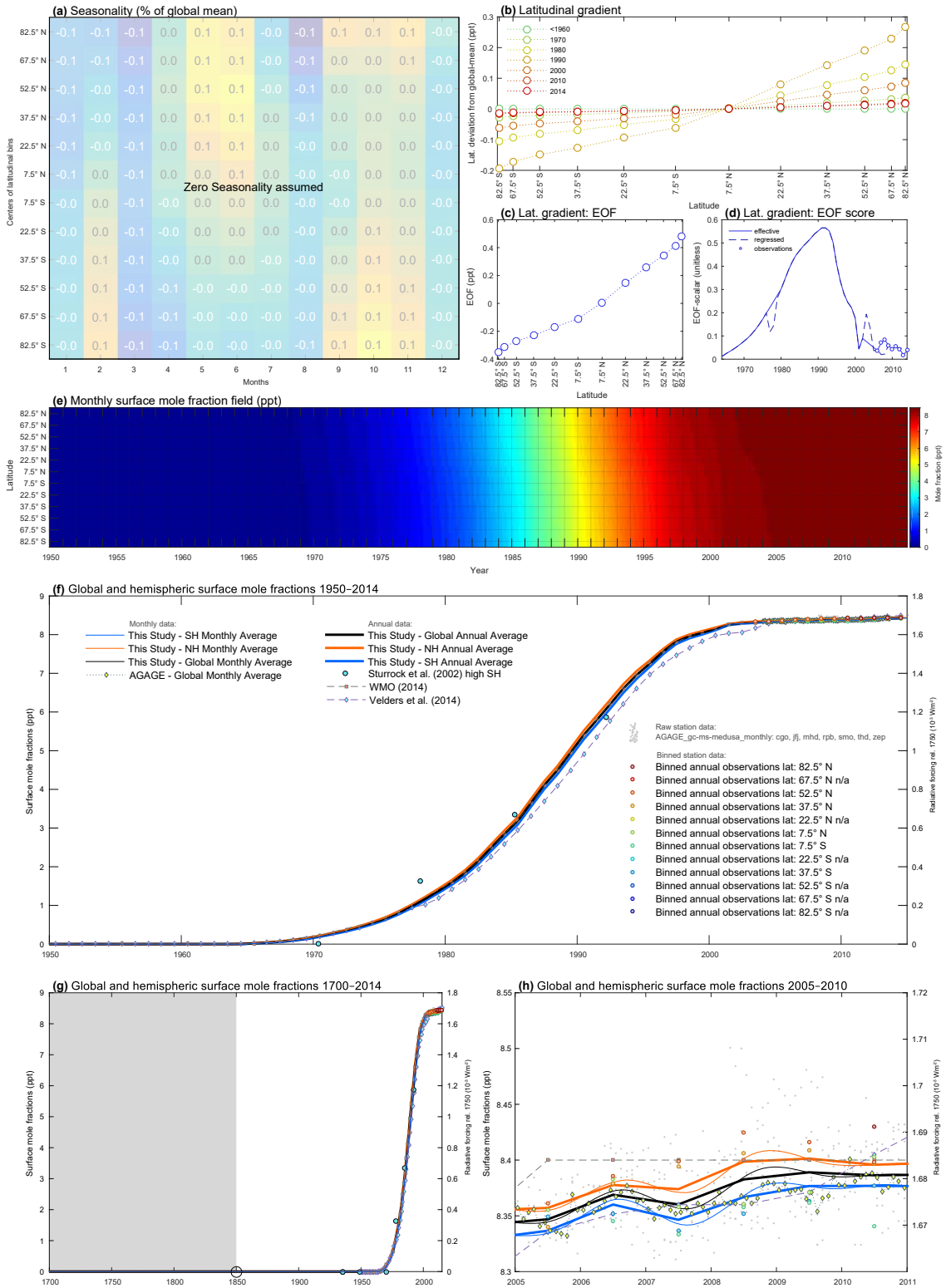


Figure S6. CFC-115 Factsheet

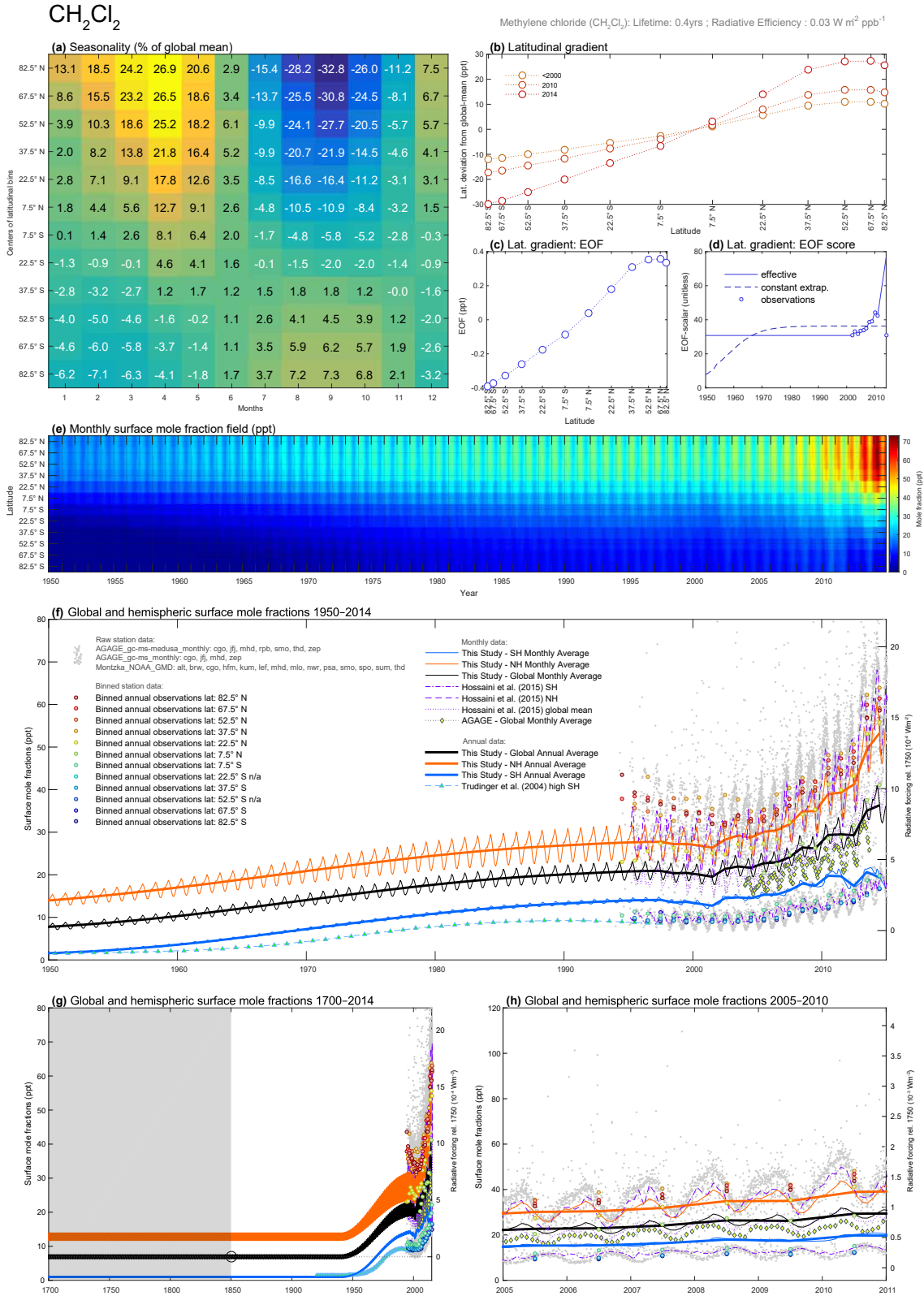


Figure S7. CH₂Cl₂ Factsheet

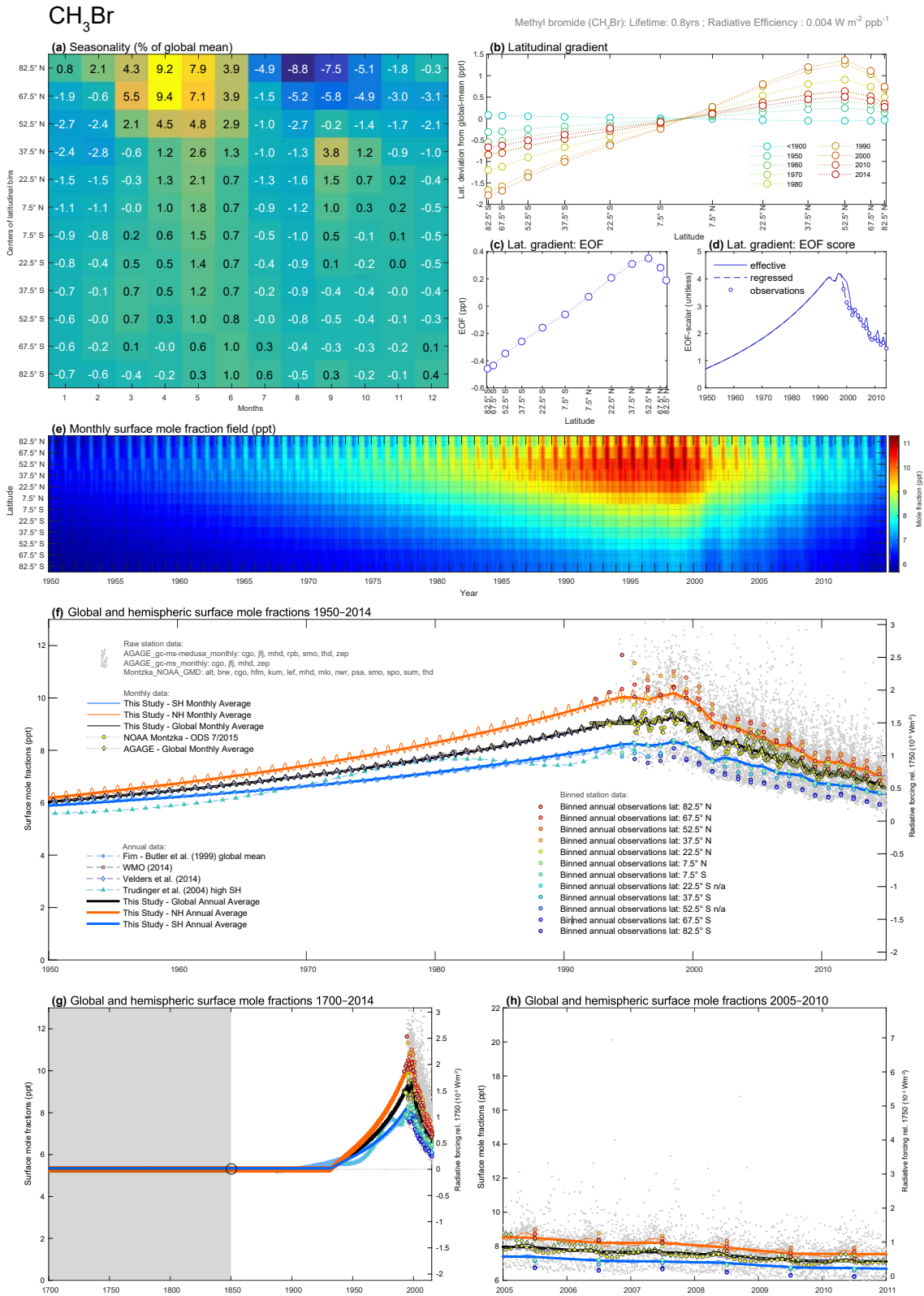


Figure S8. CH₃Br Factsheet

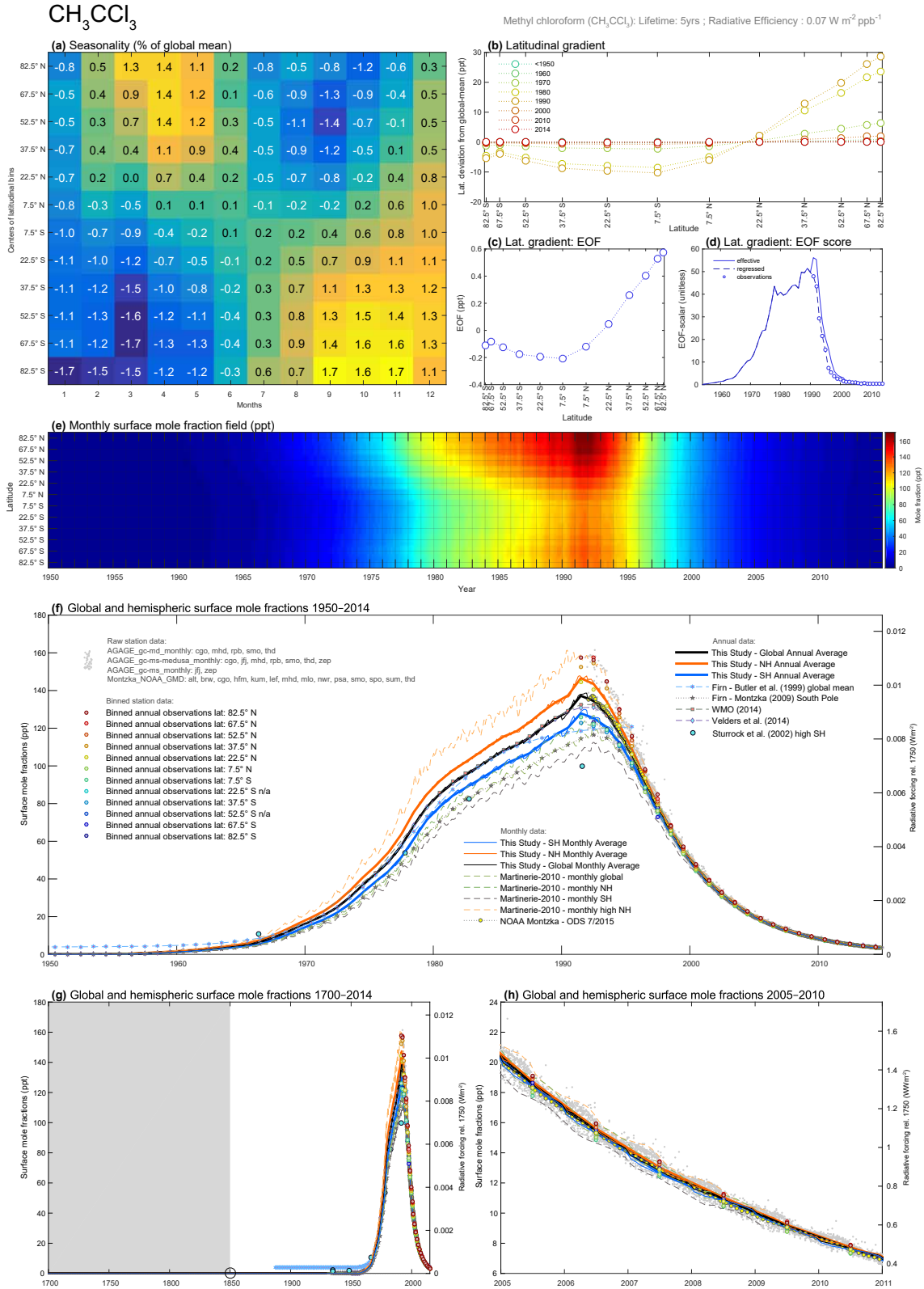


Figure S9. CH₃CCl₃ Factsheet

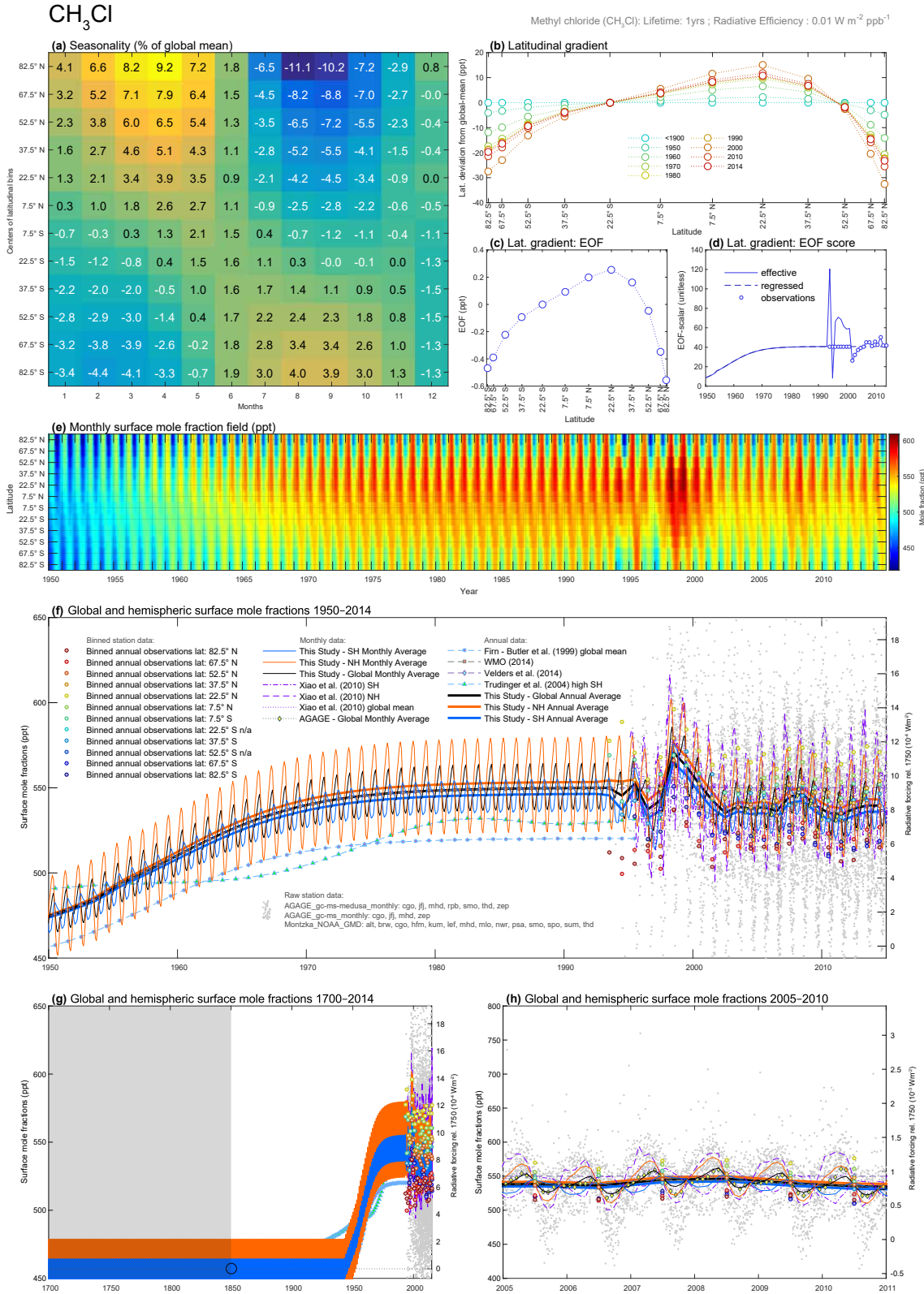


Figure S10. CH₃Cl Factsheet

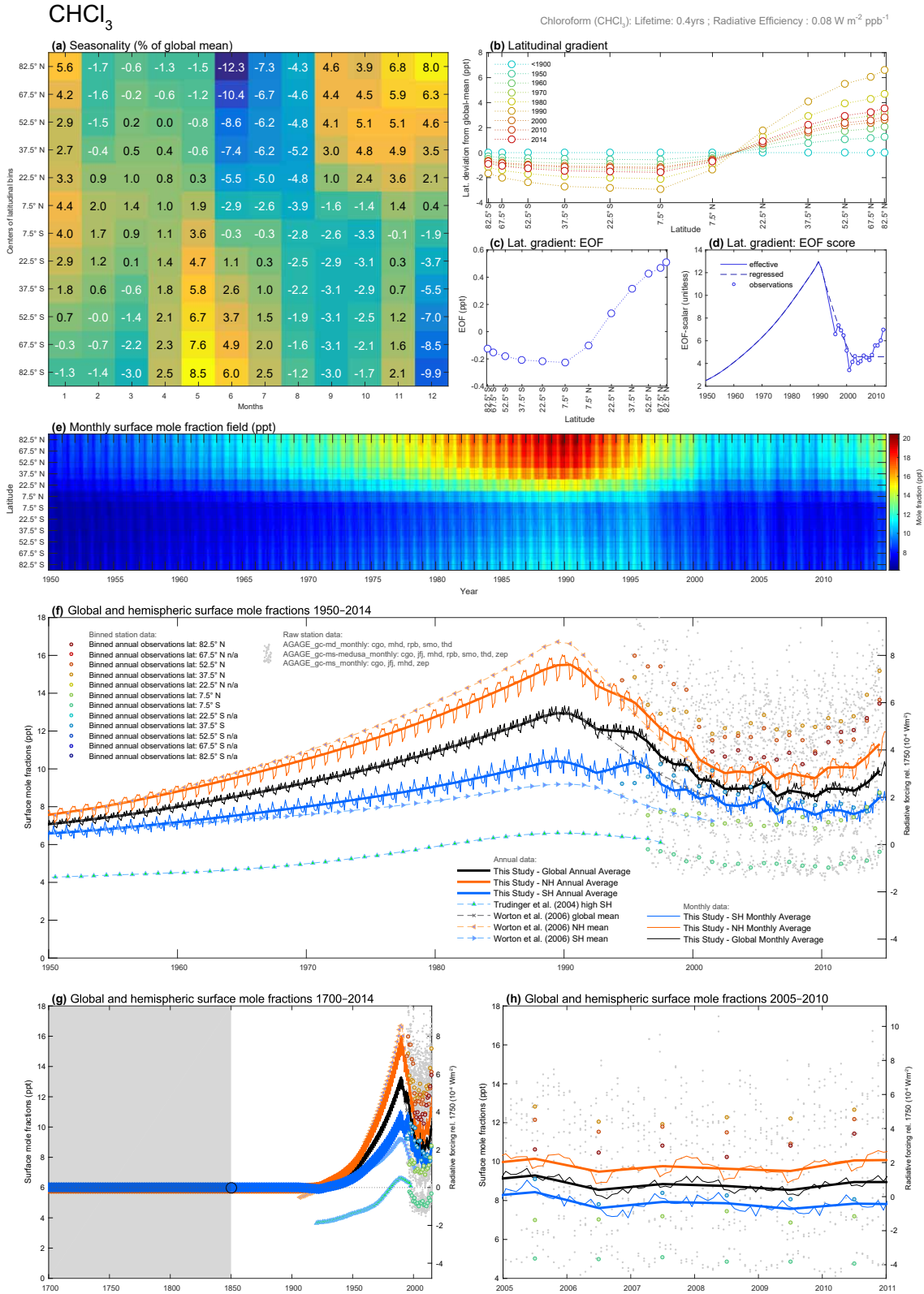


Figure S11. CHCl₃ Factsheet

Halon-1211

Halon-1211 (CBrClF₃): Lifetime: 16yrs ; Radiative Efficiency : 0.29 W m⁻² ppb⁻¹

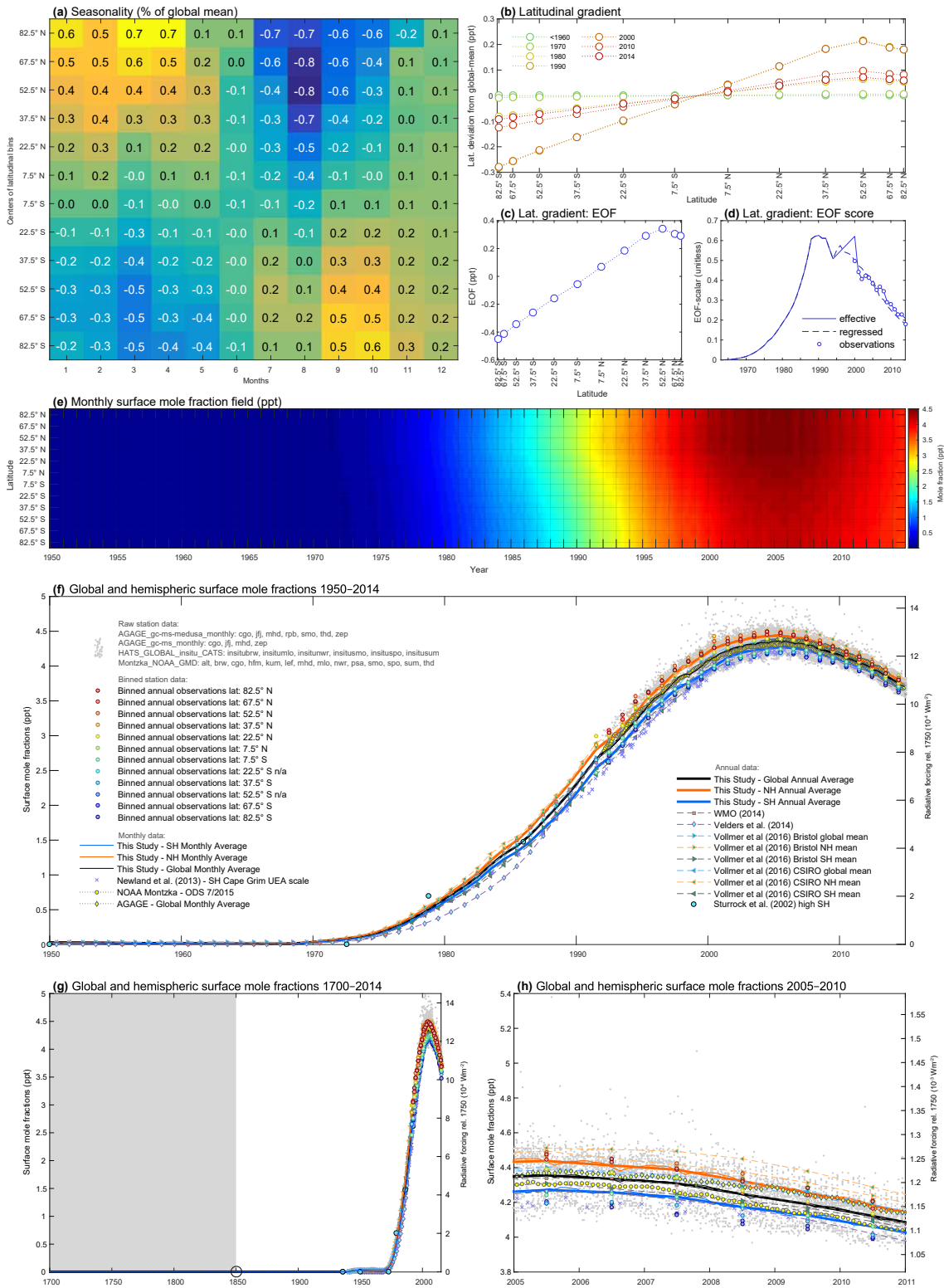


Figure S12. Halon-1211 Factsheet

Halon-1301

Halon-1301 (CBF₃): Lifetime: 65yrs ; Radiative Efficiency : 0.3 W m⁻² ppb⁻¹

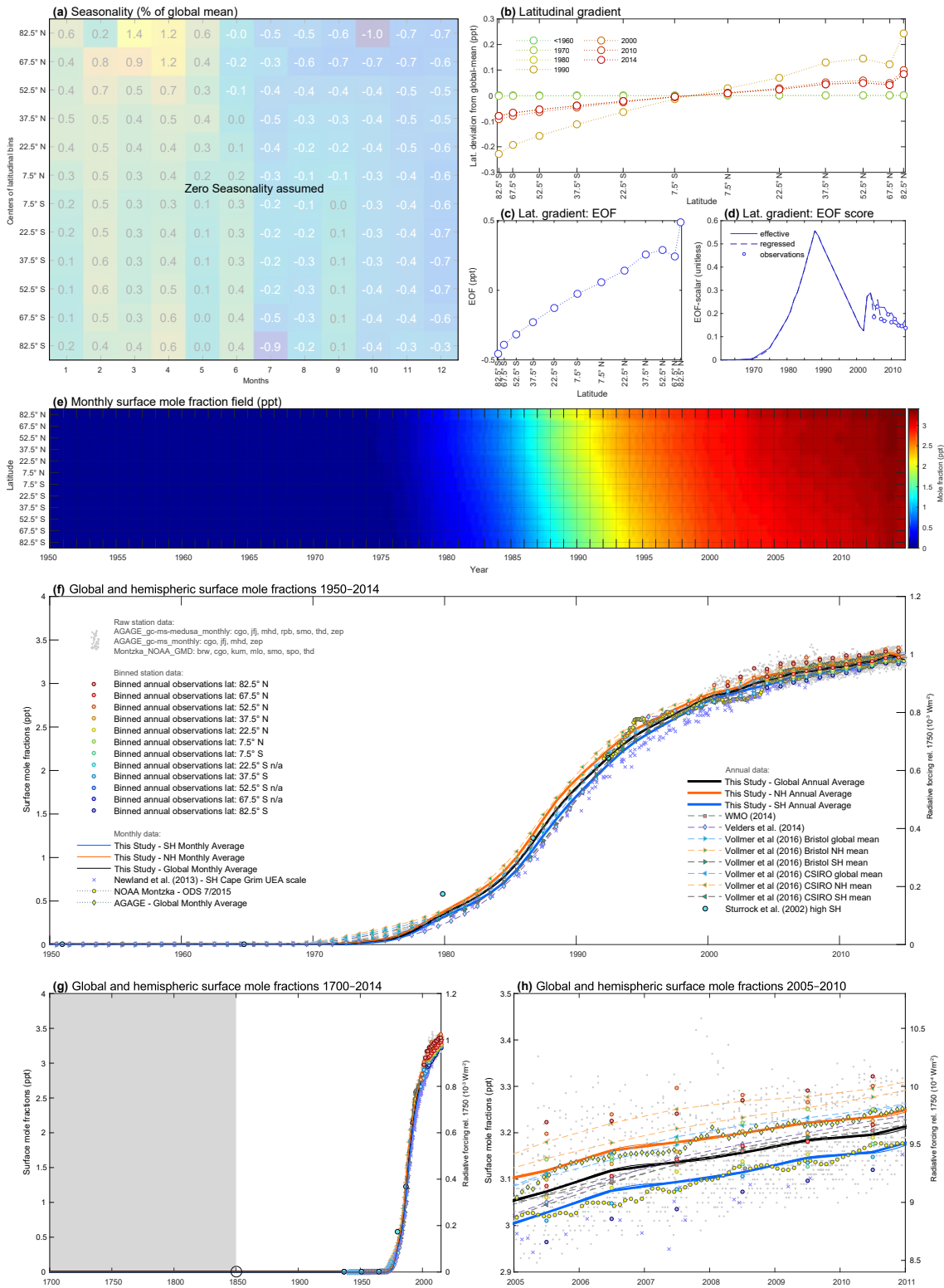


Figure S13. Halon-1301 Factsheet

Halon-2402

Halon-2402 (CBrF₂CBBrF₂): Lifetime: 20yrs ; Radiative Efficiency : 0.31 W m⁻² ppb⁻¹

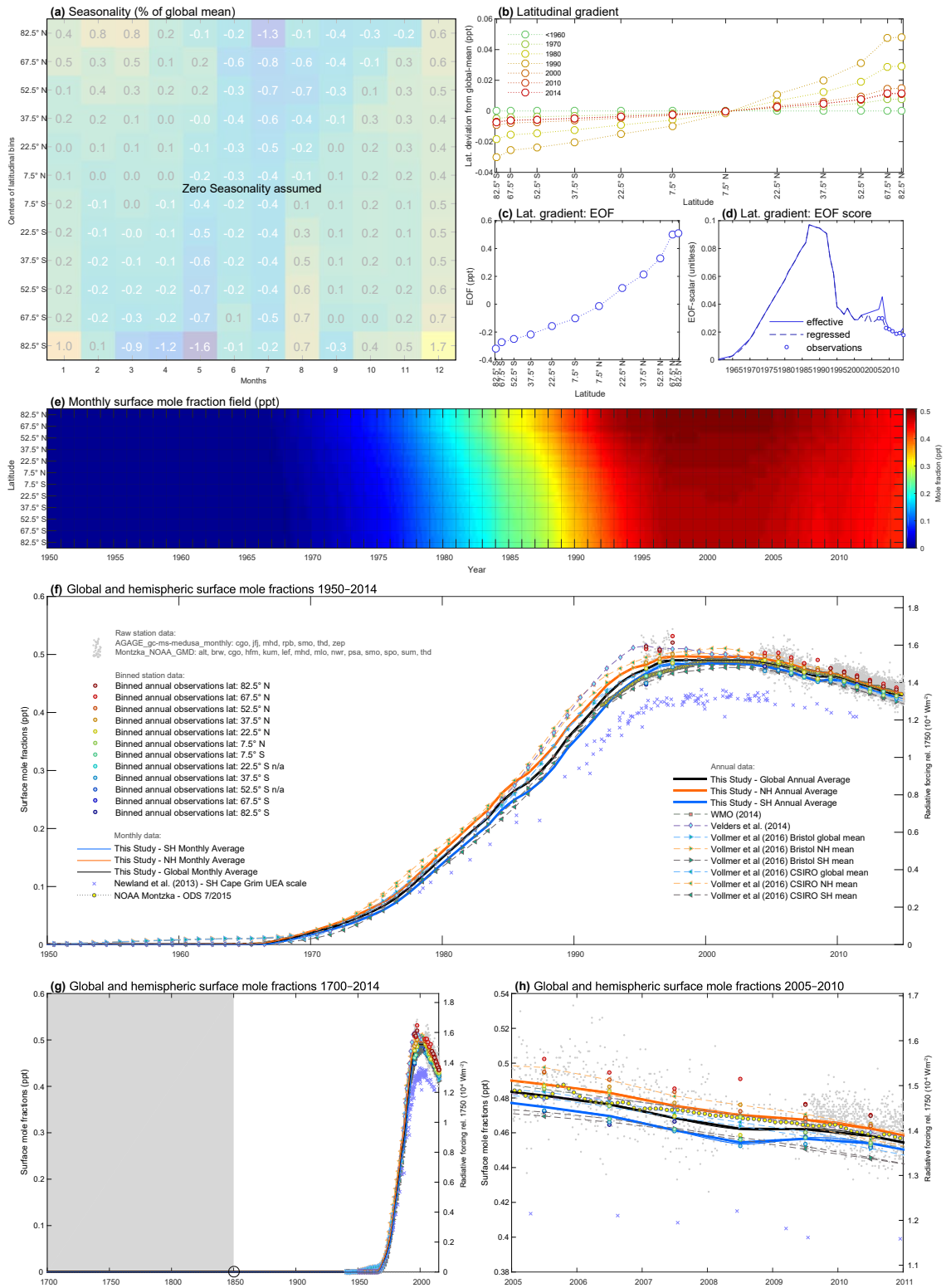


Figure S14. Halon-2402 Factsheet

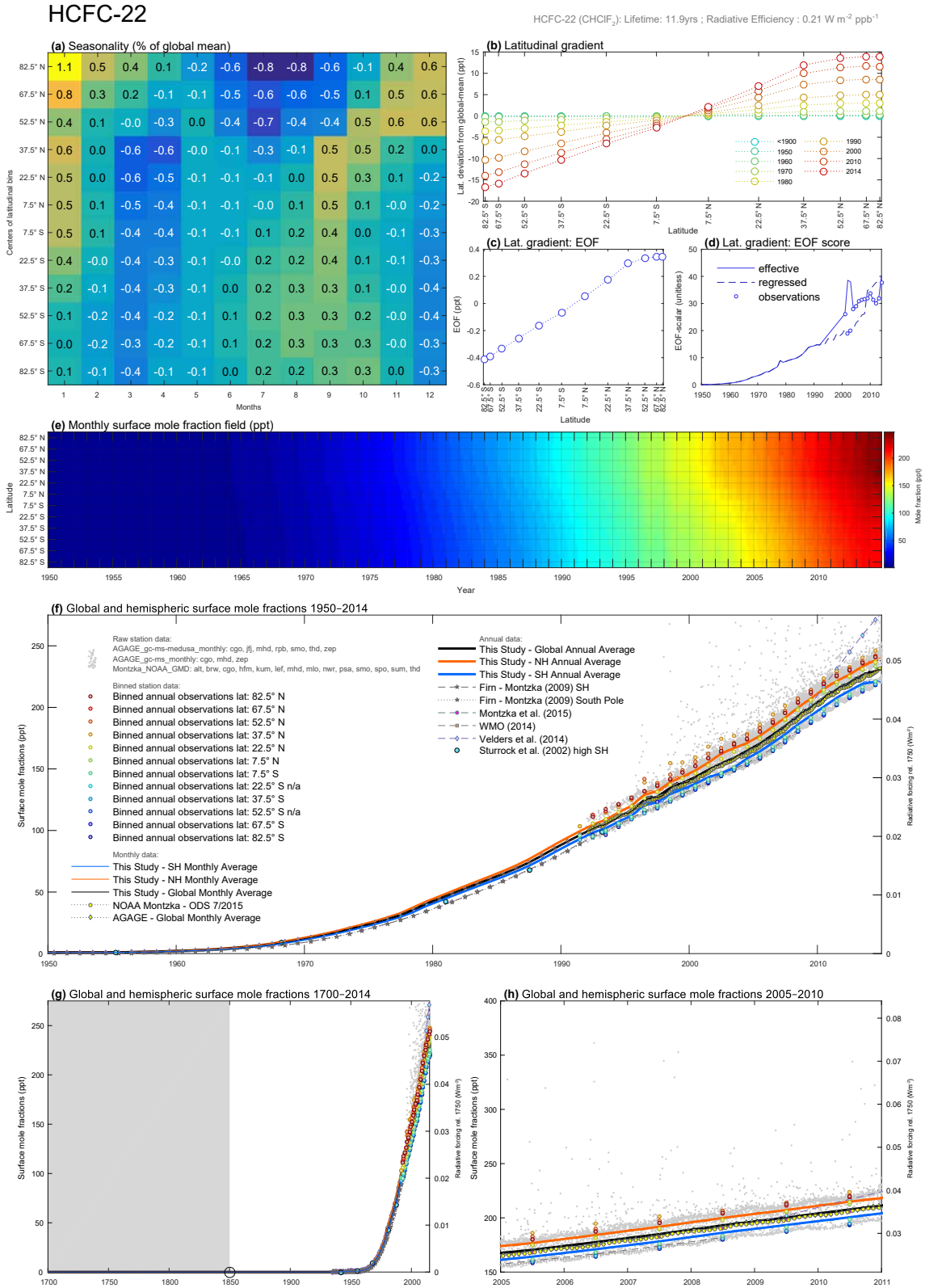


Figure S15. HCFC-22 Factsheet

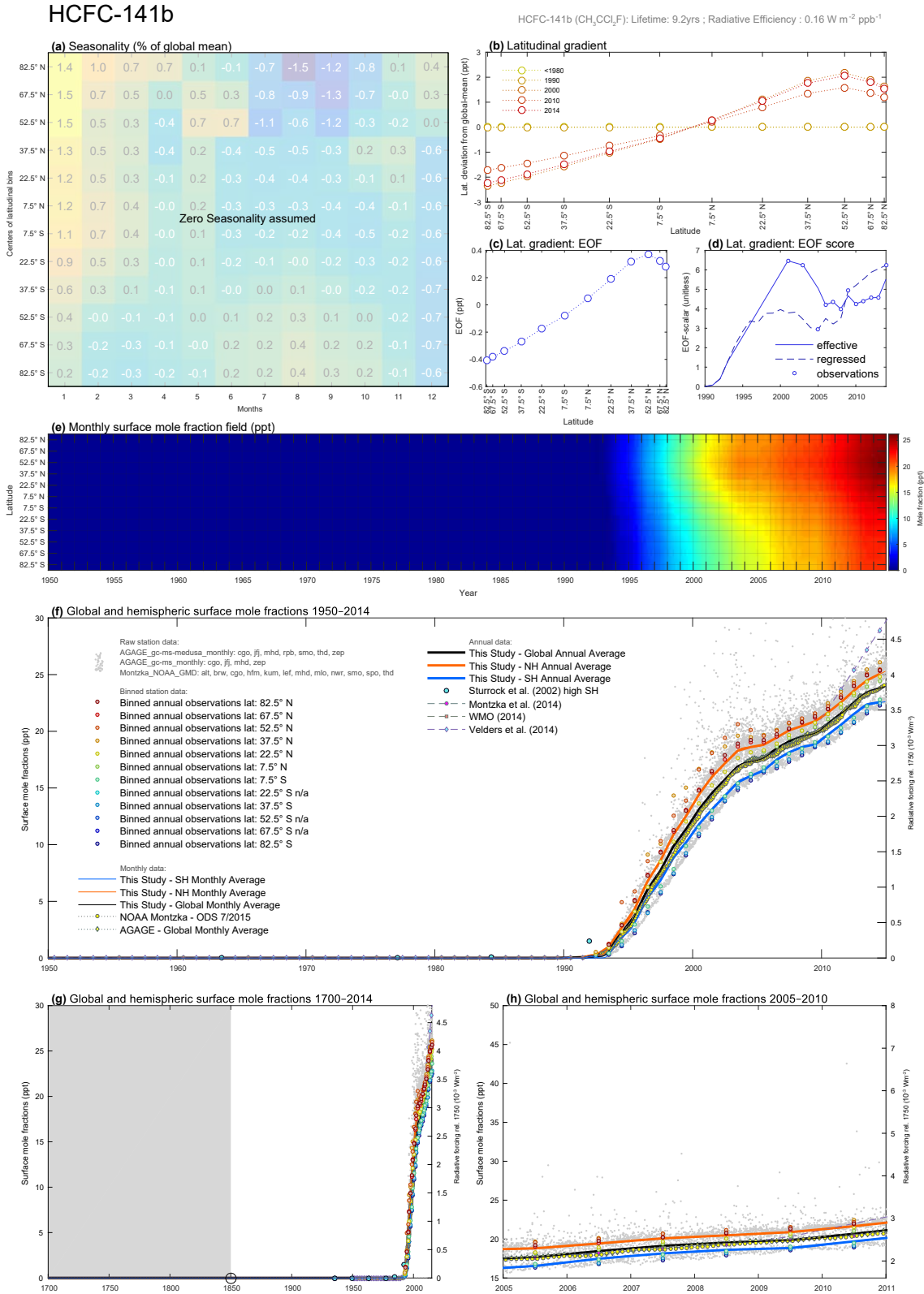


Figure S16. HCFC-141b Factsheet

HCFC-142b

HCFC-142b (CH₂CClF₂): Lifetime: 17.2yrs ; Radiative Efficiency : 0.19 W m⁻² ppb⁻¹

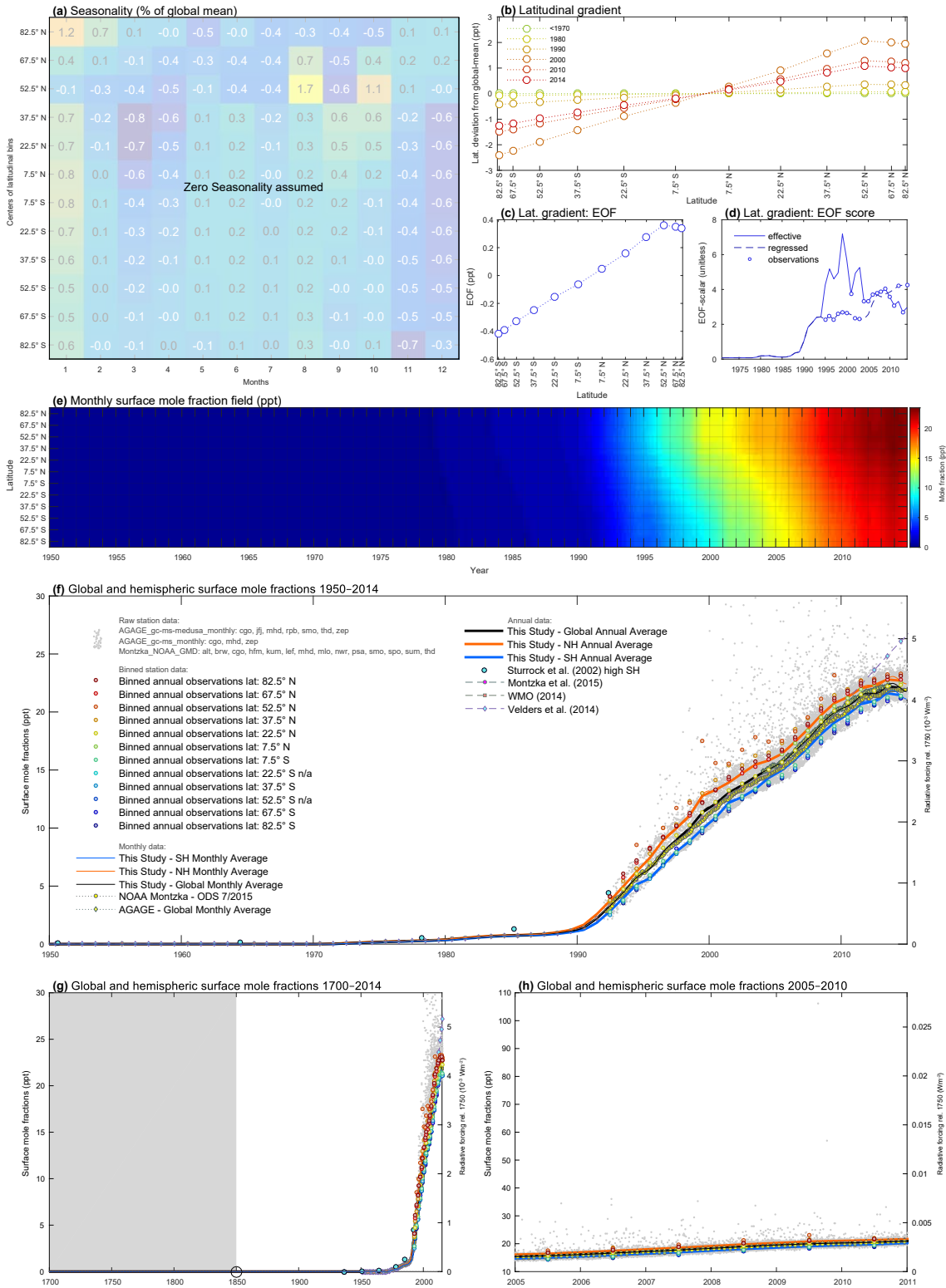


Figure S17. HCFC-142b Factsheet

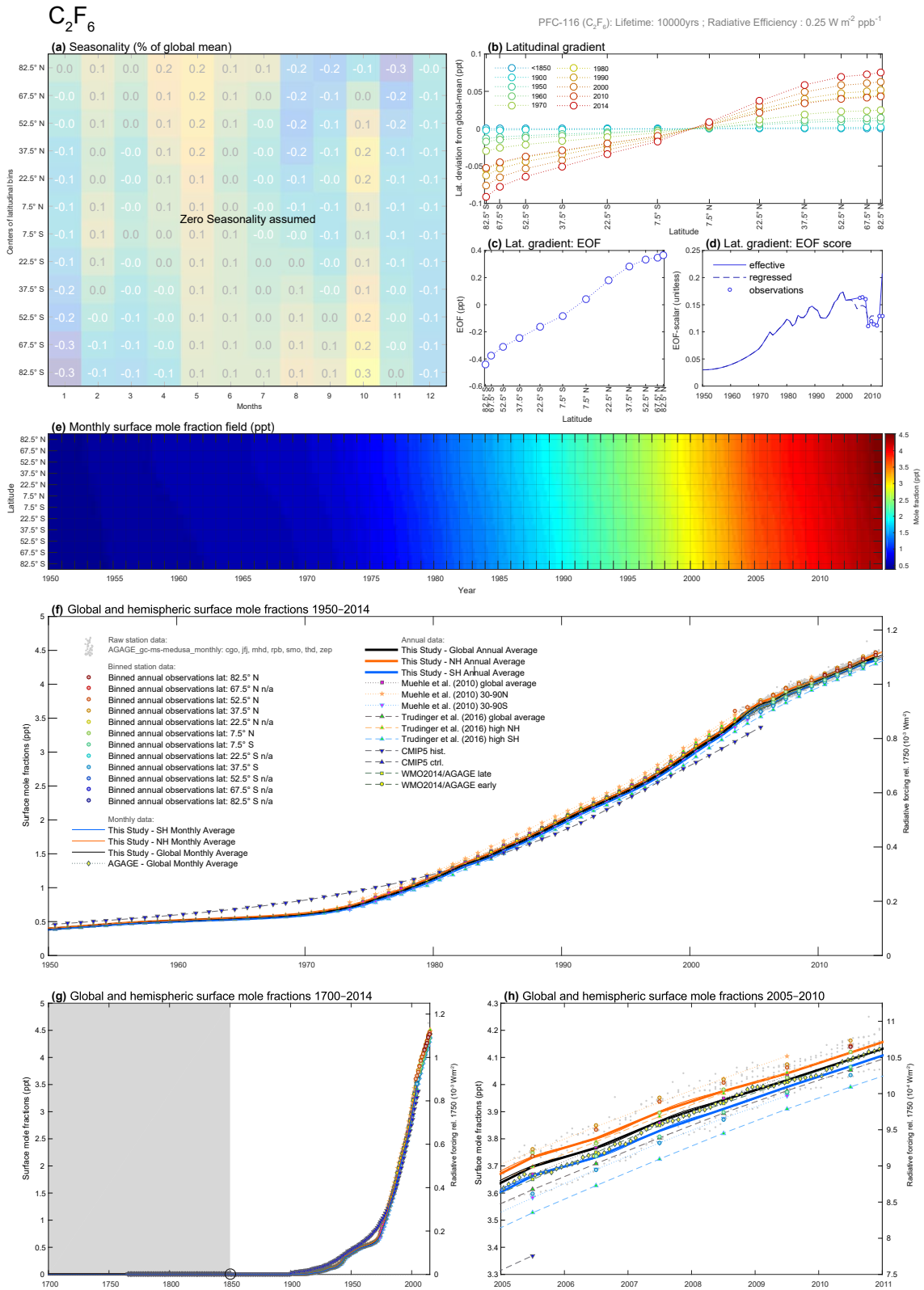


Figure S18. C₂F₆ Factsheet

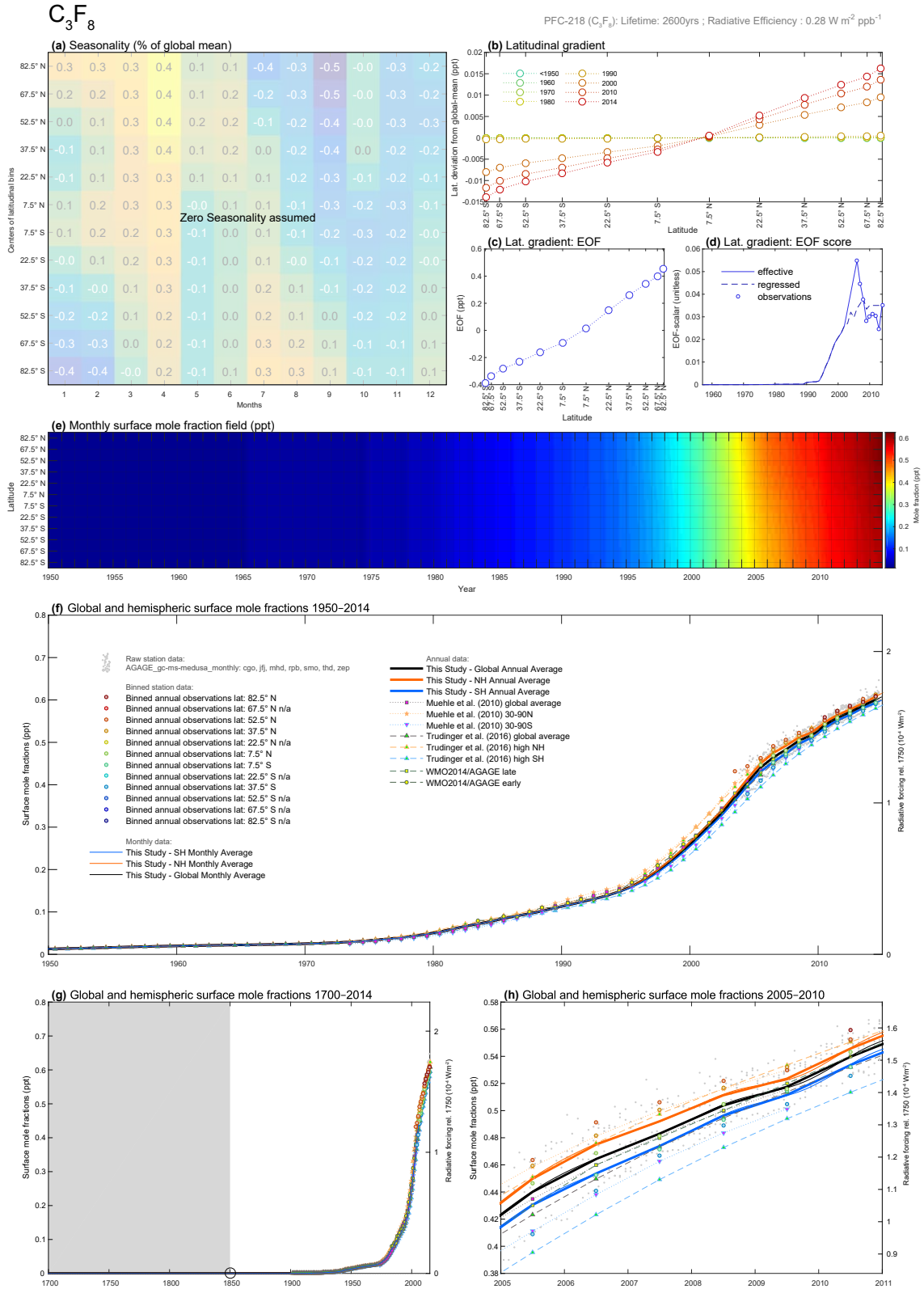


Figure S19. C₃F₈ Factsheet

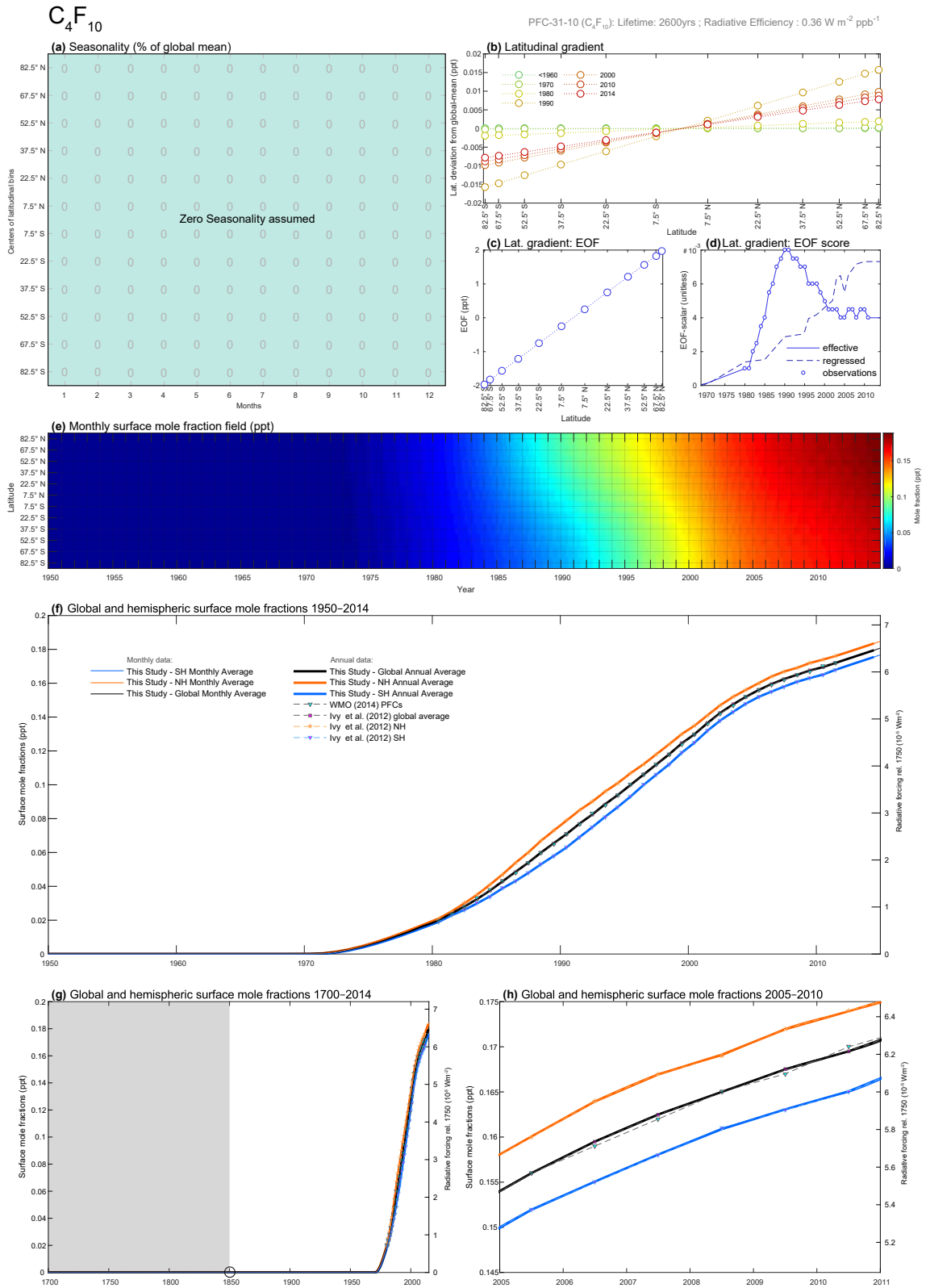


Figure S20. C_4F_{10} Factsheet

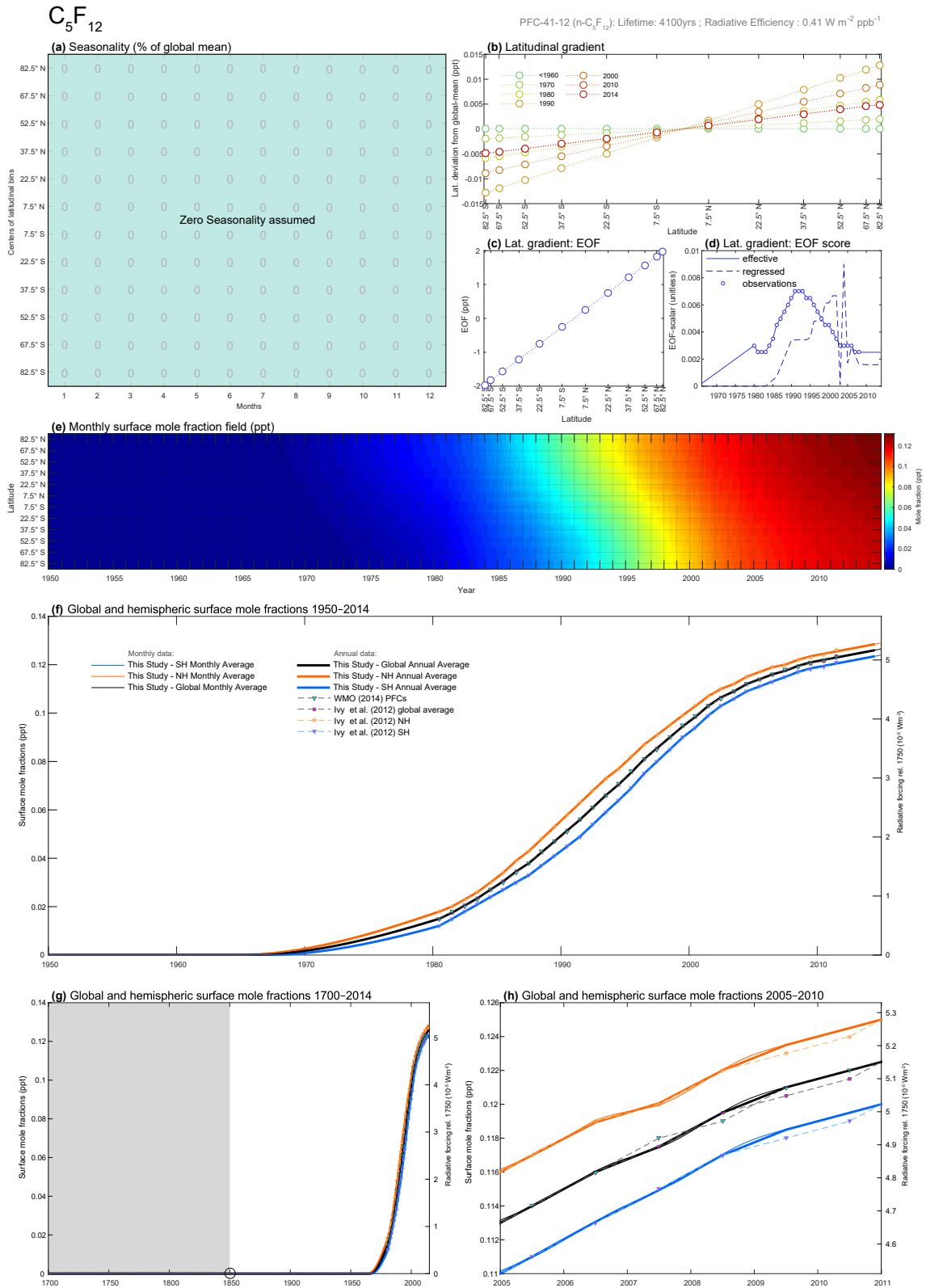


Figure S21. C_5F_{12} Factsheet

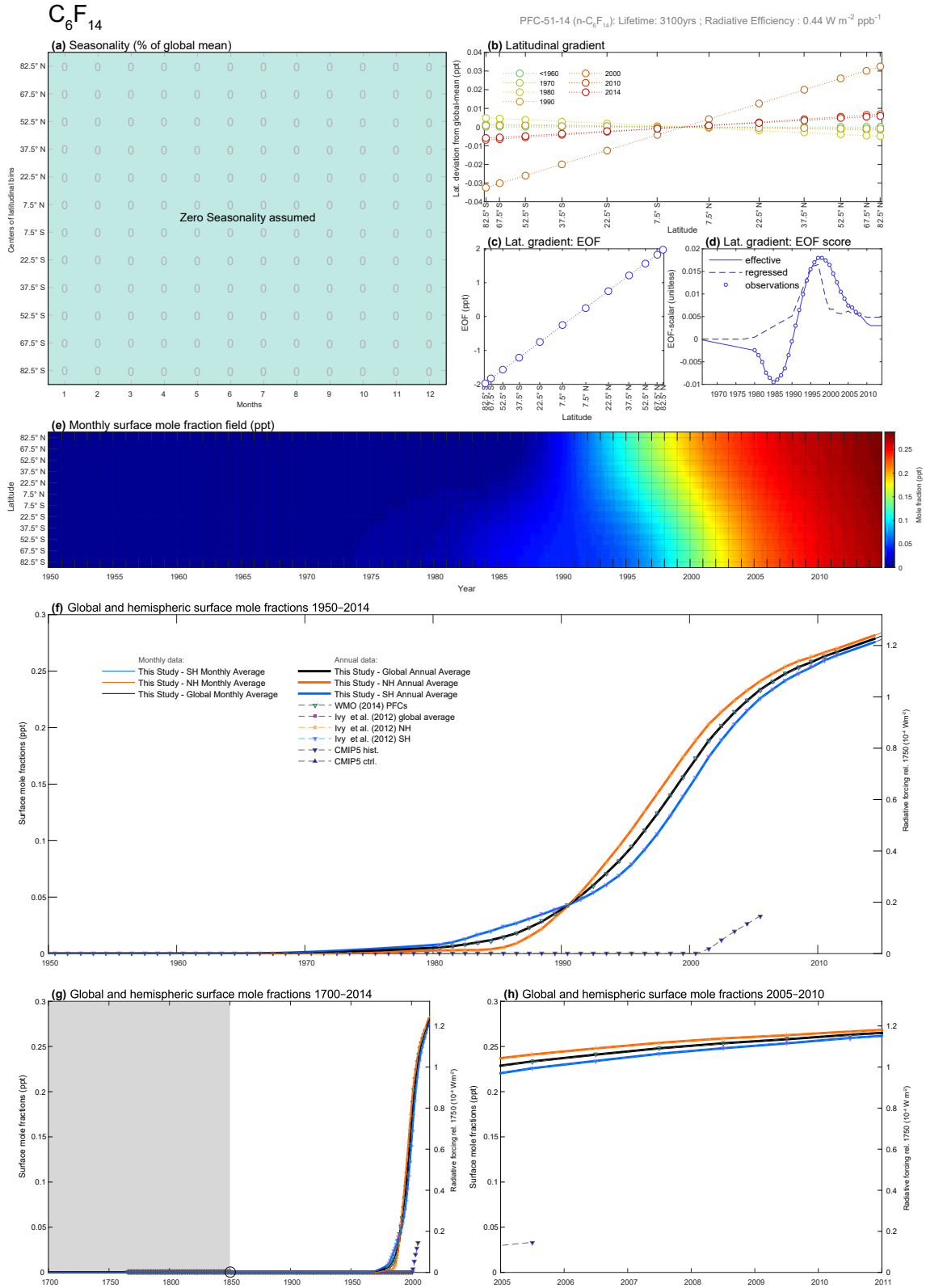


Figure S22. C₆F₁₄ Factsheet

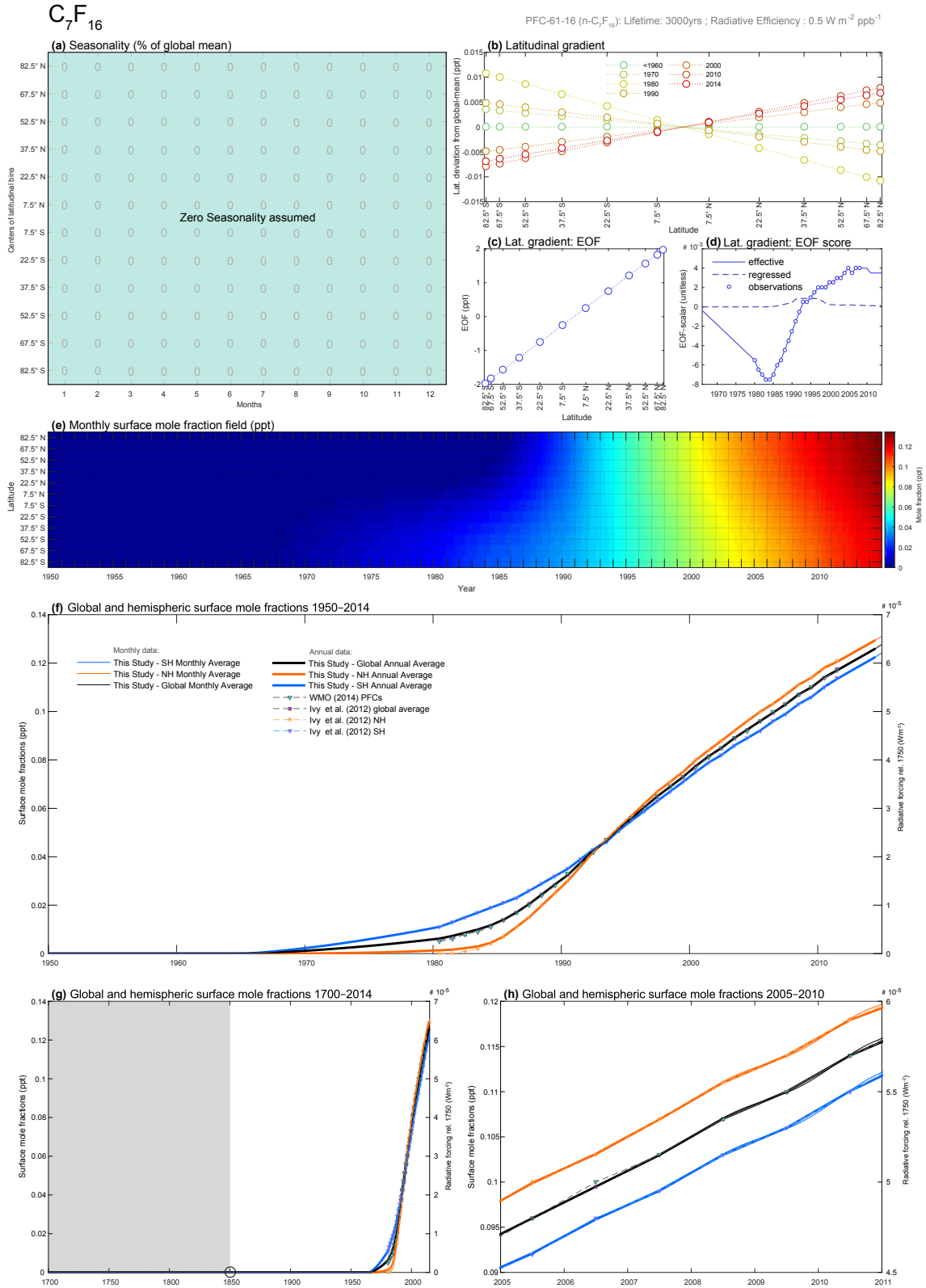


Figure S23. C₇F₁₆ Factsheet

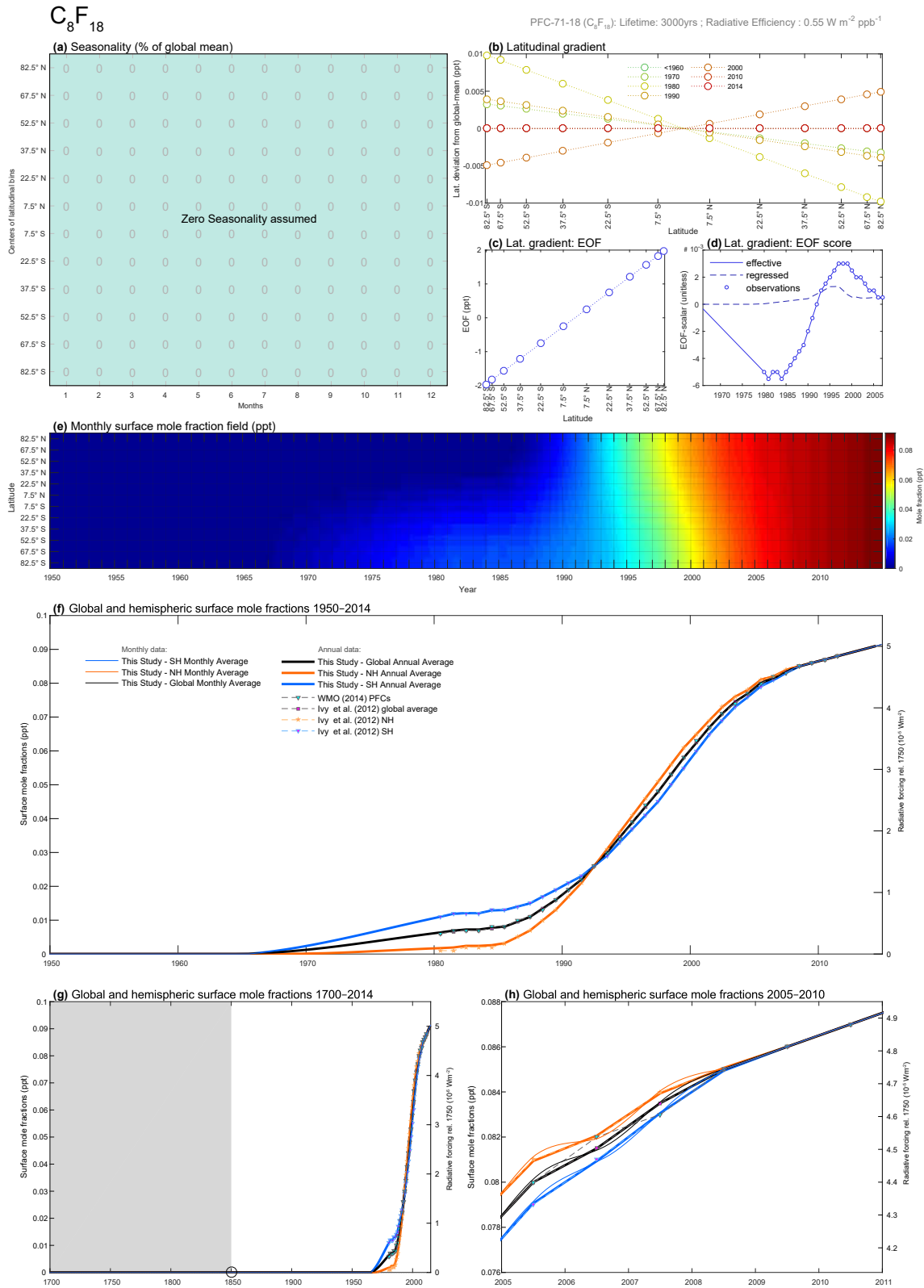


Figure S24. C₈F₁₈ Factsheet

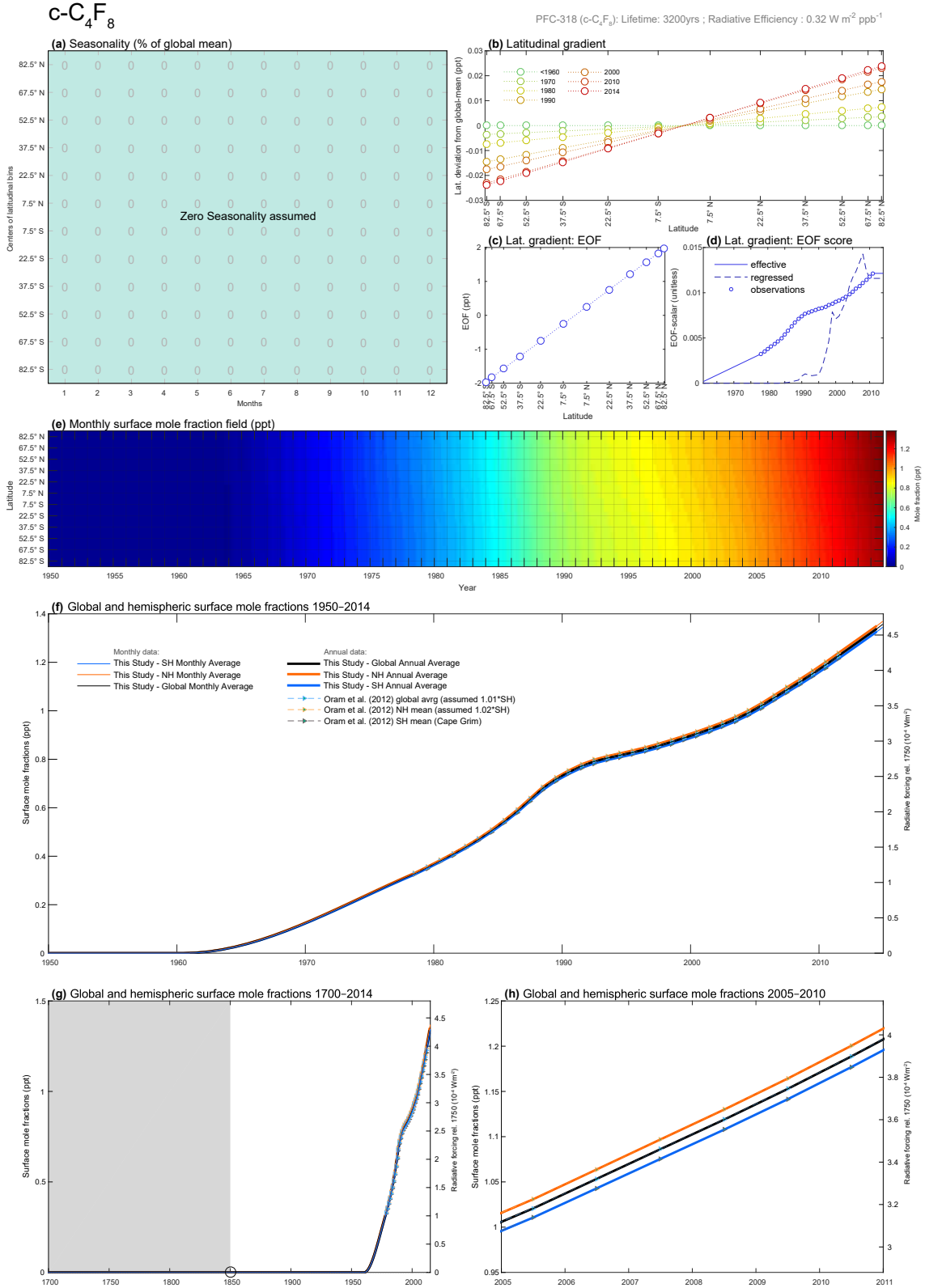


Figure S25. c-C₄F₈ Factsheet

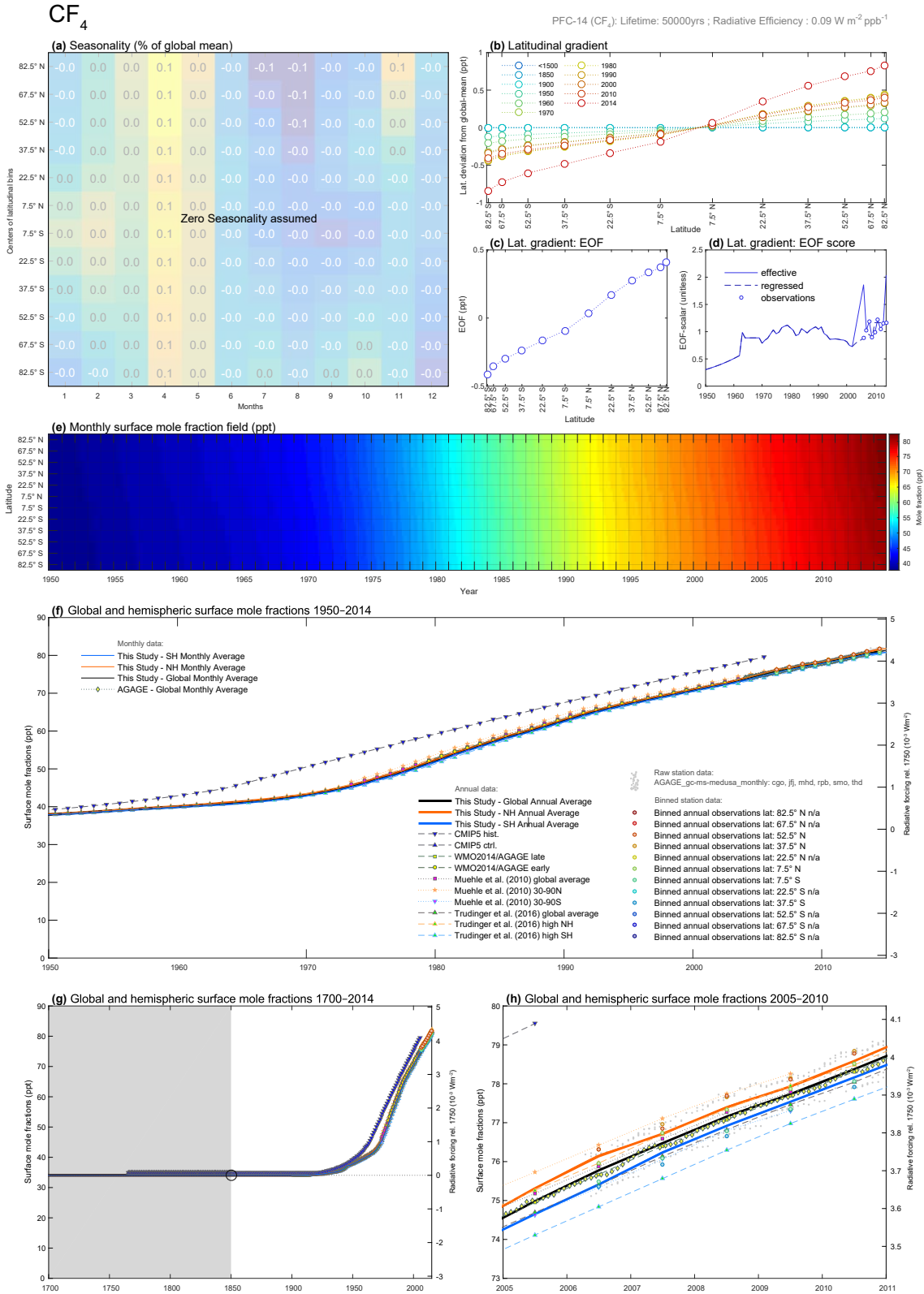


Figure S26. CF₄ Factsheet

HFC-23

HFC-23 (CHF₃): Lifetime: 222yrs ; Radiative Efficiency : 0.18 W m⁻² ppb⁻¹

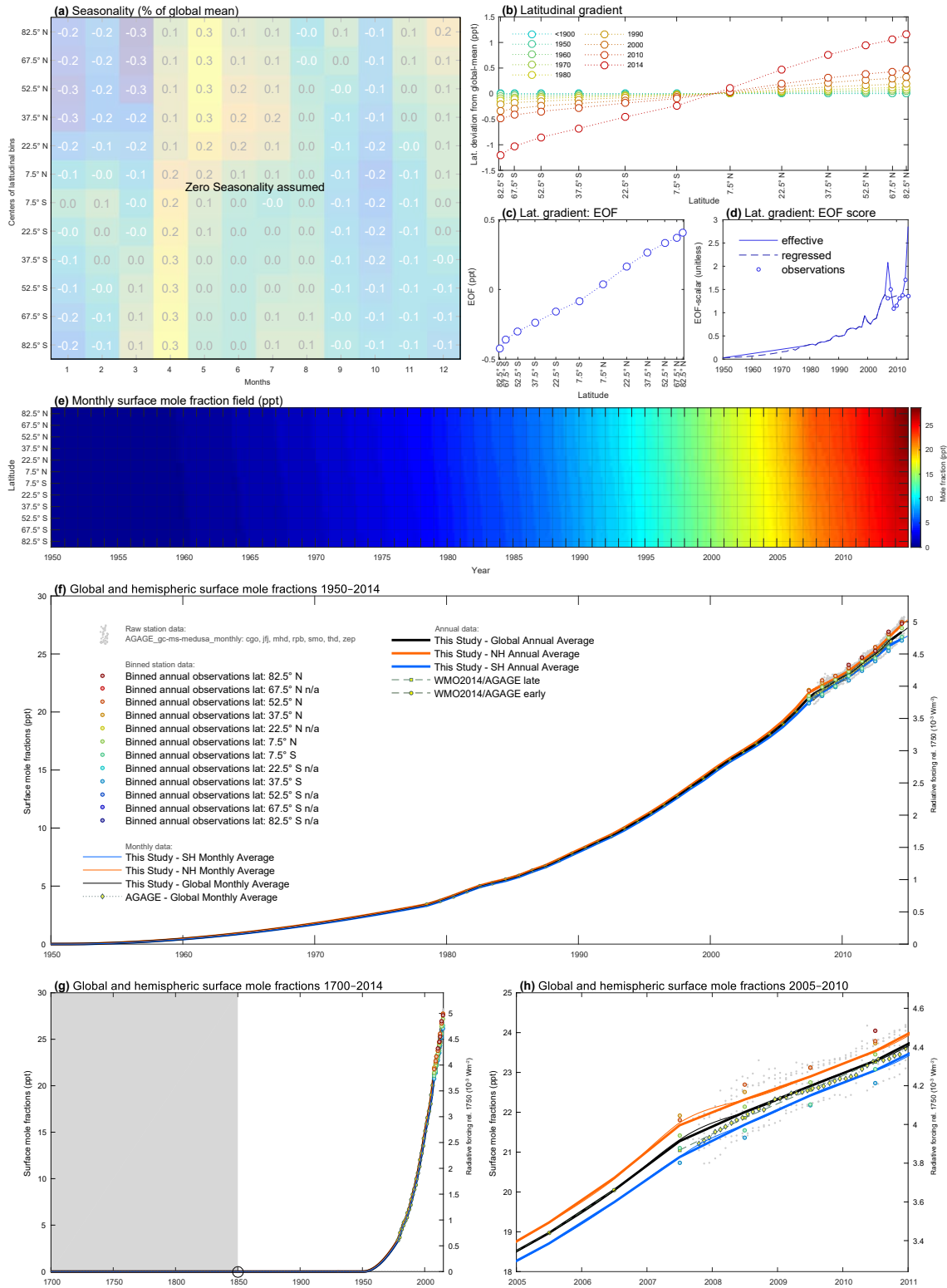


Figure S27. HFC-23 Factsheet

HFC-32

HFC-32 (CH₂F₂): Lifetime: 5.2yrs ; Radiative Efficiency : 0.11 W m⁻² ppb⁻¹

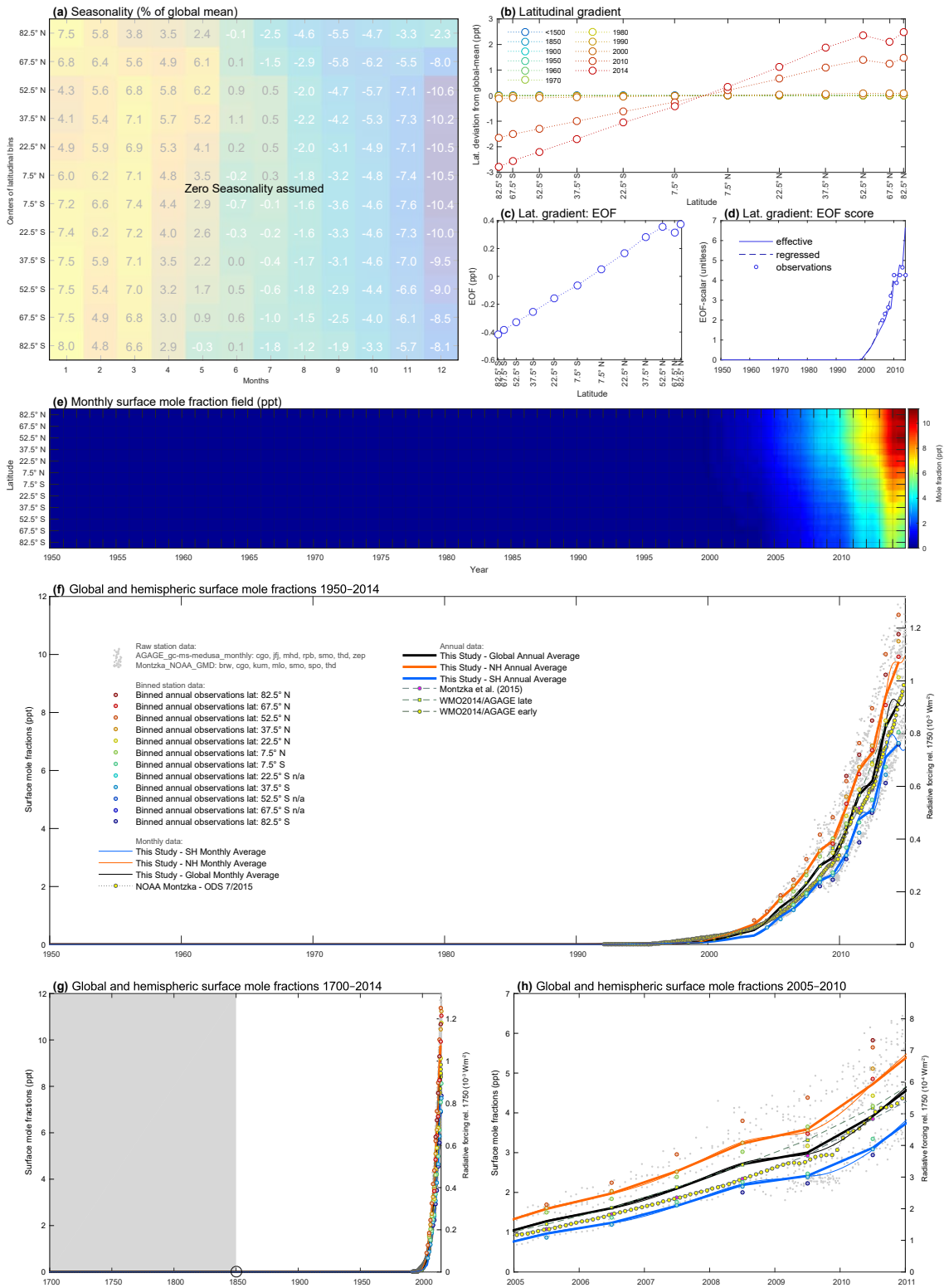


Figure S28. HFC-32 Factsheet

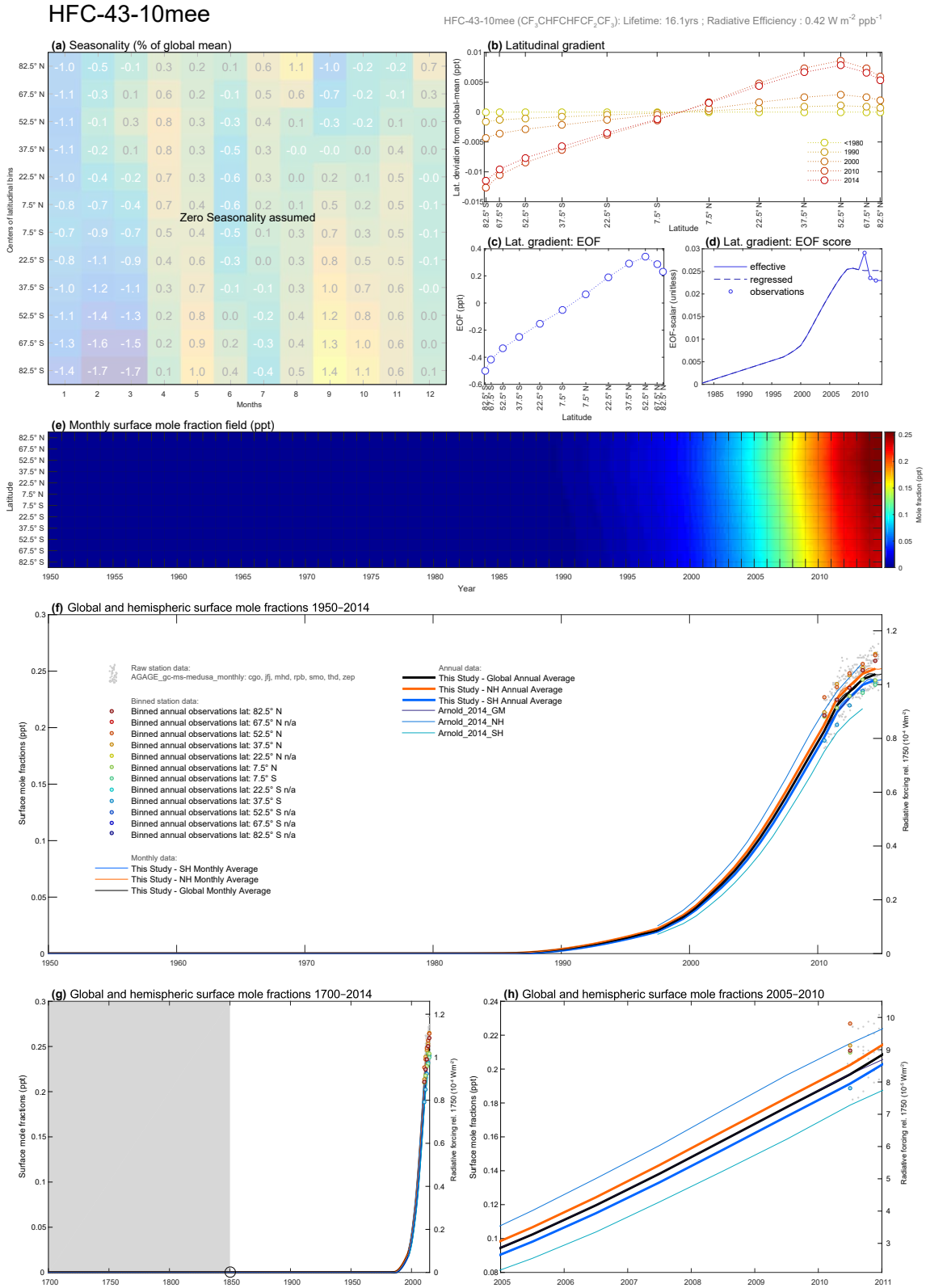


Figure S29. HFC-43-10-mee Factsheet

HFC-125

HFC-125 (CHF₂CF₃): Lifetime: 28.2yrs ; Radiative Efficiency : 0.23 W m⁻² ppb⁻¹

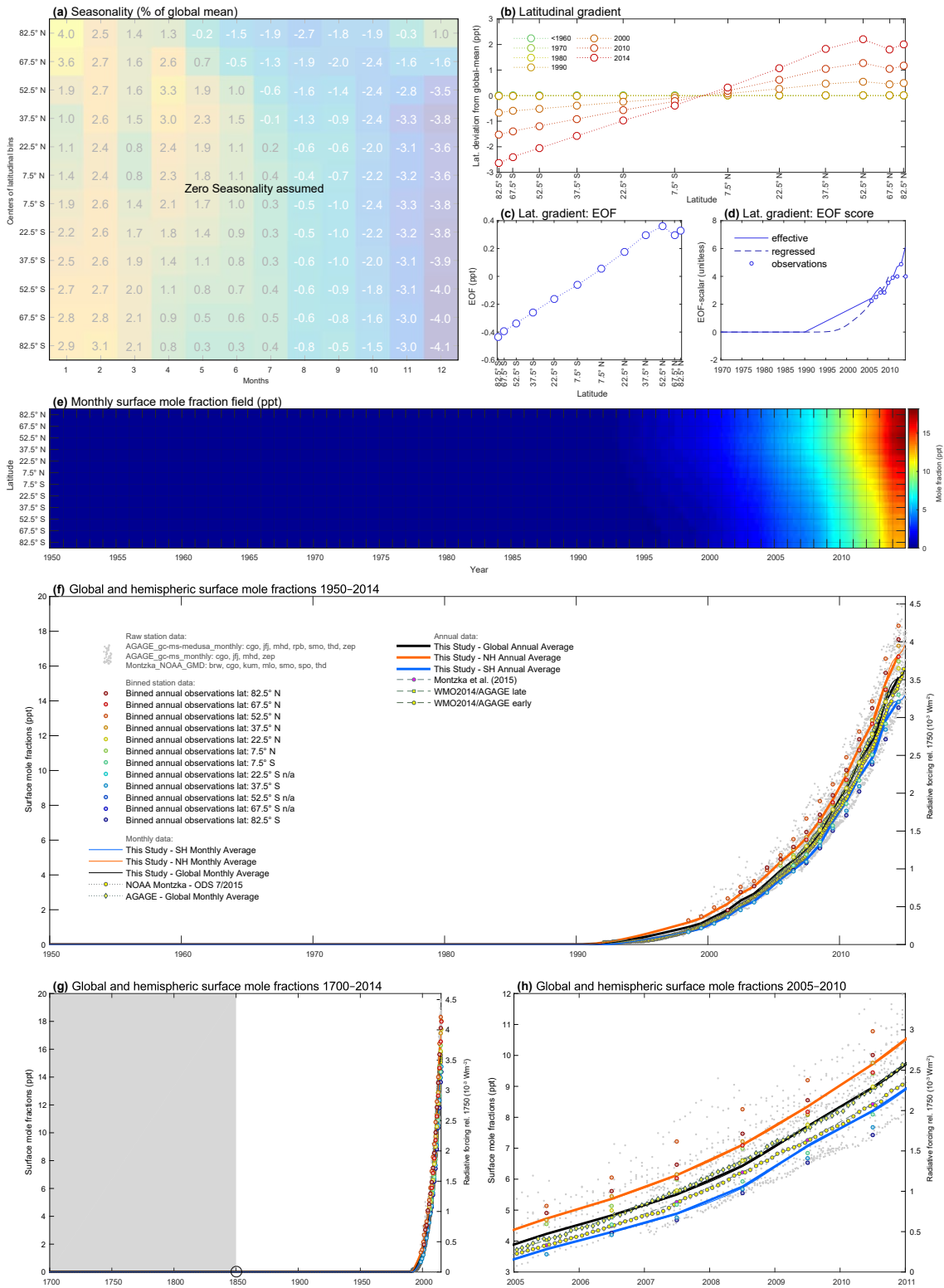


Figure S30. HFC-125 Factsheet

HFC-134a

HFC-134a (CH₂FCF₂): Lifetime: 13.4yrs ; Radiative Efficiency : 0.16 W m⁻² ppb⁻¹

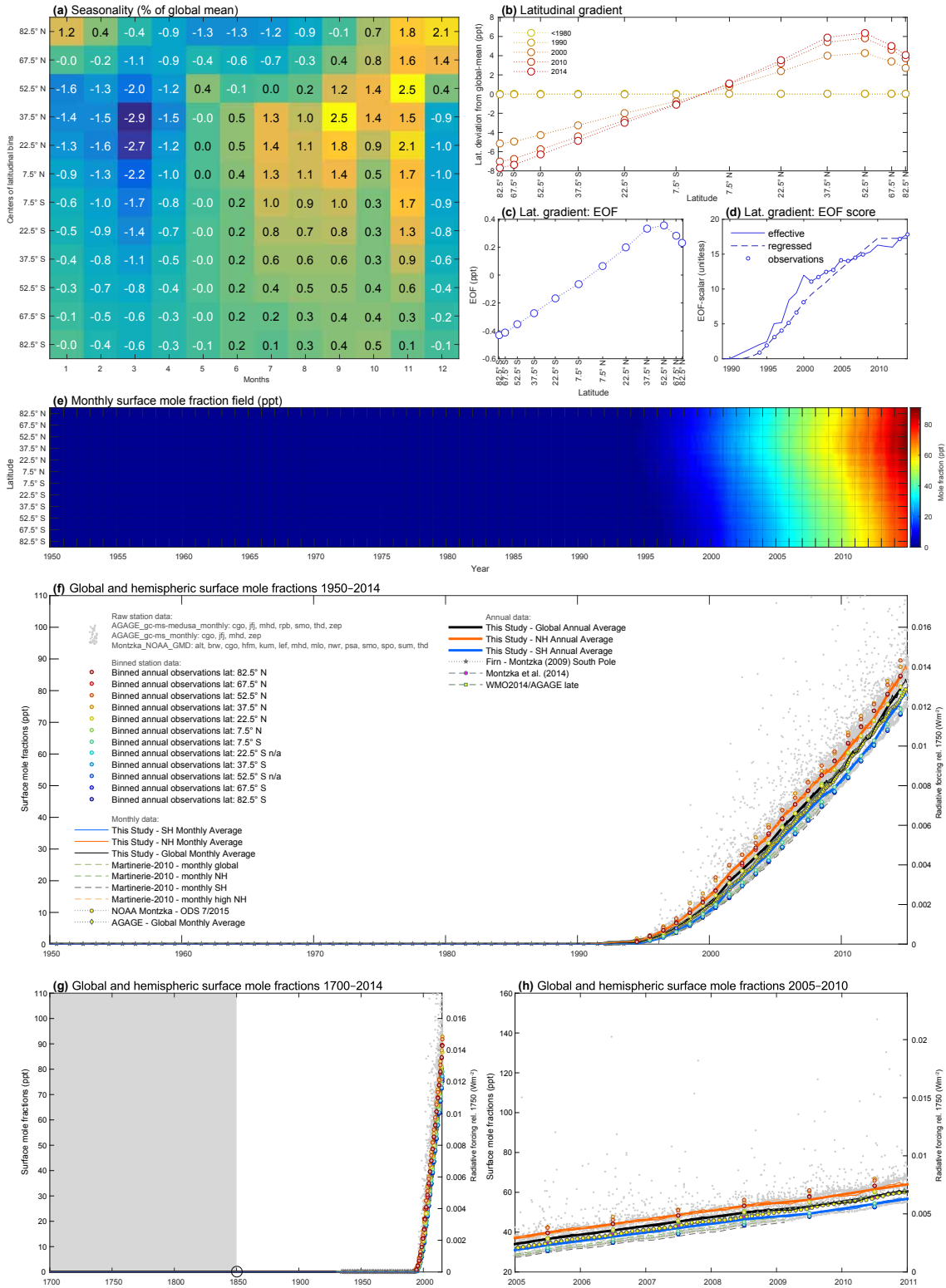


Figure S31. HFC-134a Factsheet

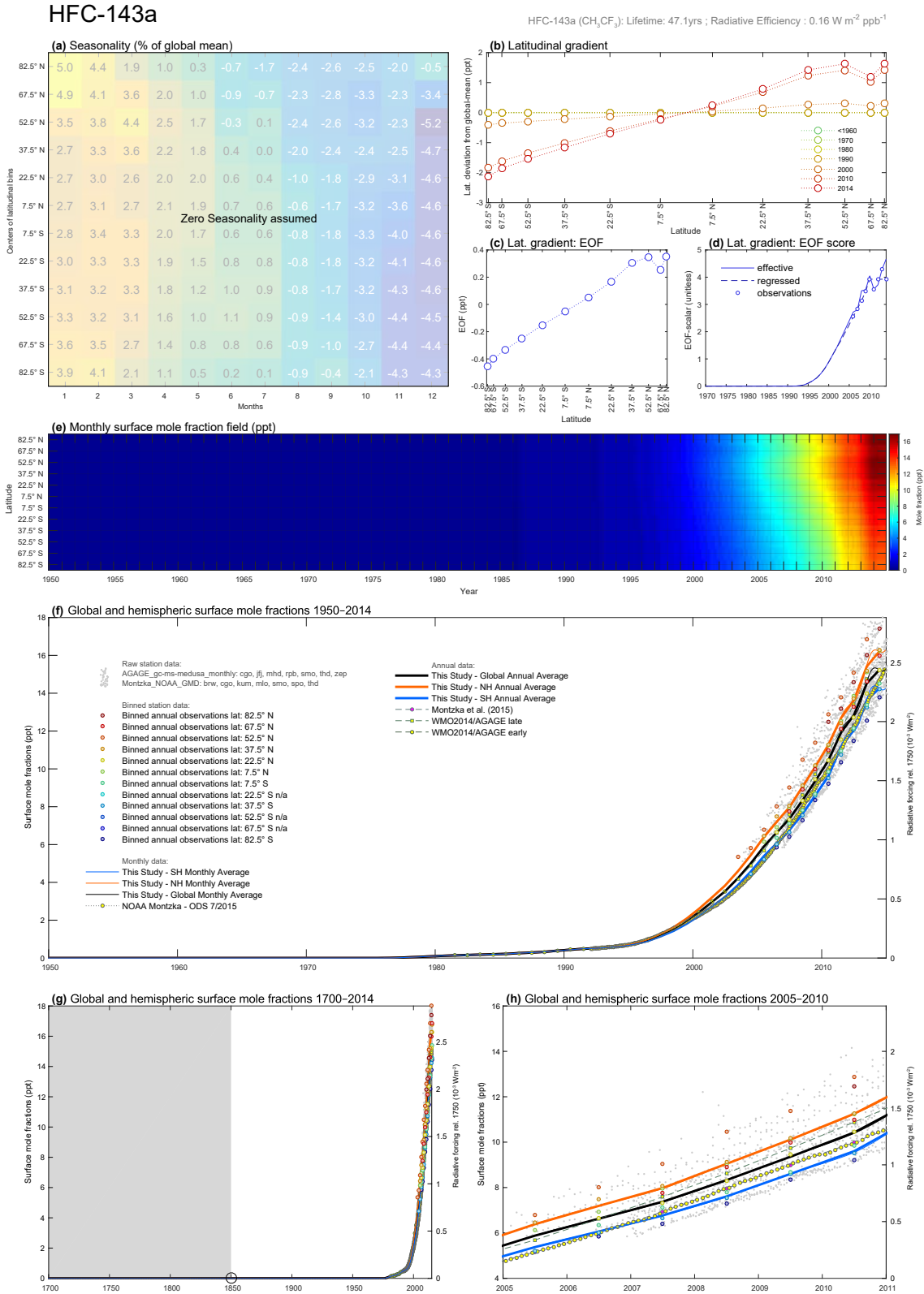


Figure S32. HFC-143a Factsheet

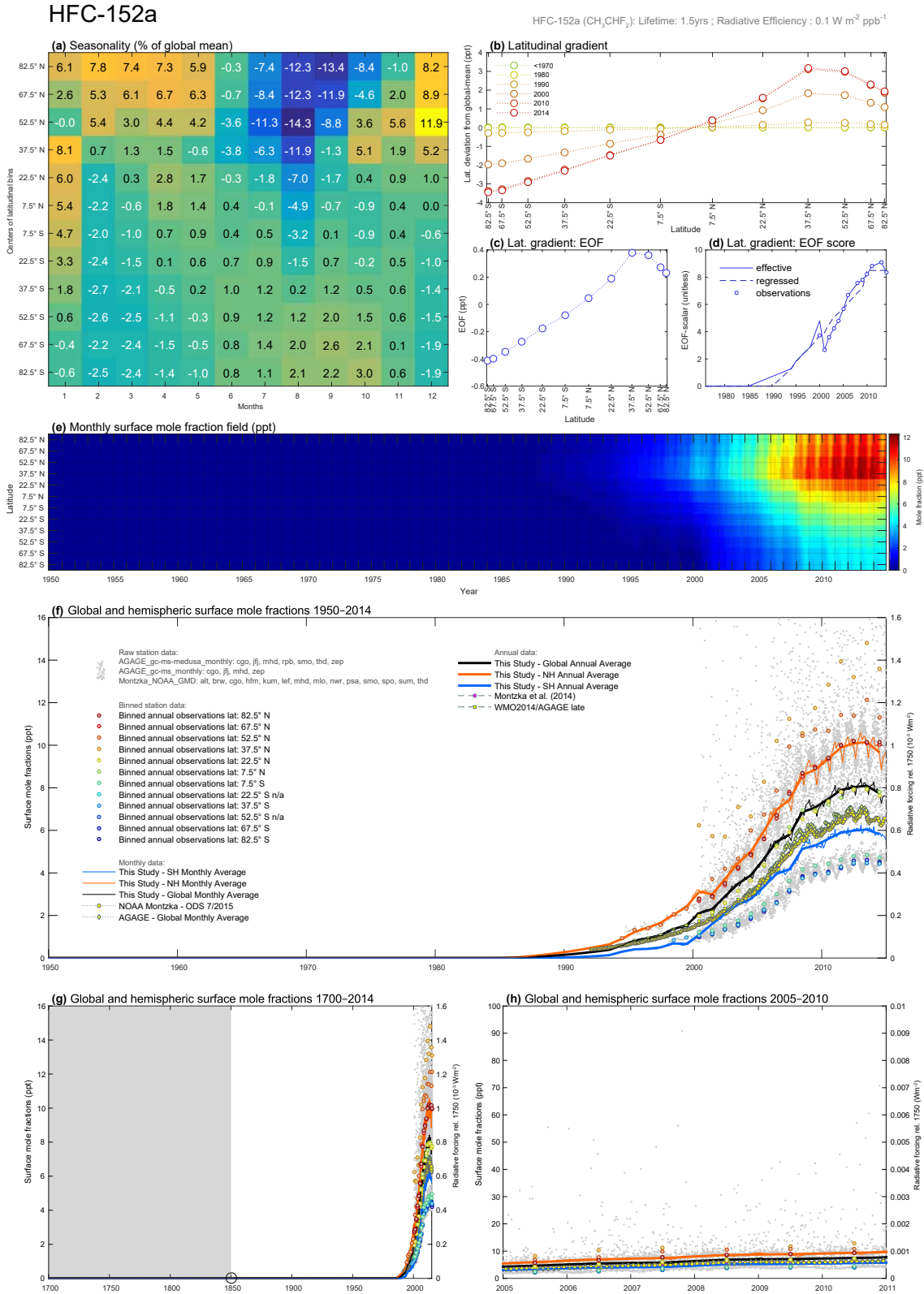


Figure S33. HFC-152a Factsheet

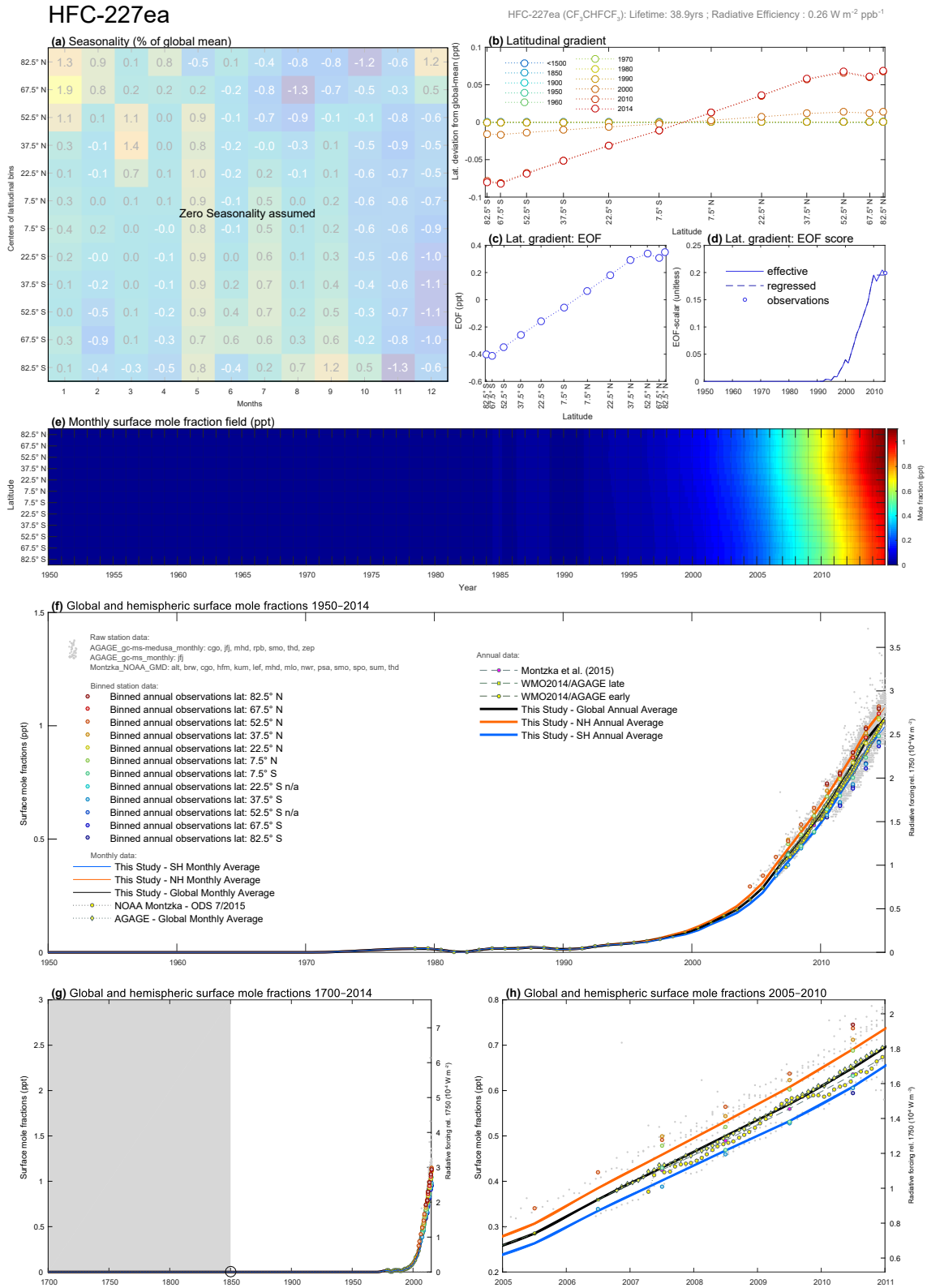


Figure S34. HFC-227ea Factsheet

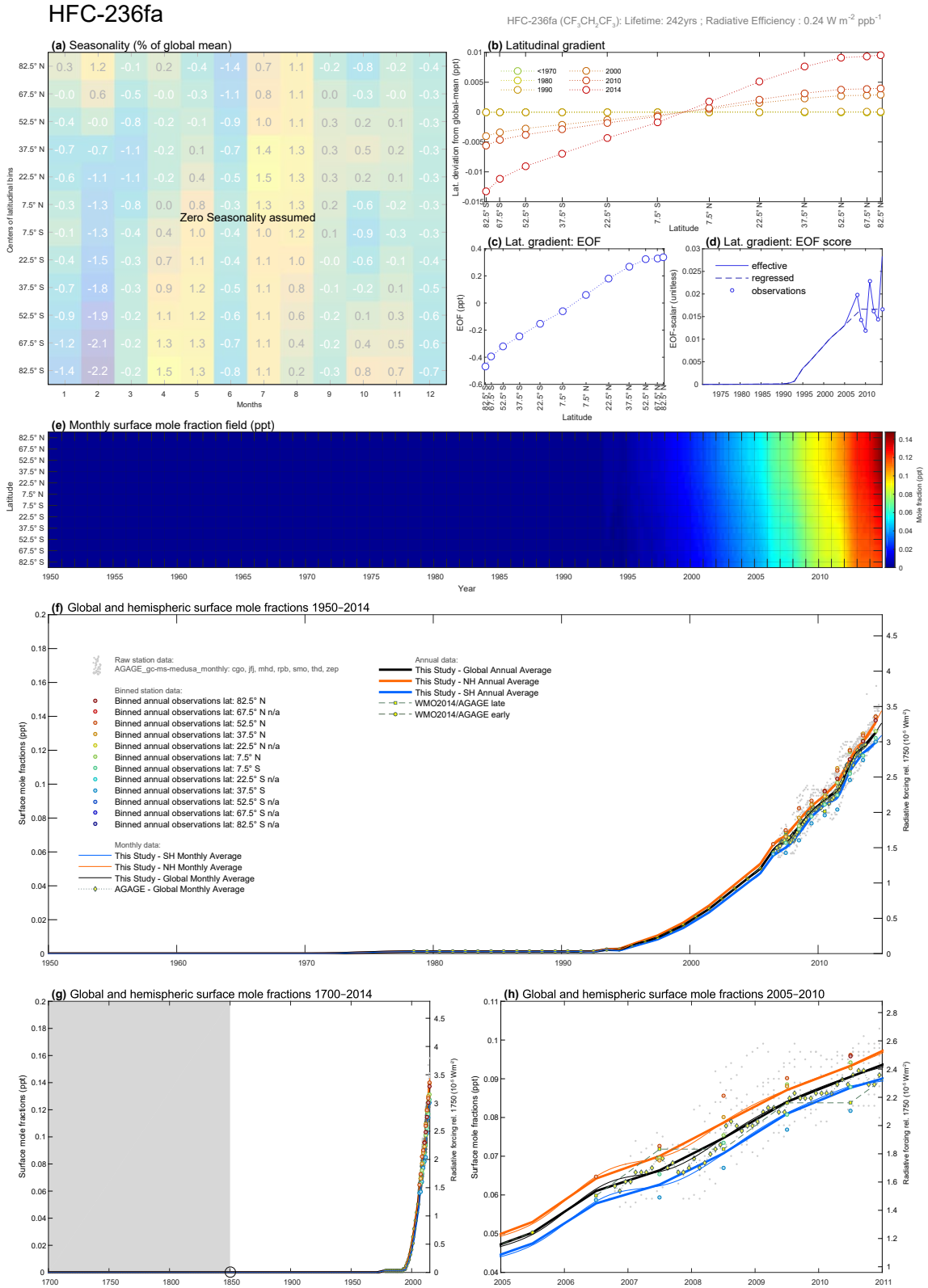


Figure S35. HFC-236fa Factsheet

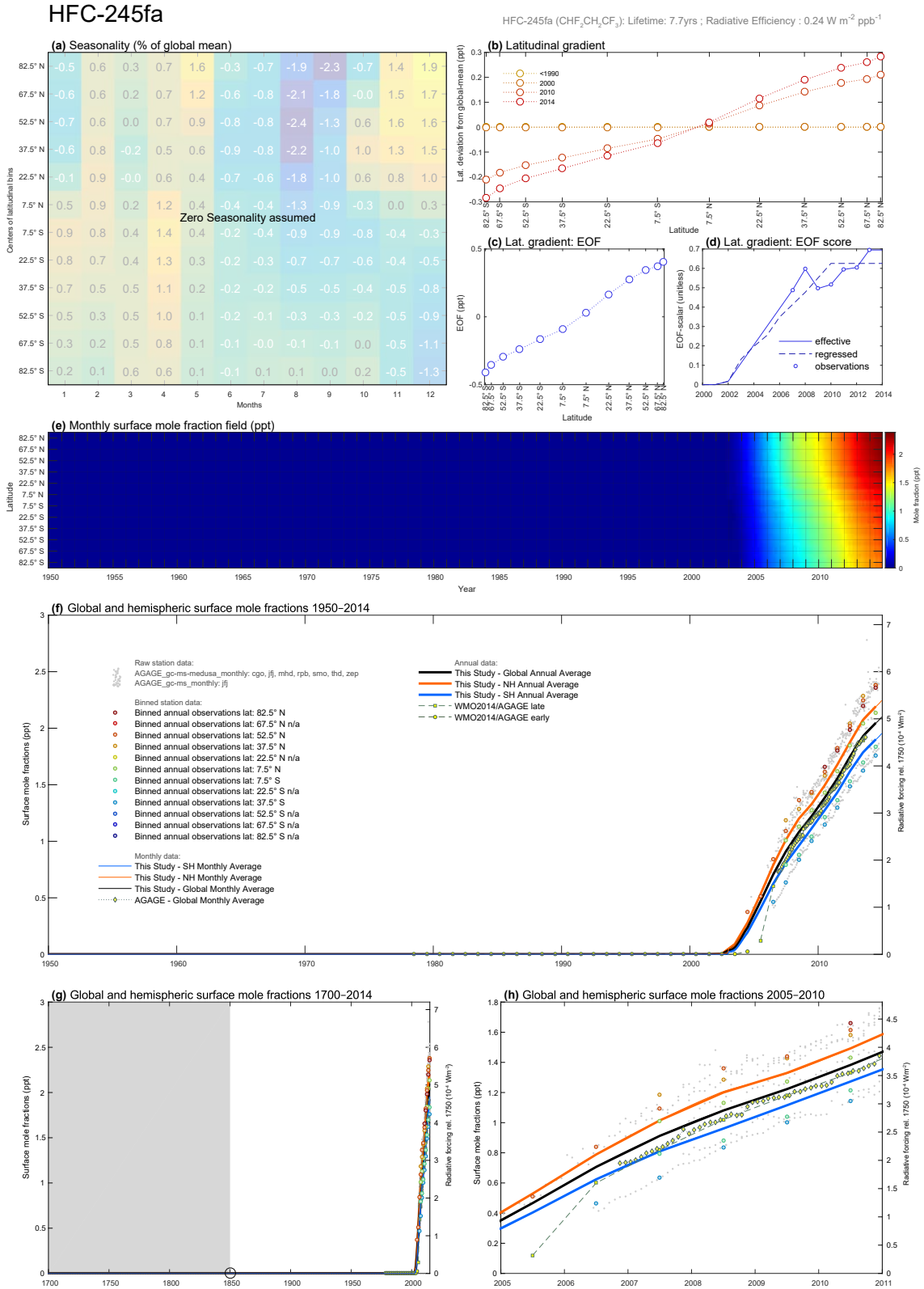


Figure S36. HFC-245fa Factsheet

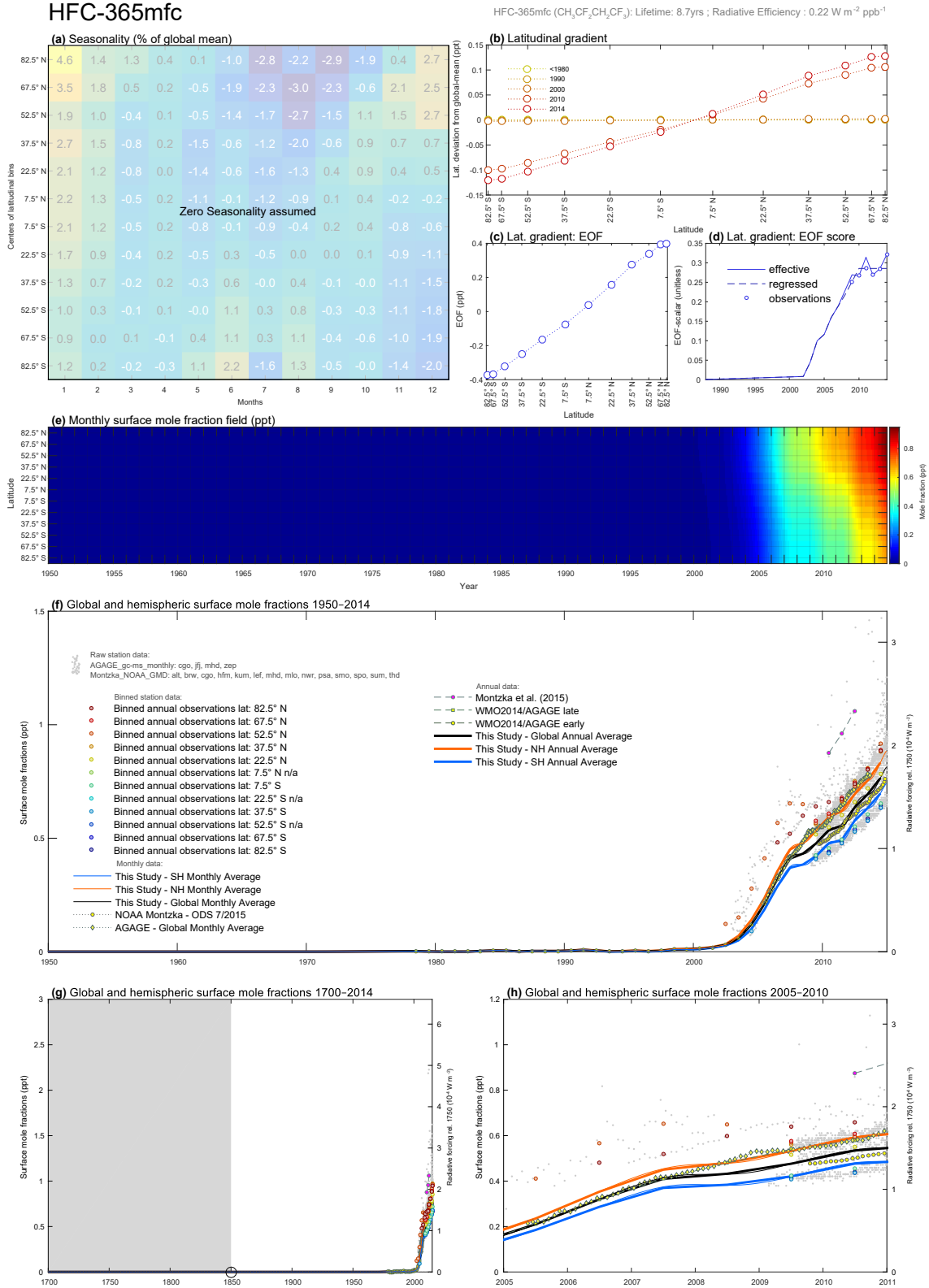


Figure S37. HFC-365mfc Factsheet

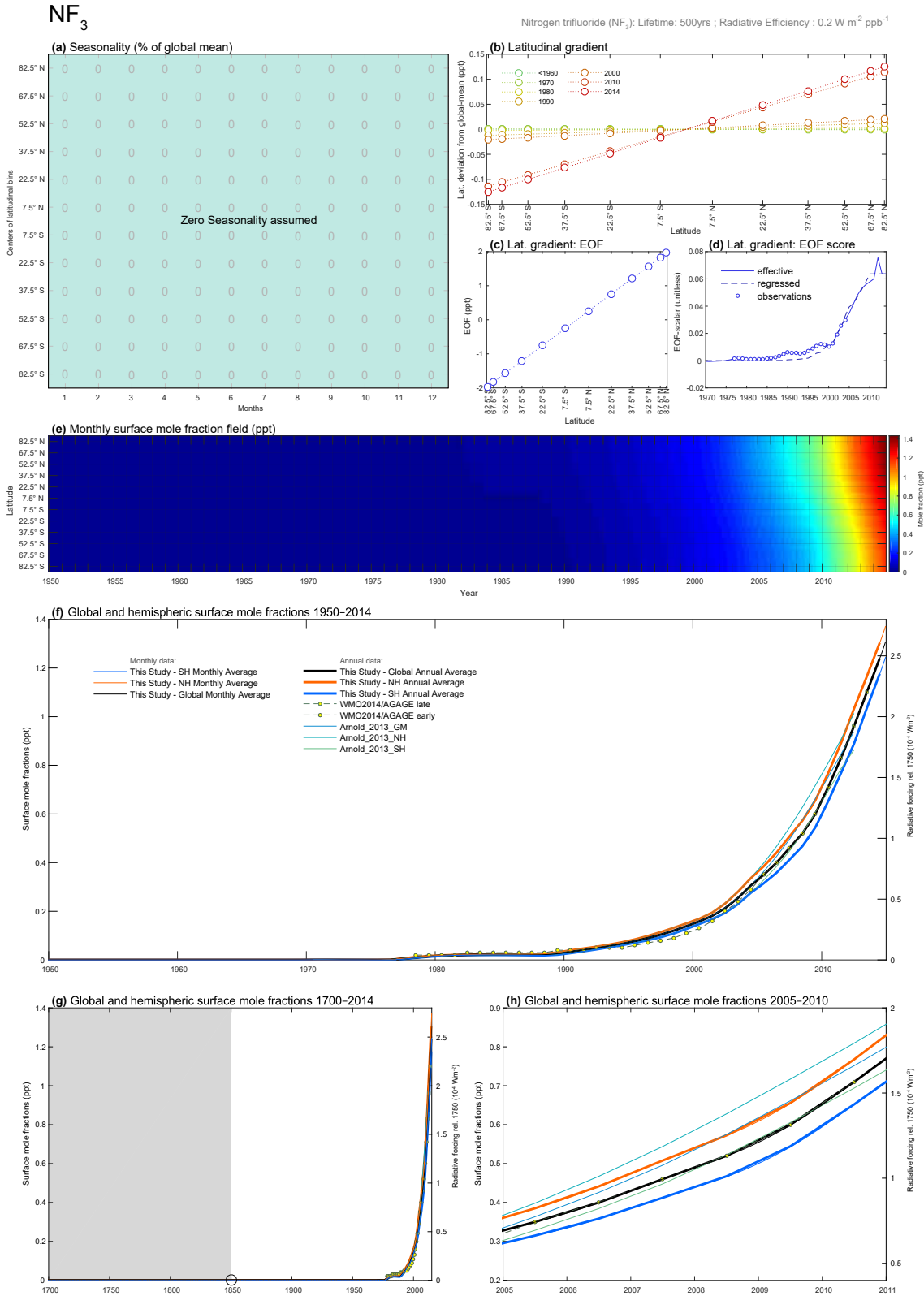


Figure S38. NF₃ Factsheet

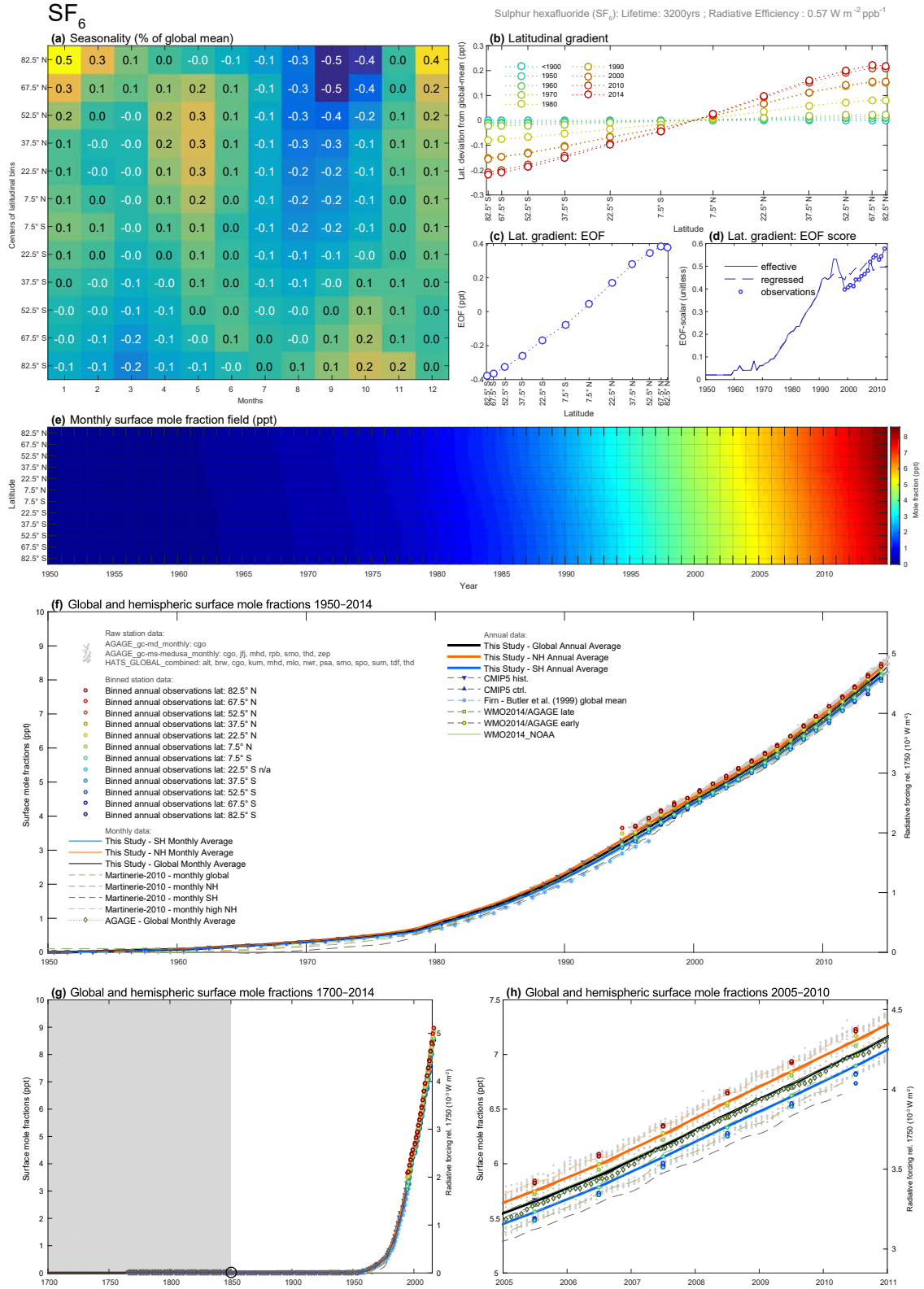


Figure S39. SF₆ Factsheet

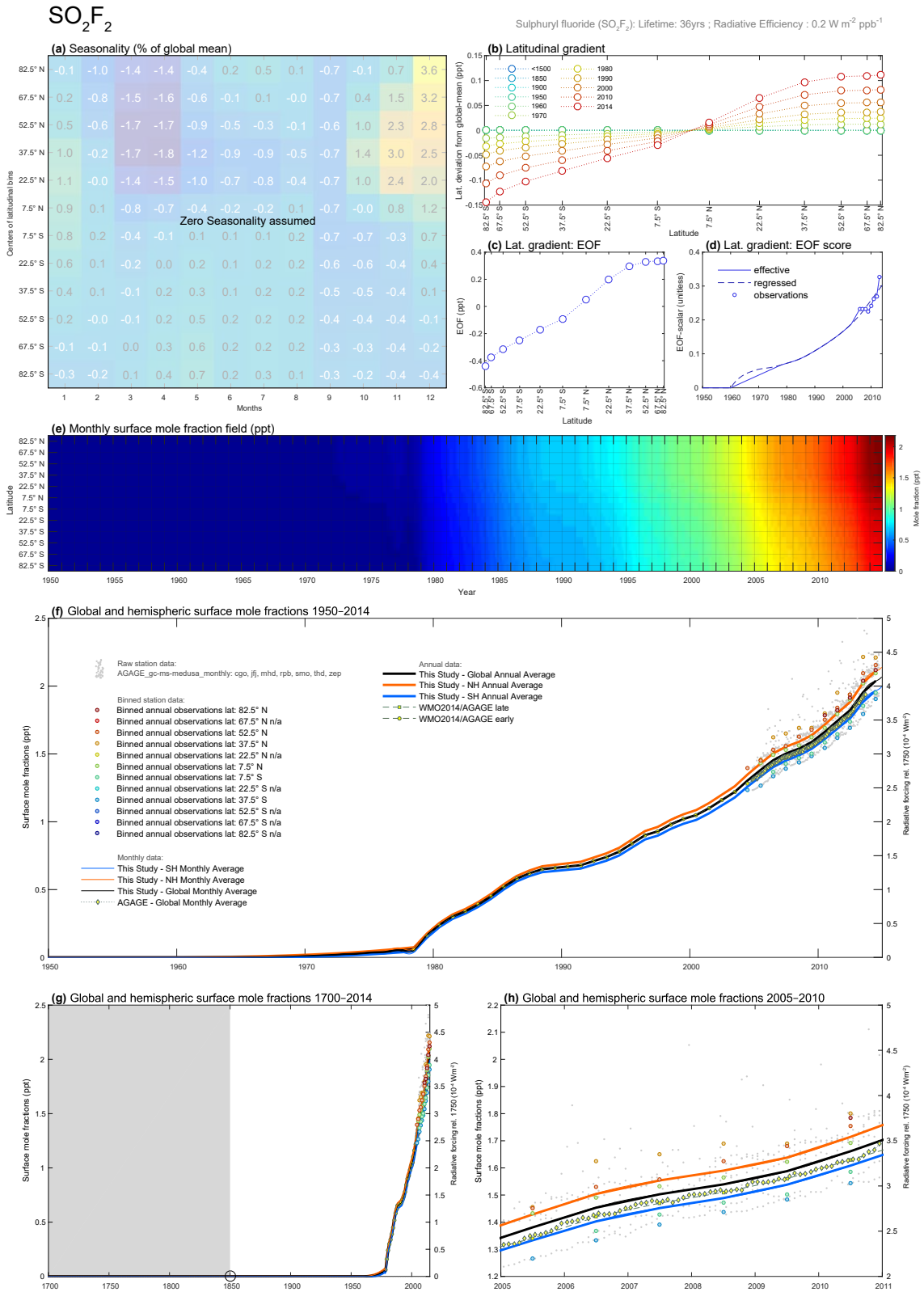


Figure S40. SO₂F₂ Factsheet

2 Supplement B:

CMIP5 Analysis of CO₂ concentration fields

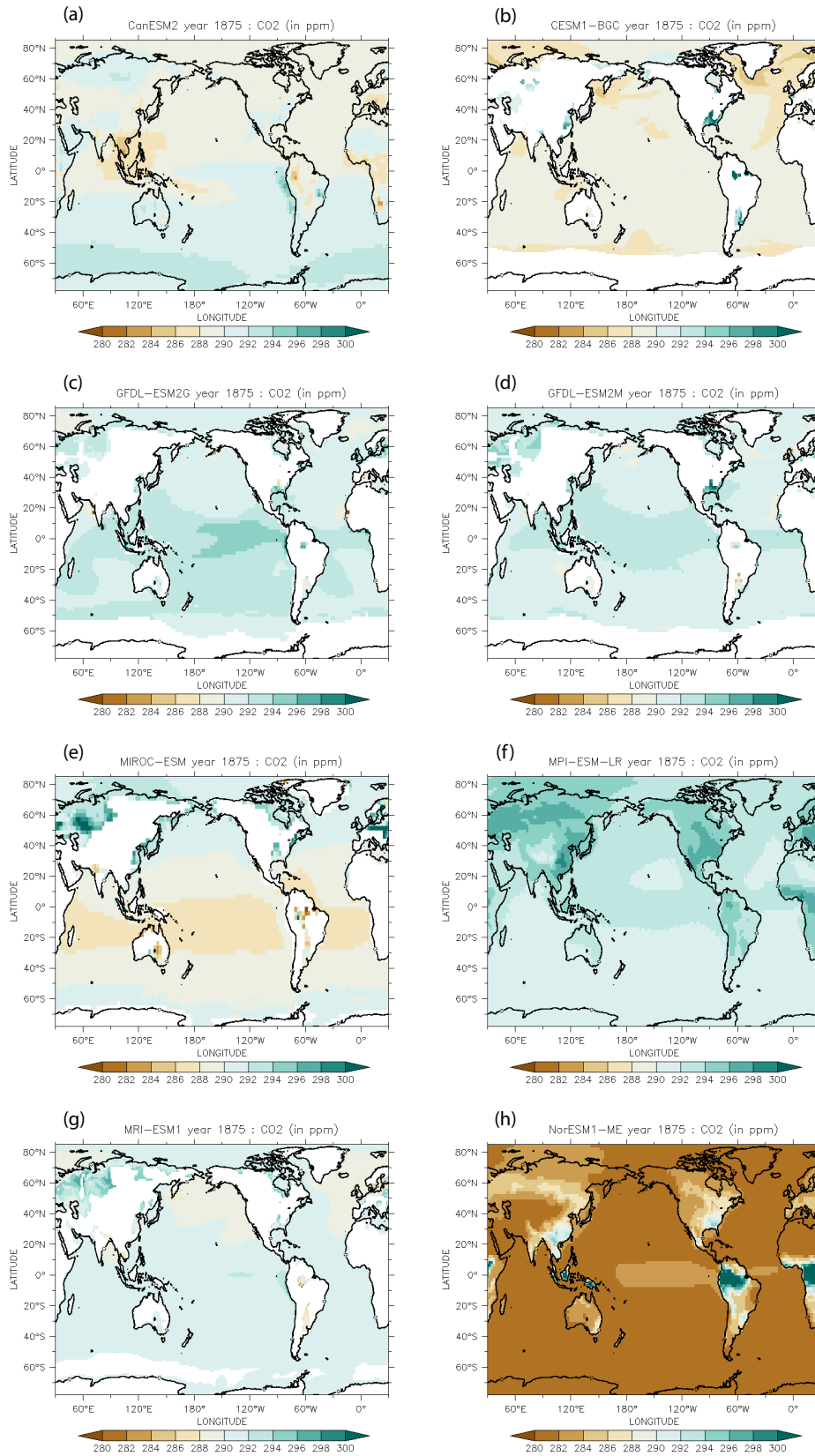


Figure S41. Annual mean CO₂ concentrations in 8 CMIP5 ESM models in the year 1875. The CMIP5 recommended value was 288.7 ppm for 1875. Two more models with higher average CO₂ concentrations, namely BNU-ESM and FIO-ESM, are shown in Fig. S.B7.

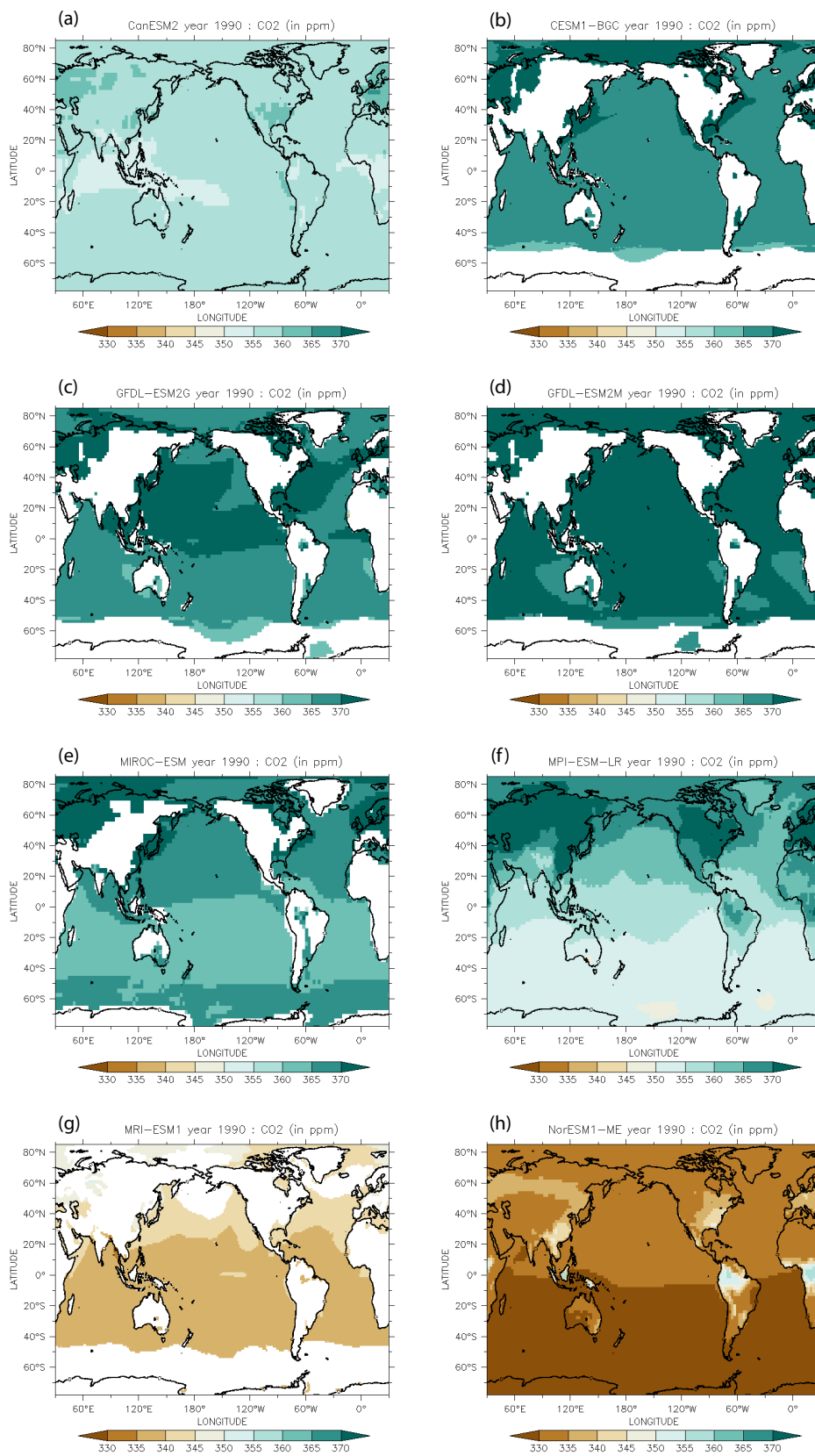


Figure S42. Annual mean CO₂ concentrations in 8 CMIP5 ESM models in the year 1990. The CMIP5 recommended value was 353.885 ppm for 1990 in the historical experiment.

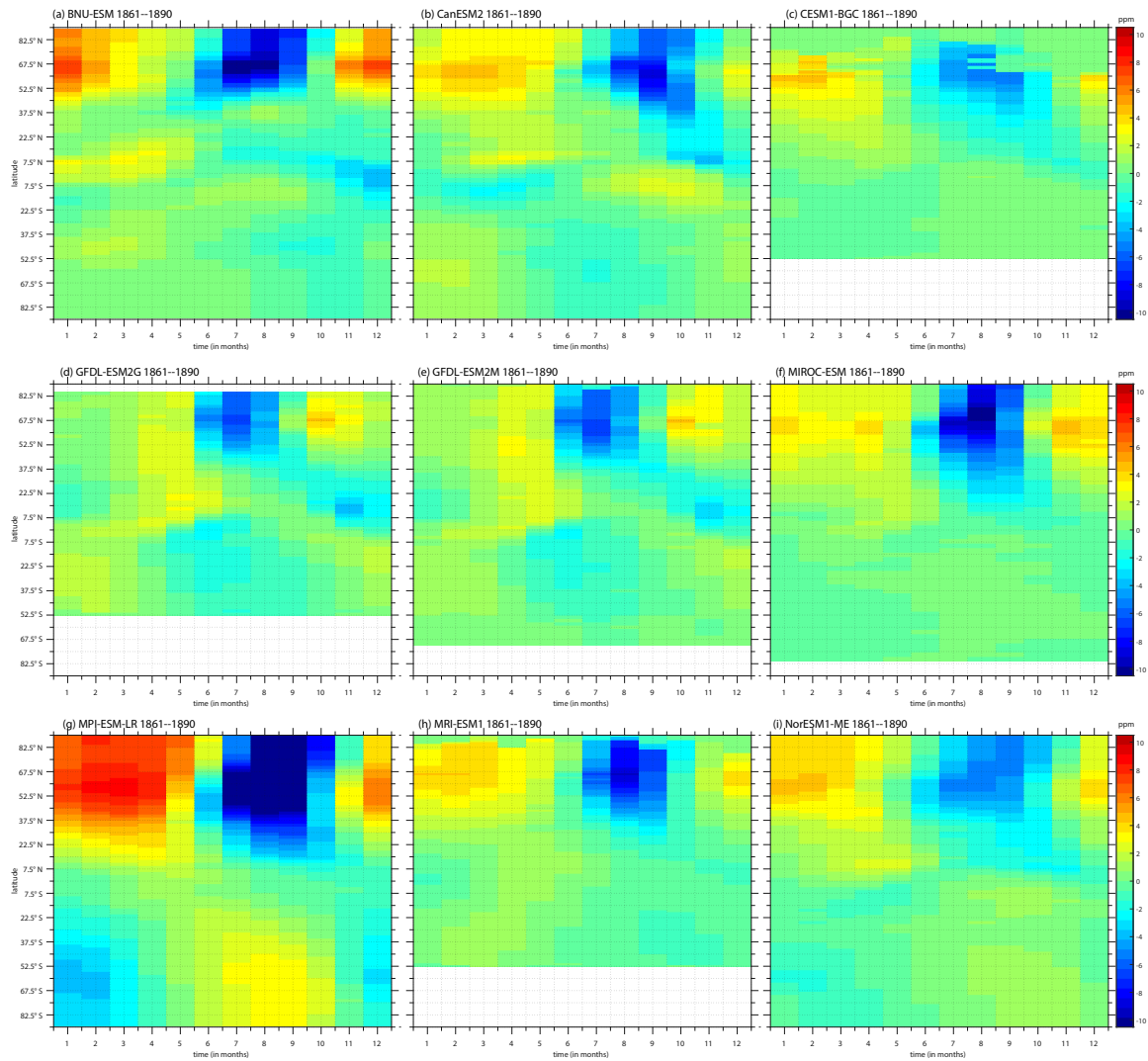


Figure S43. Climatological seasonal cycle of CO₂ concentrations in 9 CMIP5 ESM models for the historical experiment's 30-year period 1861-1890.

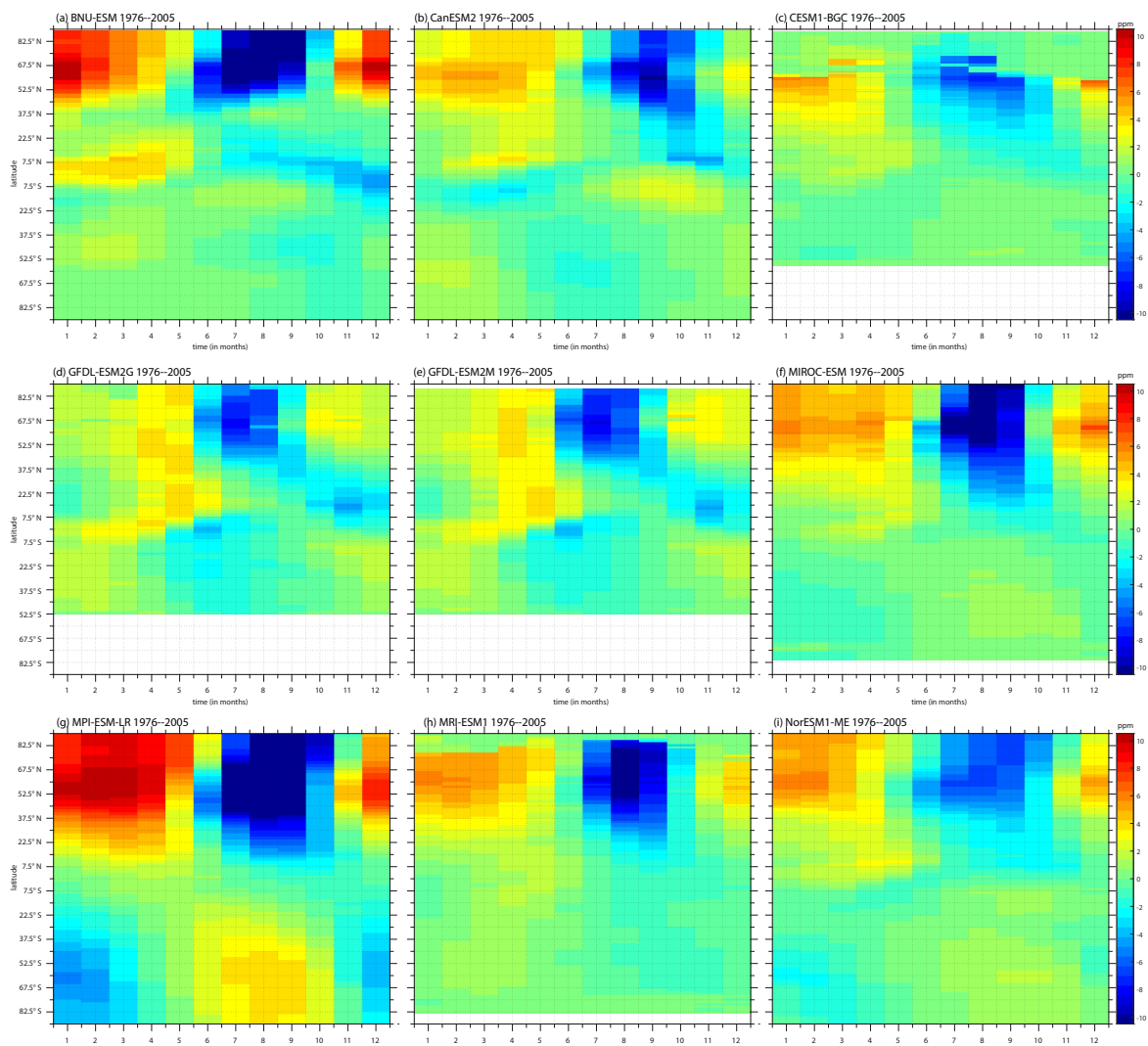


Figure S44. Climatological seasonal cycle of CO₂ concentrations in 9 CMIP5 ESM models for the historical experiment's 30-year period 1976-2005.

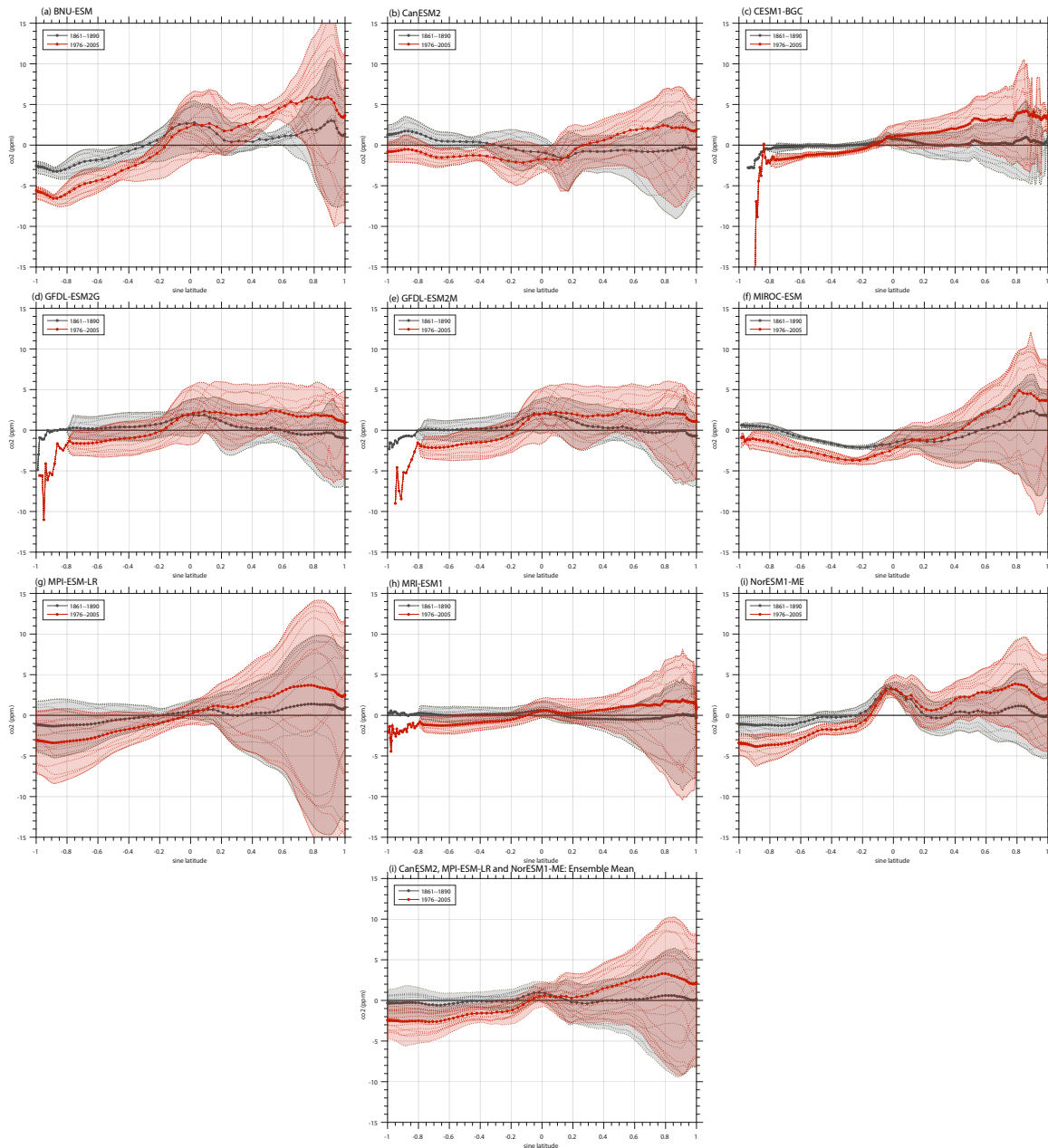


Figure S45. Latitudinal gradient of surface atmospheric CO₂ concentrations exhibited in 9 considered CMIP5 ESM models for both the preindustrial period (grey lines) and recent period 1976-2005 (red lines). The bold dotted lines indicate the annual means. The 12 finer lines represent the individual twelve monthly averages over the respective 30 year periods (shaded areas show the min-max of those monthly averages). The lowest panel shows an ensemble mean for three CMIP5 ESMs, namely CanESM2, MPI-ESM-LR and NorESM1-ME.

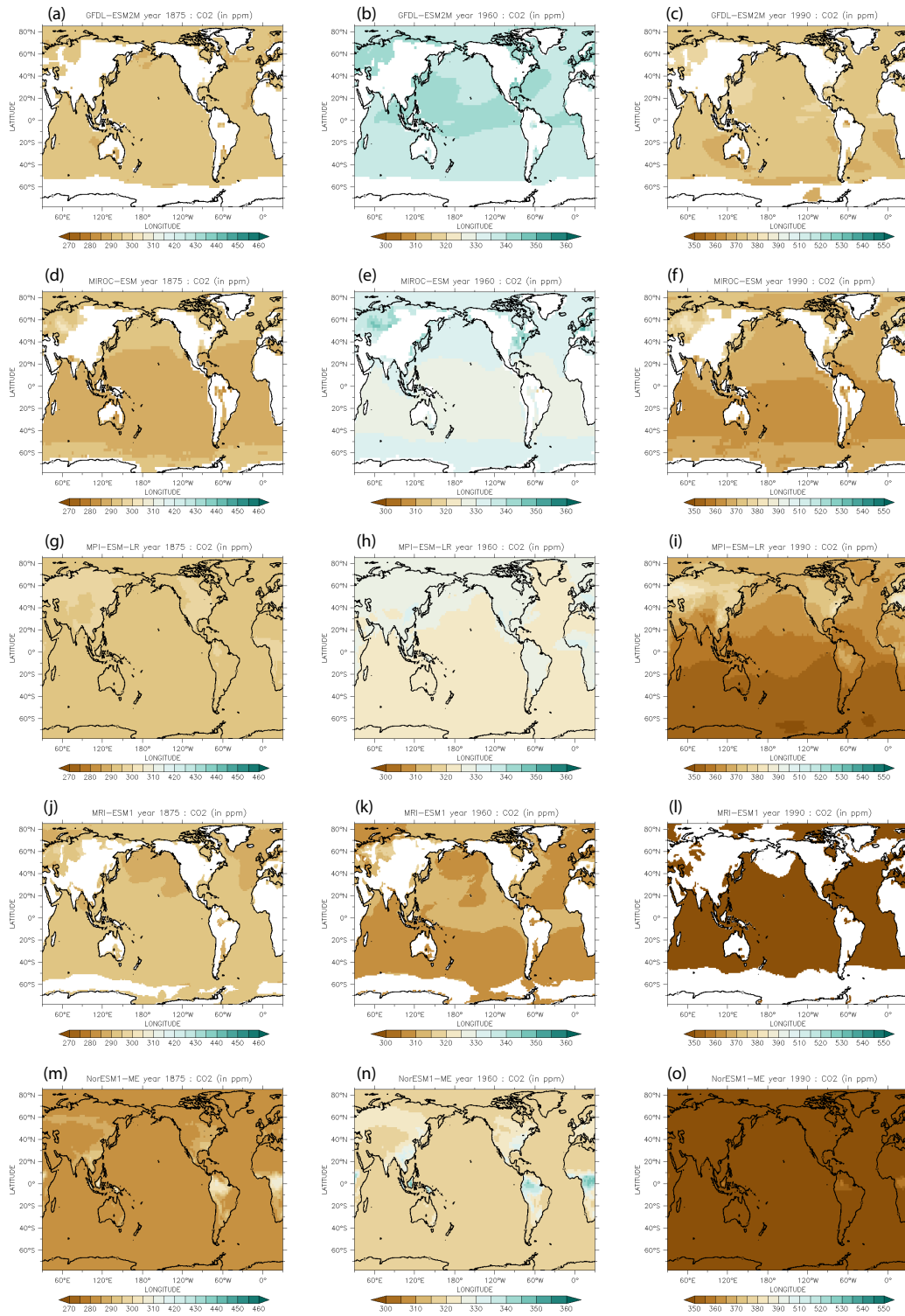


Figure S46. Annual average CO₂ concentration fields diagnosed from CMIP5 ESM models for the years 1875 (left column), 1960 (middle column), and 1990 (right column). All models are on the same colour scale, with colouring steps at 5 ppm. 1990 annual average CO₂ concentrations are estimated in this study to be 354.07 ppm and had been specified for CMIP5 with 353.855 ppm.

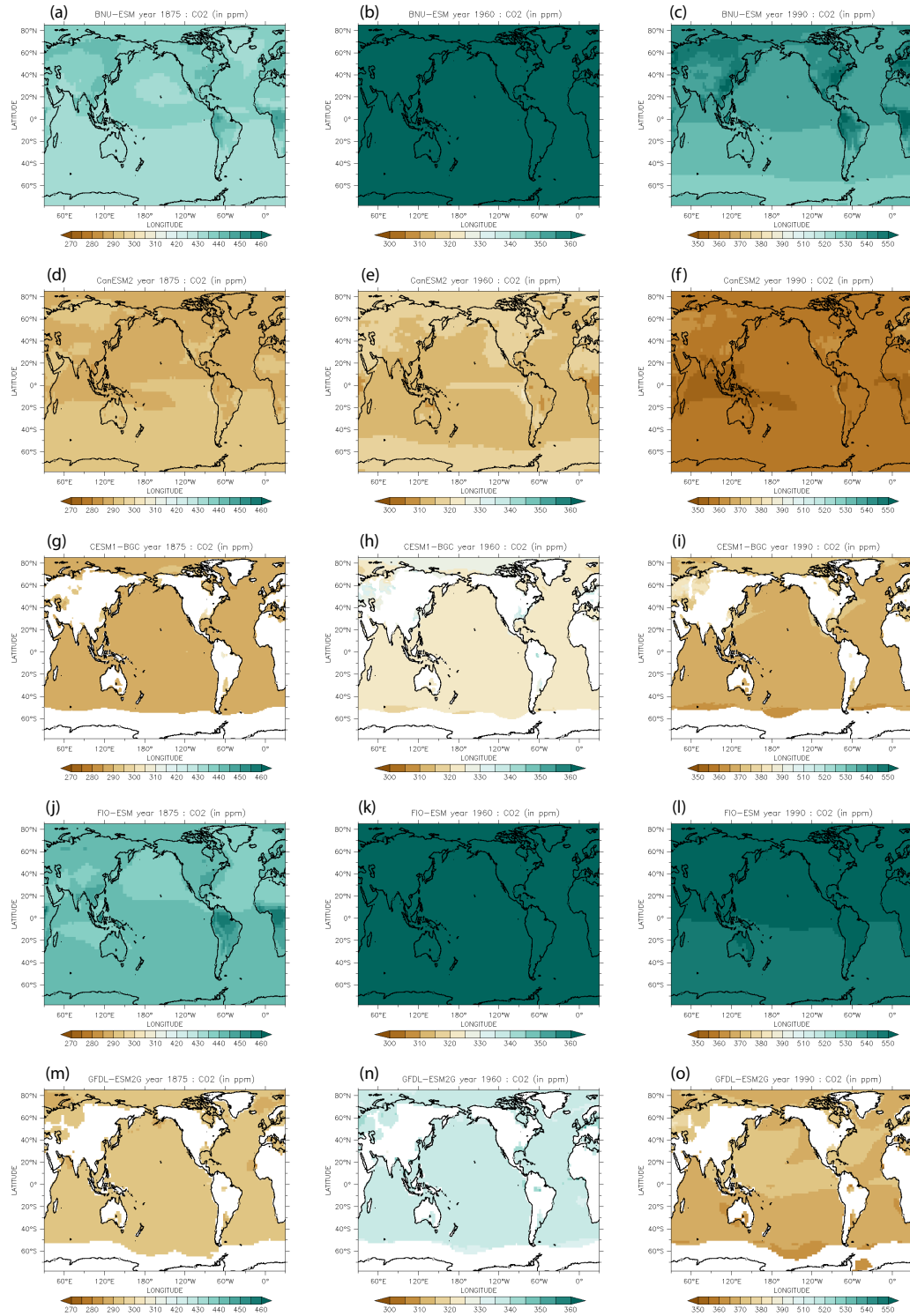


Figure S47. As Fig. S.B6, but for a different set of five CMIP5 ESM models.