

HFC-227ca

Molecular Formula: CHF₂-CF₂-CF₃
 CAS RN: 2252-84-8
 Molecular Weight: 170.03

Global Atmospheric Lifetime (years): 23.7 (30)
 Tropospheric Atmospheric Lifetime (years): 24.8 (32)
 Stratospheric Atmospheric Lifetime (years): 523 (640)

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.266	0.285 (0.27)

Global Warming Potential (GWP _H):		
GWP ₂₀		5122 (5260)
GWP ₁₀₀		2410 (2865)

Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		4742 (5070)
GTP ₅₀		2085 (2795)
GTP ₁₀₀		598 (975)

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂
 * Italic values in () taken from WMO-2018

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 2.37 \times 10^{-15}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 1.51 \times 10^{-15}$$

$$\tau_{\text{Global}}^{\text{OH}} = 23.8 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 24.8 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 609.8 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 1.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 3700 \text{ years}$$

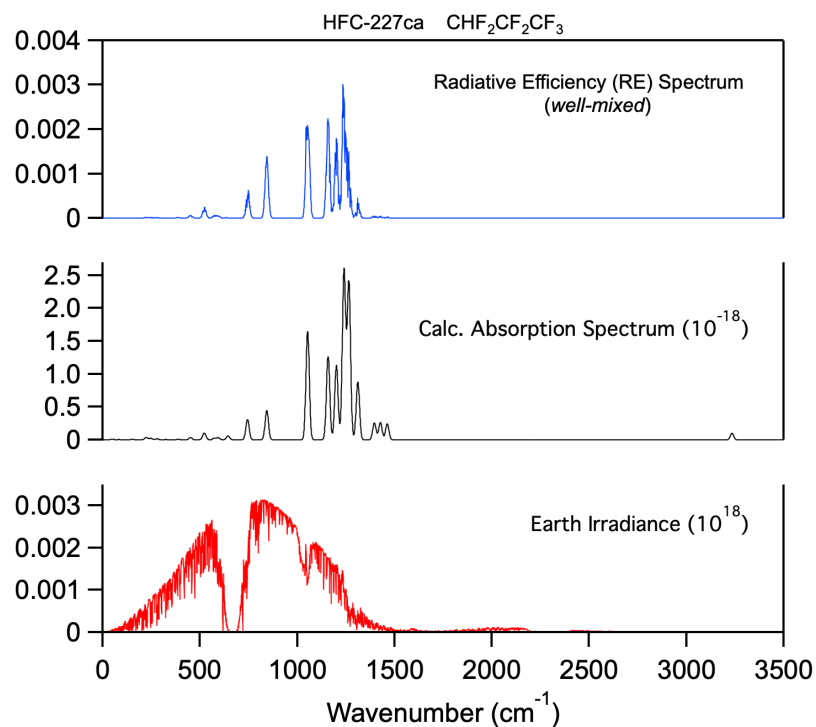
$$k_{\text{Rec}}(T) = NA$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
49	1.2
83	0.6
152	1
223	4.4
247	2.8
279	1.8
324	0.6
352	0.1
388	1
451	4.1
522	13.4
574	3.1
594	3.8
644	7.8
744	39.4
843	57.5
1053	212.3
1157	78.2
1159	85.9
1201	145.1
1240	330.9
1265	305.9
1311	113.3
1396	33.2
1427	34.1
1462	31.2
3234	12.8

Radiative Efficiency Spectrum



HFC-227ea

Molecular Formula: CF₃-CHF-CF₃
 CAS RN: 431-89-0
 Molecular Weight: 170.03

Global Atmospheric Lifetime (years): 48.6 (36)
 Tropospheric Atmospheric Lifetime (years): 50.9 (37.5)
 Stratospheric Atmospheric Lifetime (years): 1070 (673)

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.253	0.274 (0.26)

Global Warming Potential (GWP _H):	
GWP ₂₀	5984 (5250)
GWP ₁₀₀	4211 (3140)

Global Temperature Change Potentials (GTP _H):	
GTP ₂₀	5998 (5140)
GTP ₅₀	4438 (3180)
GTP ₁₀₀	2250 (1260)

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂
 * Italic values in () taken from WMO-2018

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$k_{\text{SAR}}(298 \text{ K}) = 1.22 \times 10^{-15}$	$k_{\text{Rec}}(T) = 4.8 \times 10^{-13} \exp(-1680/T)$
$k_{\text{SAR}}(272 \text{ K}) \approx 7.35 \times 10^{-16}$	$k_{\text{Rec}}(298 \text{ K}) = 1.7 \times 10^{-15}$
	$k_{\text{Rec}}(272 \text{ K}) = 9.97 \times 10^{-16}$
$\tau_{\text{Global}}^{\text{OH}} = 48.8 \text{ years}$	
$\tau_{\text{Trop}}^{\text{OH}} = 50.9 \text{ years}$	
$\tau_{\text{Strat}}^{\text{OH}} = 1164 \text{ years}$	

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

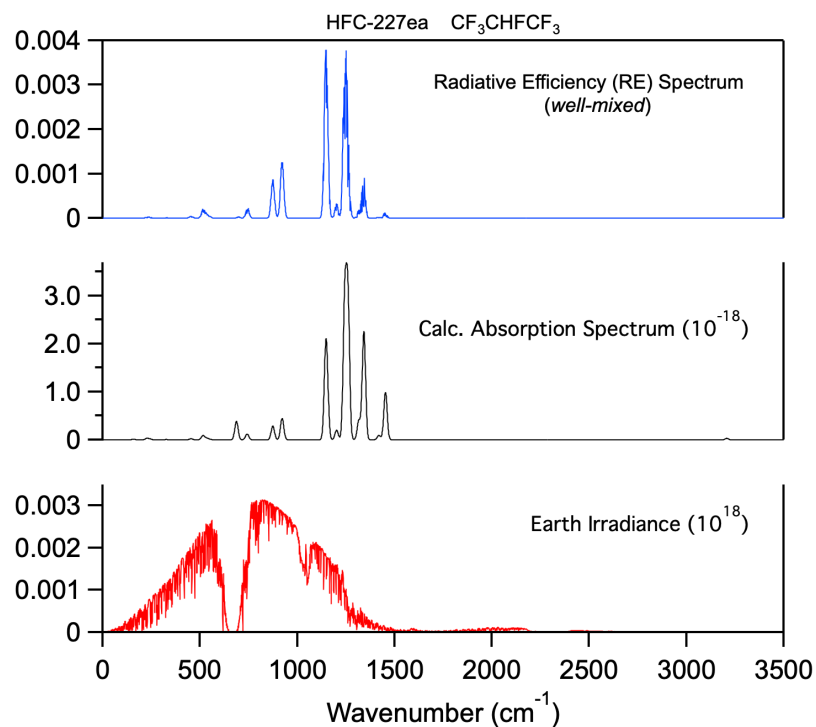
$k_{\text{Est}}(T) = 2.8 \times 10^{-12}$	$k_{\text{Rec}}(T) = 0.72 \times 7.9 \times 10^{-12} \exp(70/T)$
$\tau_{\text{O}(\text{1D})} = 13214 \text{ years}$	



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
19	0
91	0.2
158	1.7
227	3.9
243	2.1
292	0.4
326	0.8
344	0.1
454	2.8
515	11
533	4.3
550	1.5
607	0.3
687	49.7
742	15.5
874	37
922	57.5
1146	205
1153	85.5
1202	25.9
1244	365.1
1260	371.7
1316	50.7
1342	289.8
1419	11.6
1453	126.5
3207	3.8

Radiative Efficiency Spectrum



HFC-236ca

Molecular Formula: CHF₂-CF₂-CHF₂
 CAS RN: 680-00-2
 Molecular Weight: 152.04

Global Atmospheric Lifetime (years): 11.4
 Tropospheric Atmospheric Lifetime (years): 11.9
 Stratospheric Atmospheric Lifetime (years): 268

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.289	0.304
Global Warming Potential (GWP _H):		
GWP ₂₀		4259
GWP ₁₀₀		1399
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		3327
GTP ₅₀		622
GTP ₁₀₀		205

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 4.74 \times 10^{-15}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 3.16 \times 10^{-15}$$

$$\tau_{\text{Global}}^{\text{OH}} = 11.5 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 11.9 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 313 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 2.0 \times 10^{-11}$$

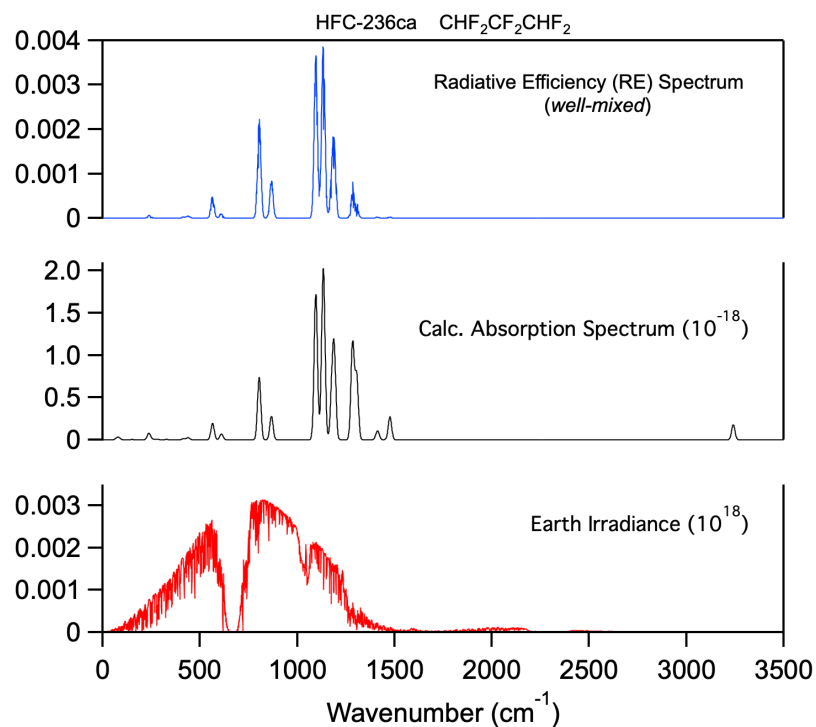
$$\tau_{\text{O}(\text{1D})} = 1850 \text{ years}$$

$$k_{\text{Rec}}(T) = NA$$

Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
74	2.9
84	2.2
151	0.5
237	10.1
256	0.7
280	0.9
328	0.6
416	1.9
439	3.1
564	21.1
567	4
610	8.8
804	94.7
867	35.4
1095	221.5
1132	129.4
1135	135.2
1178	68.9
1190	121.1
1284	145.9
1305	95.9
1404	1.3
1413	12.8
1453	0.3
1476	34.9
3238	4.2
3241	18.8

Radiative Efficiency Spectrum



HFC-236cb

Molecular Formula: CH₂F-CF₂-CF₃
 CAS RN: 677-56-5
 Molecular Weight: 152.04

Global Atmospheric Lifetime (years): 14.6 (*13.4*)
 Tropospheric Atmospheric Lifetime (years): 15.3 (*14*)
 Stratospheric Atmospheric Lifetime (years): 325.4 (*305*)

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.237	0.251 (<i>0.23</i>)

Global Warming Potential (GWP _H):	
GWP ₂₀	4076 (<i>3540</i>)
GWP ₁₀₀	1488 (<i>1235</i>)

Global Temperature Change Potentials (GTP _H):	
GTP ₂₀	3425 (<i>2915</i>)
GTP ₅₀	881 (<i>670</i>)
GTP ₁₀₀	239 (<i>192</i>)

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂
 * Italic values in () taken from WMO-2018

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$k_{\text{SAR}}(298 \text{ K}) = 3.72 \times 10^{-15}$	$k_{\text{Rec}}(T) = 1.03 \times 10^{-12} \exp(-1620/T)$
$k_{\text{SAR}}(272 \text{ K}) \approx 2.44 \times 10^{-15}$	$k_{\text{Rec}}(298 \text{ K}) = 4.5 \times 10^{-15}$
	$k_{\text{Rec}}(272 \text{ K}) = 2.67 \times 10^{-15}$
$\tau_{\text{Global}}^{\text{OH}} = 14.6 \text{ years}$	
$\tau_{\text{Trop}}^{\text{OH}} = 15.3 \text{ years}$	
$\tau_{\text{Strat}}^{\text{OH}} = 313 \text{ years}$	

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

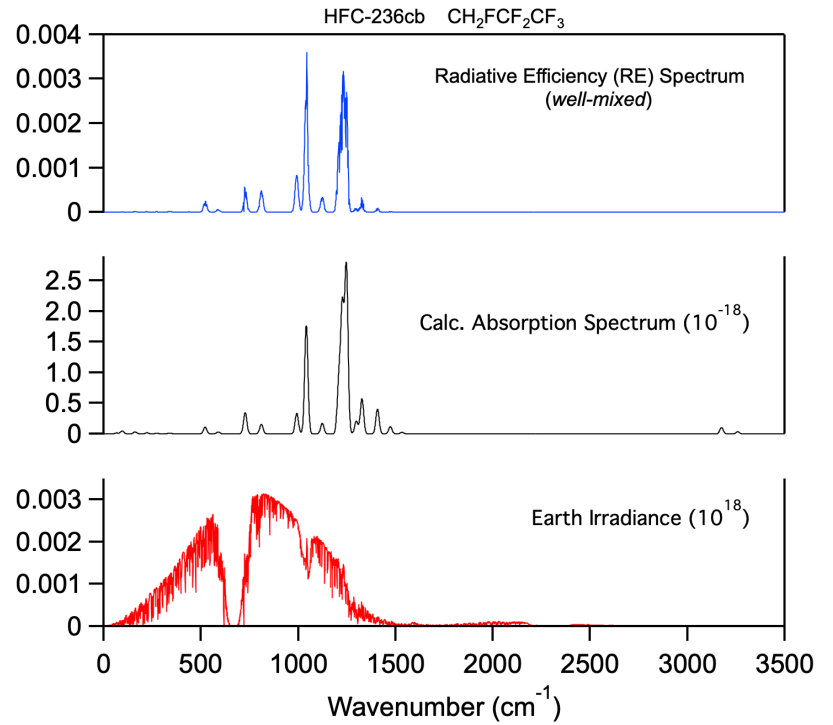
$k_{\text{Est}}(T) = 2.0 \times 10^{-11}$	$k_{\text{Rec}}(T) = NA$
$\tau_{\text{O}(\text{1D})} = 1850 \text{ years}$	



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
66	1.8
95	6
161	4.1
222	2
273	1.3
339	0.7
339	0.9
372	0.5
440	0.5
521	13.9
587	0.5
589	3.3
727	44.5
810	20
992	42.9
1041	226.8
1123	22
1208	104
1226	258.5
1247	346.9
1298	26.5
1327	73.6
1407	51.8
1473	15
1533	3.1
3175	13.3
3258	4.3

Radiative Efficiency Spectrum



HFC-236ea

Molecular Formula: CHF₂-CHF-CF₃
 CAS RN: 431-63-0
 Molecular Weight: 152.04

Global Atmospheric Lifetime (years): 9.27 (11.4)
 Tropospheric Atmospheric Lifetime (years): 9.66 (11.9)
 Stratospheric Atmospheric Lifetime (years): 228 (270)

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.281	0.294 (0.30)

Global Warming Potential (GWP _H):	
GWP ₂₀	3591 (4190)
GWP ₁₀₀	1105 (1370)

Global Temperature Change Potentials (GTP _H):	
GTP ₂₀	2613 (3290)
GTP ₅₀	386 (620)
GTP ₁₀₀	157 (202)

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂
 * Italic values in () taken from WMO-2018

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$k_{\text{SAR}}(298 \text{ K}) = 5.75 \times 10^{-15}$	$k_{\text{Rec}}(T) = 9.4 \times 10^{-13} \exp(-1550/T)$
$k_{\text{SAR}}(272 \text{ K}) \approx 3.87 \times 10^{-15}$	$k_{\text{Rec}}(298 \text{ K}) = 5.2 \times 10^{-15}$
	$k_{\text{Rec}}(272 \text{ K}) = 3.15 \times 10^{-15}$
$\tau_{\text{Global}}^{\text{OH}} = 9.31 \text{ years}$	
$\tau_{\text{Trop}}^{\text{OH}} = 9.66 \text{ years}$	
$\tau_{\text{Strat}}^{\text{OH}} = 260 \text{ years}$	

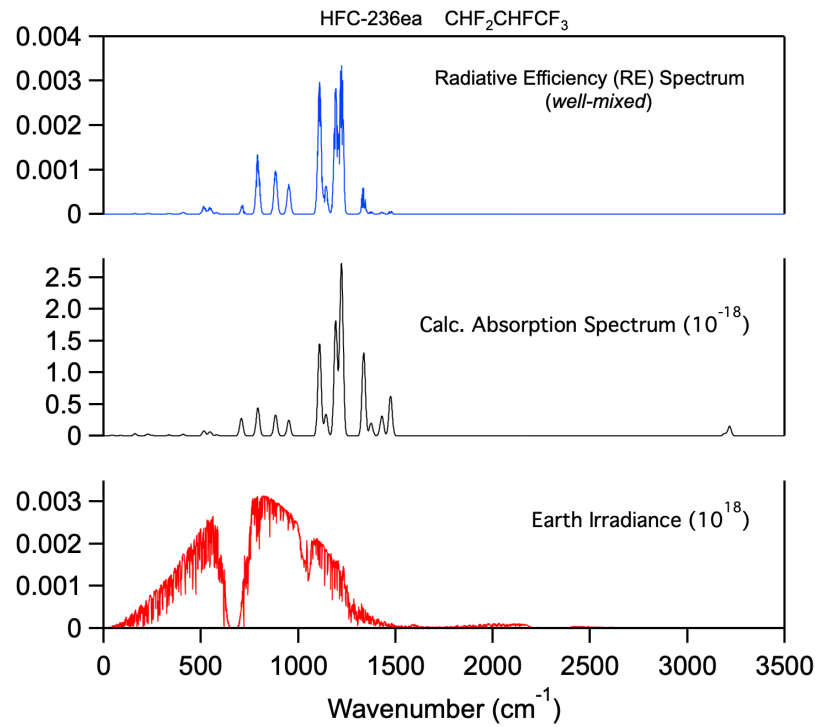
O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$k_{\text{Est}}(T) = 2.0 \times 10^{-11}$	$k_{\text{Rec}}(T) = NA$
$\tau_{\text{O}(\text{1D})} = 1850 \text{ years}$	

Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
44	1.3
87	0.9
161	4.1
227	3.8
253	0.6
303	0.4
335	1.8
408	3
515	10.2
546	8.3
580	2
707	35.2
792	56.5
883	42.2
951	31.7
1109	186.1
1142	43.4
1192	232.2
1218	100.1
1223	260.9
1336	168.2
1374	25.9
1419	2.5
1430	39.3
1474	80.9
3191	4.6
3216	19.5

Radiative Efficiency Spectrum



HFC-236fa

Molecular Formula: CF₃-CH₂-CF₃
 CAS RN: 690-39-1
 Molecular Weight: 152.04

Global Atmospheric Lifetime (years): 183.9 (213)
 Tropospheric Atmospheric Lifetime (years): 214.5 (253)
 Stratospheric Atmospheric Lifetime (years): 1289 (1350)

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.261	0.285 (0.24)

Global Warming Potential (GWP _H):		
GWP ₂₀		8021 (6785)
GWP ₁₀₀		8882 (7680)

Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		8489 (7230)
GTP ₅₀		9312 (8090)
GTP ₁₀₀		8760 (7870)

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂
 * Italic values in () taken from WMO-2018

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{SAR}}(298 \text{ K}) = 3.24 \times 10^{-16}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 1.74 \times 10^{-16}$$

$$\tau_{\text{Global}}^{\text{OH}} = 203.7 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 214 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 4252 \text{ years}$$

$$k_{\text{Rec}}(T) = 1.45 \times 10^{-12} \exp(-2500/T)$$

$$k_{\text{Rec}}(298 \text{ K}) = 3.3 \times 10^{-16}$$

$$k_{\text{Rec}}(272 \text{ K}) = 1.48 \times 10^{-16}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 2.0 \times 10^{-11}$$

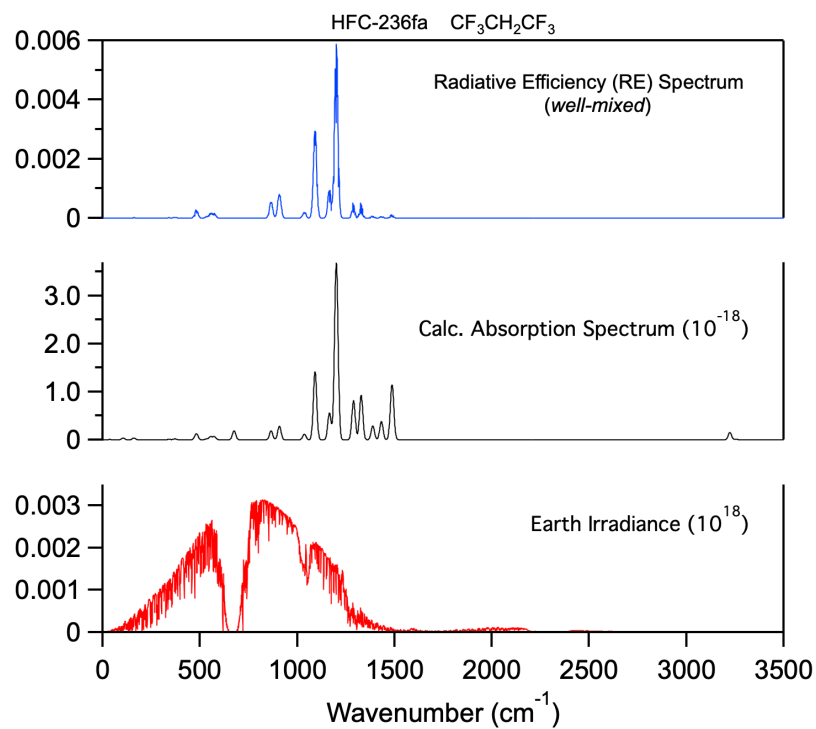
$$\tau_{\text{O}(\text{1D})} = 1850 \text{ years}$$

$$k_{\text{Rec}}(T) = NA$$

Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
36	0.9
105	4.4
160	4.6
304	0.5
340	1.2
371	2.5
481	16.6
532	2.1
554	8
574	8
675	24.2
865	23.3
908	36.6
1036	15.3
1091	182.3
1165	71.9
1197	220.1
1203	282.4
1289	104.7
1328	119
1388	36.8
1432	48.8
1486	135.2
1494	18.8
3174	0.2
3223	19.7
3255	1.4

Radiative Efficiency Spectrum



HFC-245ca

Molecular Formula: CH₂F-CF₂-CHF₂
 CAS RN: 679-86-7
 Molecular Weight: 134.05

Global Atmospheric Lifetime (years): 7.39 (6.6)
 Tropospheric Atmospheric Lifetime (years): 7.71 (6.9)
 Stratospheric Atmospheric Lifetime (years): 181 (165)

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	–	– (0.24)
Global Warming Potential (GWP _H):		
GWP ₂₀		– (2530)
GWP ₁₀₀		– (720)
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		– (1600)
GTP ₅₀		– (180)
GTP ₁₀₀		– (102)

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂
 * Italic values in () taken from WMO-2018

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{SAR}}(298 \text{ K}) = 7.12 \times 10^{-15}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 4.86 \times 10^{-15}$$

$$\tau_{\text{Global}}^{\text{OH}} = 7.44 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 7.71 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 212 \text{ years}$$

$$k_{\text{Rec}}(T) = 2.1 \times 10^{-12} \exp(-1620/T)$$

$$k_{\text{Rec}}(298 \text{ K}) = 9.2 \times 10^{-15}$$

$$k_{\text{Rec}}(272 \text{ K}) = 5.44 \times 10^{-15}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 3.0 \times 10^{-11}$$

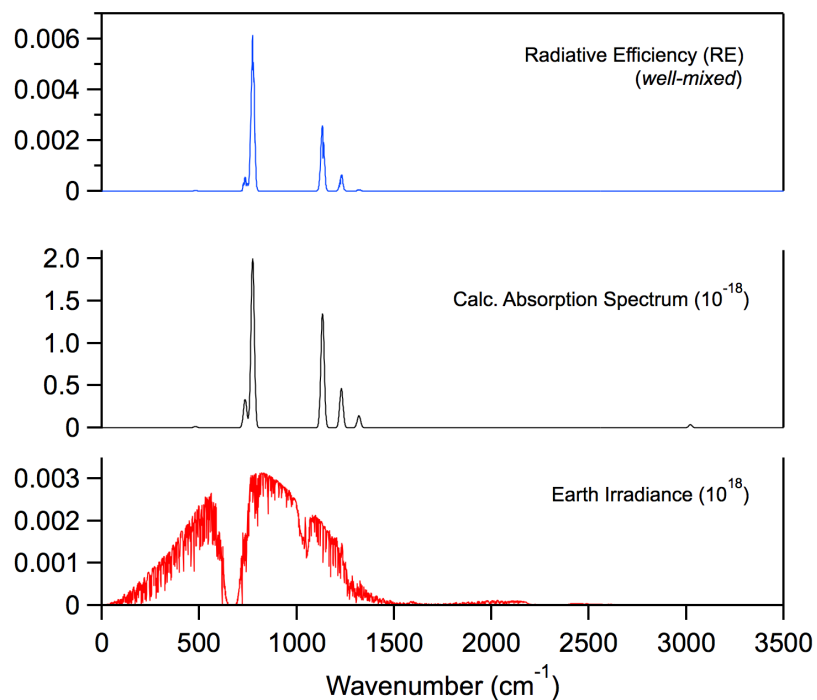
$$\tau_{\text{O}(\text{1D})} = 1233 \text{ years}$$

$$k_{\text{Rec}}(T) = NA$$

Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
87	0.7
203	0.1
232	0.4
238	0.7
335	2.8
373	6.4
467	8.9
475	2.8
592	3.0
878	11.5
957	0.0
966	2.7
997	11.1
1092	191.4
1126	130.6
1178	4.3
1213	8.5
1238	4.8
1342	3.7
1367	1.1
1405	19.8
1440	0.9
1454	1.0
1469	40.6
1521	2.0
1526	1.0
1537	10.3
1550	25.5
3106	19.2
3108	23.1
3148	3.7
3176	39.0
3204	2.2
3209	63.6
3231	14.2
3232	20.7

Radiative Efficiency Spectrum



HFC-245cb

Molecular Formula: CH₃-CF₂-CF₃
 CAS RN: 1814-88-6
 Molecular Weight: 134.05

Global Atmospheric Lifetime (years): 36.8 (39.9)
 Tropospheric Atmospheric Lifetime (years): 39.5 (43)
 Stratospheric Atmospheric Lifetime (years): 529 (550)

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	–	– (0.24)
Global Warming Potential (GWP _H):		
GWP ₂₀		– (6340)
GWP ₁₀₀		– (4000)
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		– (6280)
GTP ₅₀		– (4150)
GTP ₁₀₀		– (1800)

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂
 * Italic values in () taken from WMO-2018

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{SAR}}(298 \text{ K}) = 1.54 \times 10^{-15}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 9.47 \times 10^{-16}$$

$$\tau_{\text{Global}}^{\text{OH}} = 33.7 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 39.5 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 228.8 \text{ years}$$

$$k_{\text{Rec}}(T) = 4.2 \times 10^{-13} \exp(-1680/T)$$

$$k_{\text{Rec}}(298 \text{ K}) = 1.5 \times 10^{-15}$$

$$k_{\text{Rec}}(272 \text{ K}) = 8.73 \times 10^{-16}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 3.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{¹D})} = 1233 \text{ years}$$

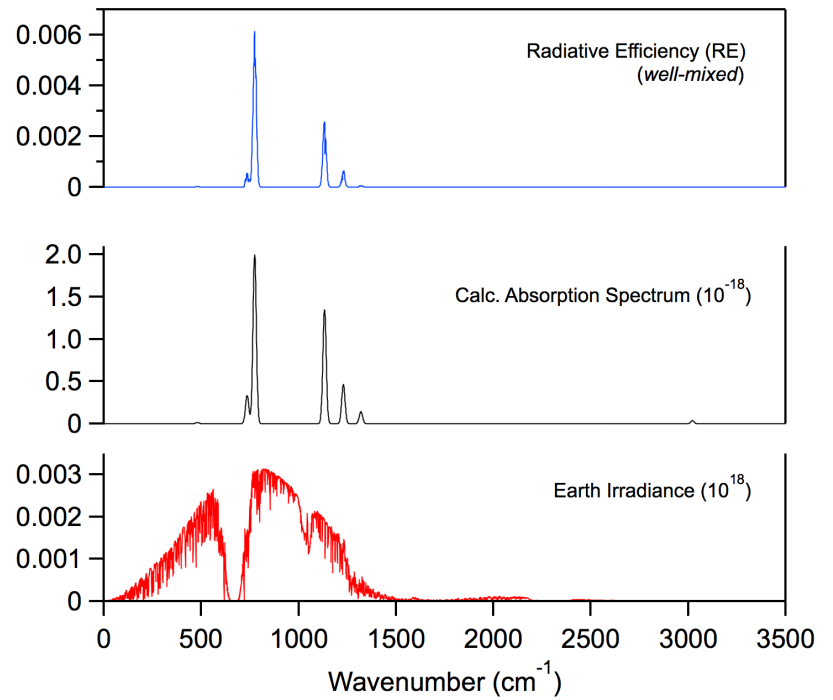
$$k_{\text{Rec}}(T) = NA$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
87	0.7
203	0.1
232	0.4
238	0.7
335	2.8
373	6.4
467	8.9
475	2.8
592	3.0
878	11.5
957	0.0
966	2.7
997	11.1
1092	191.4
1126	130.6
1178	4.3
1213	8.5
1238	4.8
1342	3.7
1367	1.1
1405	19.8
1440	0.9
1454	1.0
1469	40.6
1521	2.0
1526	1.0
1537	10.3
1550	25.5
3106	19.2
3108	23.1
3148	3.7
3176	39.0
3204	2.2
3209	63.6
3231	14.2
3232	20.7

Radiative Efficiency Spectrum



HFC-245ea

Molecular Formula: CHF₂-CHF-CHF₂
 CAS RN: 24270-66-4
 Molecular Weight: 134.05

Global Atmospheric Lifetime (years): 4.53 (3.2)
 Tropospheric Atmospheric Lifetime (years): 4.70 (3.3)
 Stratospheric Atmospheric Lifetime (years): 122.5 (95)

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	–	– (0.16)
Global Warming Potential (GWP _H):		
GWP ₂₀		– (860)
GWP ₁₀₀		– (233)
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		– (375)
GTP ₅₀		– (44)
GTP ₁₀₀		– (32)

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂
 * Italic values in () taken from WMO-2018

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$k_{\text{SAR}}(298 \text{ K}) = 1.14 \times 10^{-14}$	$k_{\text{Rec}}(T) = 1.53 \times 10^{-12} \exp(-1340/T)$
$k_{\text{SAR}}(272 \text{ K}) \approx 7.97 \times 10^{-15}$	$k_{\text{Rec}}(298 \text{ K}) = 1.7 \times 10^{-14}$
	$k_{\text{Rec}}(272 \text{ K}) = 1.11 \times 10^{-14}$
$\tau_{\text{Global}}^{\text{OH}} = 4.54 \text{ years}$	
$\tau_{\text{Trop}}^{\text{OH}} = 4.70 \text{ years}$	
$\tau_{\text{Strat}}^{\text{OH}} = 136.0 \text{ years}$	

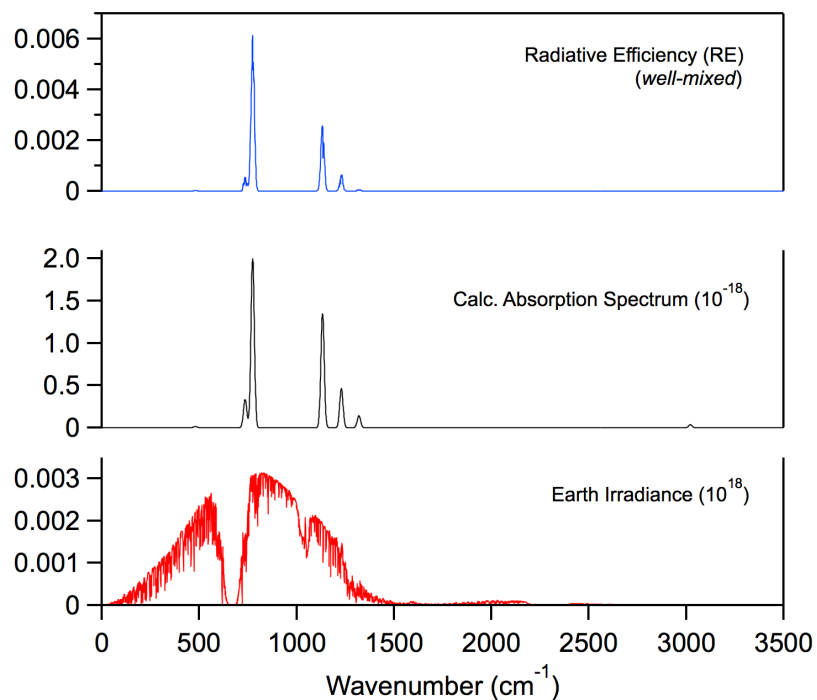
O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$k_{\text{Est}}(T) = 3.0 \times 10^{-11}$	$k_{\text{Rec}}(T) = NA$
$\tau_{\text{O}(\text{1D})} = 1233 \text{ years}$	

Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
87	0.7
203	0.1
232	0.4
238	0.7
335	2.8
373	6.4
467	8.9
475	2.8
592	3.0
878	11.5
957	0.0
966	2.7
997	11.1
1092	191.4
1126	130.6
1178	4.3
1213	8.5
1238	4.8
1342	3.7
1367	1.1
1405	19.8
1440	0.9
1454	1.0
1469	40.6
1521	2.0
1526	1.0
1537	10.3
1550	25.5
3106	19.2
3108	23.1
3148	3.7
3176	39.0
3204	2.2
3209	63.6
3231	14.2
3232	20.7

Radiative Efficiency Spectrum



HFC-245eb

Molecular Formula: CH₂F-CHF-CF₃
 CAS RN: 431-31-2
 Molecular Weight: 134.05

Global Atmospheric Lifetime (years): 3.35 (3.2)
 Tropospheric Atmospheric Lifetime (years): 3.47 (3.3)
 Stratospheric Atmospheric Lifetime (years): 95.4 (90)

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	–	– (0.20)
Global Warming Potential (GWP _H):		
GWP ₂₀		– (1070)
GWP ₁₀₀		– (290)
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		– (460)
GTP ₅₀		– (54)
GTP ₁₀₀		– (40)

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂
 * Italic values in () taken from WMO-2018

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{SAR}}(298 \text{ K}) = 1.52 \times 10^{-14}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 1.08 \times 10^{-14}$$

$$\tau_{\text{Global}}^{\text{OH}} = 3.36 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 3.47 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 103.4 \text{ years}$$

$$k_{\text{Rec}}(T) = 1.16 \times 10^{-12} \exp(-1260/T)$$

$$k_{\text{Rec}}(298 \text{ K}) = 1.7 \times 10^{-14}$$

$$k_{\text{Rec}}(272 \text{ K}) = 1.13 \times 10^{-14}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 3.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 1233 \text{ years}$$

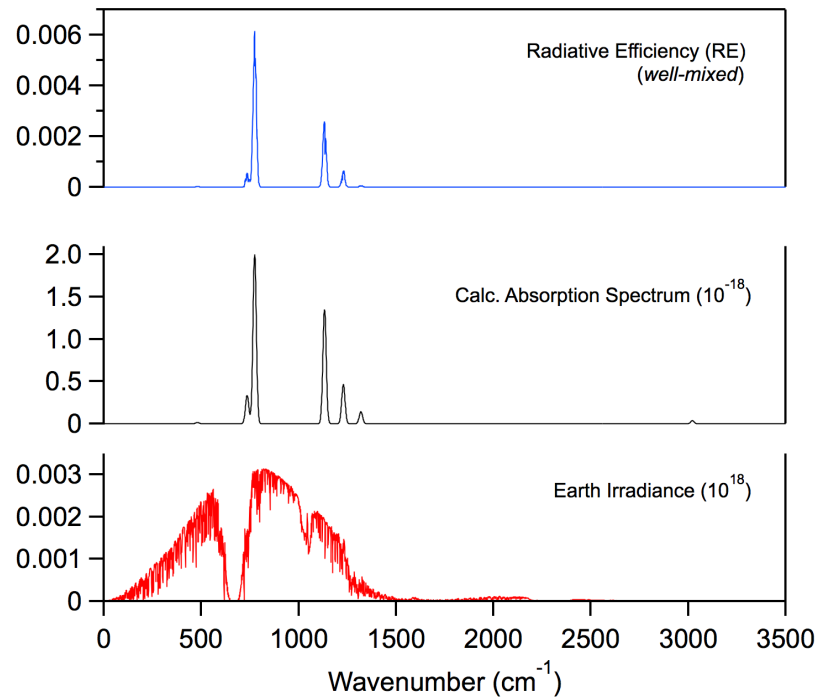
$$k_{\text{Rec}}(T) = NA$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
87	0.7
203	0.1
232	0.4
238	0.7
335	2.8
373	6.4
467	8.9
475	2.8
592	3.0
878	11.5
957	0.0
966	2.7
997	11.1
1092	191.4
1126	130.6
1178	4.3
1213	8.5
1238	4.8
1342	3.7
1367	1.1
1405	19.8
1440	0.9
1454	1.0
1469	40.6
1521	2.0
1526	1.0
1537	10.3
1550	25.5
3106	19.2
3108	23.1
3148	3.7
3176	39.0
3204	2.2
3209	63.6
3231	14.2
3232	20.7

Radiative Efficiency Spectrum



HFC-245fa

Molecular Formula: CHF₂-CH₂-CF₃
 CAS RN: 460-73-1
 Molecular Weight: 134.05

Global Atmospheric Lifetime (years): 7.95 (7.9)
 Tropospheric Atmospheric Lifetime (years): 8.37 (8.2)
 Stratospheric Atmospheric Lifetime (years): 156.3 (149)

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	–	– (0.24)
Global Warming Potential (GWP _H):		
GWP ₂₀		– (2980)
GWP ₁₀₀		– (880)
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		– (2040)
GTP ₅₀		– (260)
GTP ₁₀₀		– (124)

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂
 * Italic values in () taken from WMO-2018

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{SAR}}(298 \text{ K}) = 6.58 \times 10^{-15}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 4.47 \times 10^{-15}$$

$$\tau_{\text{Global}}^{\text{OH}} = 8.07 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 8.37 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 228.8 \text{ years}$$

$$k_{\text{Rec}}(T) = 6.1 \times 10^{-13} \exp(-1330/T)$$

$$k_{\text{Rec}}(T) = 7.0 \times 10^{-15}$$

$$k_{\text{Rec}}(T) = 4.59 \times 10^{-15}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 7.5 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 493 \text{ years}$$

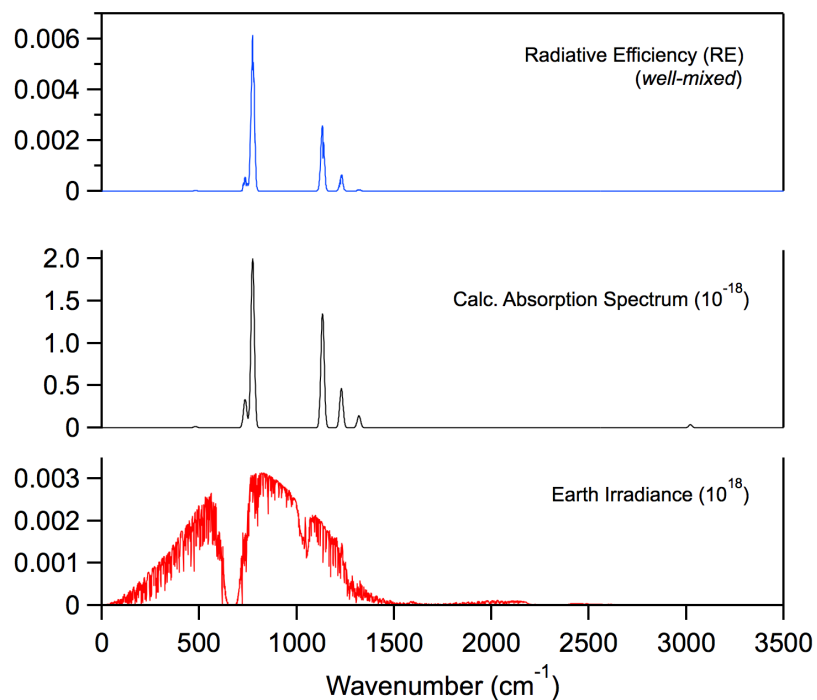
$$k_{\text{Rec}}(T) = 0.5 \times 1.5 \times 10^{-11}$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
87	0.7
203	0.1
232	0.4
238	0.7
335	2.8
373	6.4
467	8.9
475	2.8
592	3.0
878	11.5
957	0.0
966	2.7
997	11.1
1092	191.4
1126	130.6
1178	4.3
1213	8.5
1238	4.8
1342	3.7
1367	1.1
1405	19.8
1440	0.9
1454	1.0
1469	40.6
1521	2.0
1526	1.0
1537	10.3
1550	25.5
3106	19.2
3108	23.1
3148	3.7
3176	39.0
3204	2.2
3209	63.6
3231	14.2
3232	20.7

Radiative Efficiency Spectrum



HFC-254ca

Molecular Formula: CH₂F-CF₂-CH₂F
 CAS RN: 813-75-2
 Molecular Weight: 116.06

Global Atmospheric Lifetime (years): 2.56
 Tropospheric Atmospheric Lifetime (years): 2.65
 Stratospheric Atmospheric Lifetime (years): 74.5

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.154	0.147
Global Warming Potential (GWP _H):		
GWP ₂₀		734
GWP ₁₀₀		200
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		292
GTP ₅₀		36
GTP ₁₀₀		28

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 1.96 \times 10^{-14}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 1.41 \times 10^{-14}$$

$$\tau_{\text{Global}}^{\text{OH}} = 2.57 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 2.65 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 81.1 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 4.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 925 \text{ years}$$

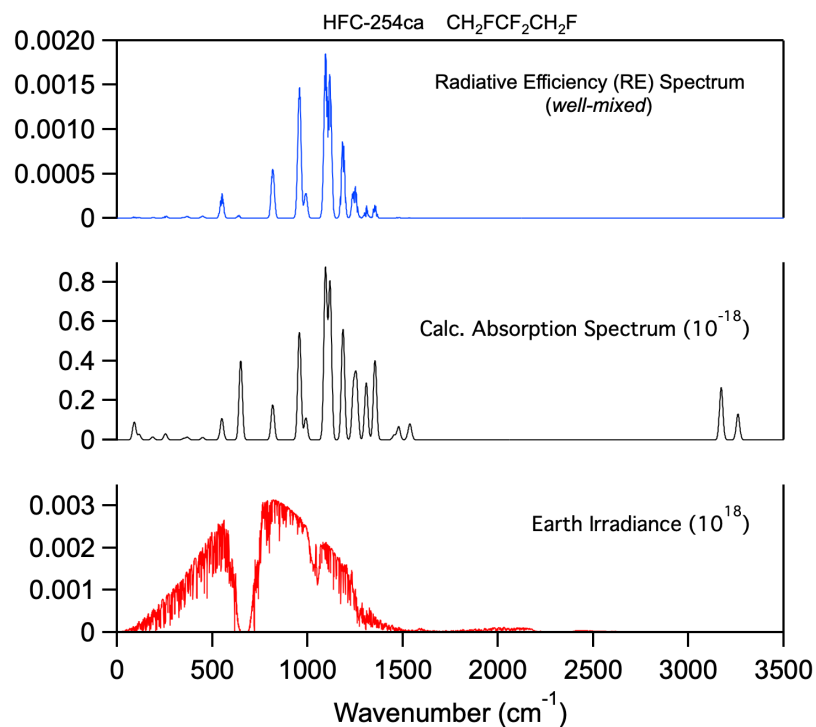
$$k_{\text{Rec}}(T) = NA$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
90	11.6
116	3.4
187	1.9
254	3.9
350	0.9
369	1.6
449	1.5
550	14
649	51.3
817	22.8
957	70.1
991	14.2
1094	110.4
1118	101.2
1186	71.8
1241	31.3
1257	37.3
1308	37
1354	51.7
1454	3
1478	8.6
1532	4.5
1540	7
3169	17.9
3174	17.6
3256	5.4
3261	12

Radiative Efficiency Spectrum



HFC-254cb

Molecular Formula: CH₃-CF₂-CHF₂
 CAS RN: 40723-63-5
 Molecular Weight: 116.06

Global Atmospheric Lifetime (years): 10.8
 Tropospheric Atmospheric Lifetime (years): 11.4
 Stratospheric Atmospheric Lifetime (years): 228

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.192	0.203
Global Warming Potential (GWP _H):		
GWP ₂₀		3603
GWP ₁₀₀		1164
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		2772
GTP ₅₀		490
GTP ₁₀₀		169

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 4.93 \times 10^{-15}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 1.41 \times 10^{-15}$$

$$\tau_{\text{Global}}^{\text{OH}} = 11.0 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 11.4 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 301.6 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 4.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 925 \text{ years}$$

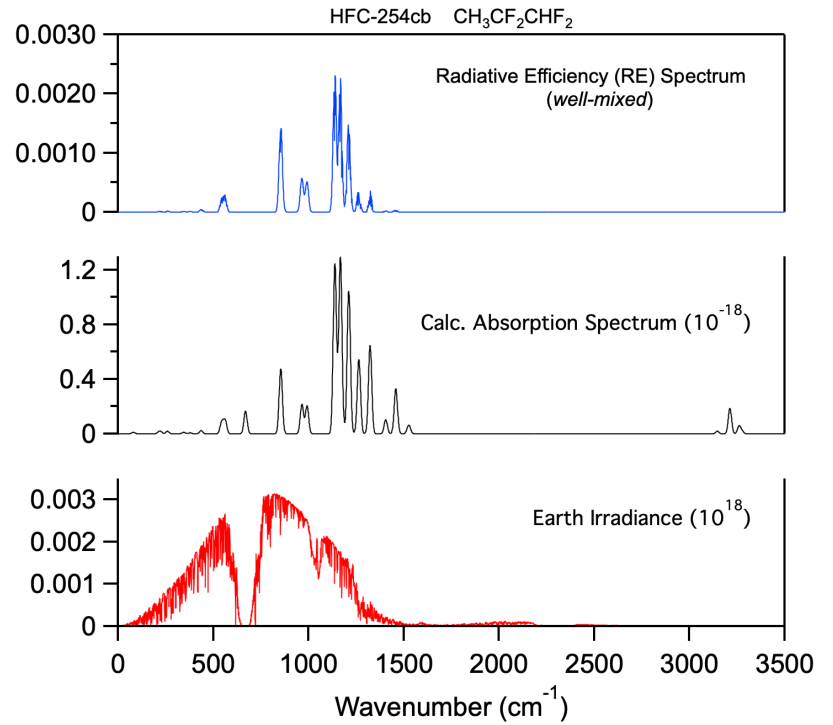
$$k_{\text{Rec}}(T) = NA$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
80	1.4
213	1.3
223	1.9
259	2.4
344	1.4
378	0.9
436	3
544	11.2
562	12.6
669	21.3
854	61.1
965	27.6
992	26.1
1138	159.7
1167	166.1
1211	134.5
1264	70.2
1323	83.2
1405	13.4
1458	42.3
1469	0.8
1522	3.6
1529	5.2
3146	2.5
3212	24.1
3260	7.2
3275	2.5

Radiative Efficiency Spectrum



HFC-254ea

Molecular Formula: CH₂F-CHF-CHF₂
 CAS RN: 24270-68-6
 Molecular Weight: 116.06

Global Atmospheric Lifetime (years): 1.94
 Tropospheric Atmospheric Lifetime (years): 2.01
 Stratospheric Atmospheric Lifetime (years): 59

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.187	0.173
Global Warming Potential (GWP _H):		
GWP ₂₀		655
GWP ₁₀₀		178
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		239
GTP ₅₀		31
GTP ₁₀₀		25

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 2.55 \times 10^{-14}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 1.86 \times 10^{-14}$$

$$\tau_{\text{Global}}^{\text{OH}} = 1.95 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 2.01 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 63.2 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 4.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 925 \text{ years}$$

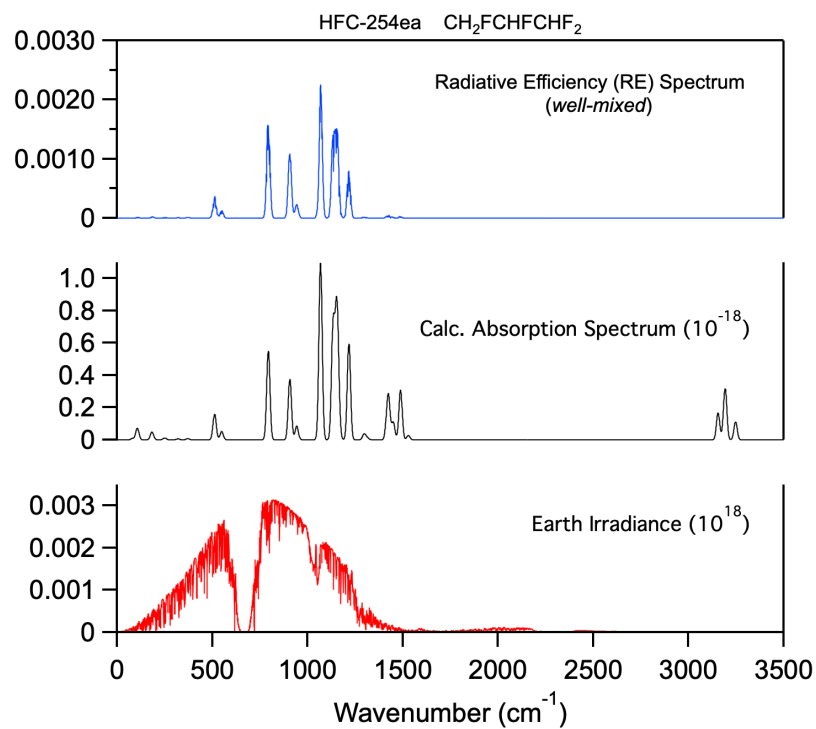
$$k_{\text{Rec}}(T) = NA$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
81	1.1
106	9.3
183	6.3
250	1.5
320	0.8
371	0.9
512	20.4
549	6.7
794	70.7
907	48.1
943	10.8
1068	140.3
1134	89.6
1153	97.2
1163	18.7
1217	76.5
1297	4.6
1314	1.6
1418	14.6
1426	26.1
1450	13.8
1488	39.6
1529	3.4
3155	21.5
3184	4.6
3193	38.1
3247	14.2

Radiative Efficiency Spectrum



HFC-254eb

Molecular Formula: CH₃-CHF-CF₃
 CAS RN: 421-48-7
 Molecular Weight: 116.06

Global Atmospheric Lifetime (years): 2.25
 Tropospheric Atmospheric Lifetime (years): 2.33
 Stratospheric Atmospheric Lifetime (years): 67

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.189	0.178
Global Warming Potential (GWP _H):		
GWP ₂₀		782
GWP ₁₀₀		213
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		298
GTP ₅₀		38
GTP ₁₀₀		29

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 2.21 \times 10^{-14}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 1.60 \times 10^{-14}$$

$$\tau_{\text{Global}}^{\text{OH}} = 2.26 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 2.33 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 72.4 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 4.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 925 \text{ years}$$

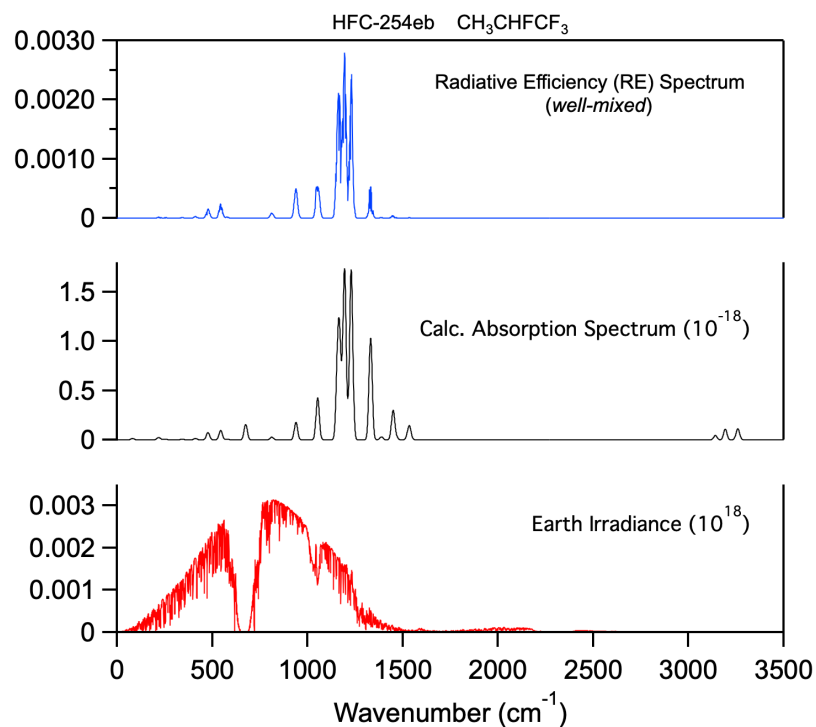
$$k_{\text{Rec}}(T) = NA$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
81	1.8
218	3
229	0.3
253	1
342	1
411	1.8
477	9.4
544	12.3
578	1
675	20
812	3.5
939	22.9
1053	54.7
1158	92.3
1169	103.5
1194	222
1229	221.5
1331	131.8
1388	3.8
1449	37.8
1465	3.4
1529	8.6
1537	11.9
3141	5.8
3193	14
3255	7.3
3262	8.3

Radiative Efficiency Spectrum



HFC-254fa

Molecular Formula: CHF₂-CH₂-CHF₂
 CAS RN: 66794-30-7
 Molecular Weight: 116.06

Global Atmospheric Lifetime (years): 3.99
 Tropospheric Atmospheric Lifetime (years): 4.14
 Stratospheric Atmospheric Lifetime (years): 107

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.237	0.236
Global Warming Potential (GWP _H):		
GWP ₂₀		1824
GWP ₁₀₀		500
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		887
GTP ₅₀		97
GTP ₁₀₀		69

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 1.28 \times 10^{-14}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 9.04 \times 10^{-15}$$

$$\tau_{\text{Global}}^{\text{OH}} = 4.00 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 4.14 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 121.3 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 4.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 925 \text{ years}$$

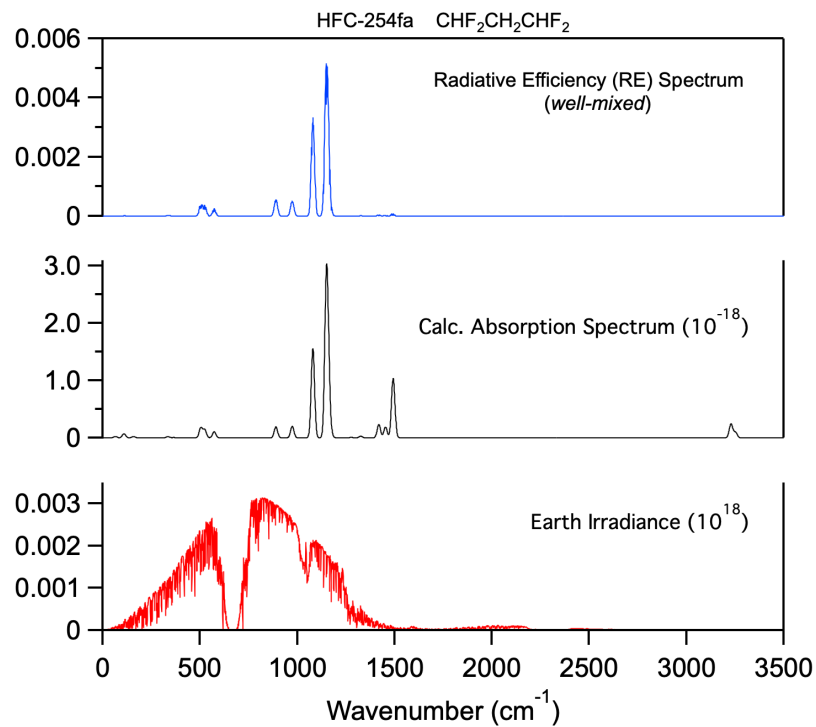
$$k_{\text{Rec}}(T) = NA$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
65	2.8
109	9.2
158	2.9
335	2.7
365	0.7
504	22.4
524	18.4
569	0.5
573	13
890	24.5
974	25.8
1080	200.1
1148	139.3
1150	197.9
1160	111.6
1175	6.4
1277	1
1326	3.8
1418	15.1
1420	14.9
1453	24
1492	125.7
1501	12
3167	0.5
3227	20.4
3232	12.1
3252	12.4

Radiative Efficiency Spectrum



HFC-254fb

Molecular Formula: CH₂F-CH₂-CF₃
 CAS RN: 460-36-6
 Molecular Weight: 116.06

Global Atmospheric Lifetime (years): 1.38
 Tropospheric Atmospheric Lifetime (years): 1.43
 Stratospheric Atmospheric Lifetime (years): 44

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.178	0.155
Global Warming Potential (GWP _H):		
GWP ₂₀		419
GWP ₁₀₀		114
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		142
GTP ₅₀		20
GTP ₁₀₀		16

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 3.53 \times 10^{-14}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 2.62 \times 10^{-14}$$

$$\tau_{\text{Global}}^{\text{OH}} = 1.39 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 1.43 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 46.5 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 4.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 925 \text{ years}$$

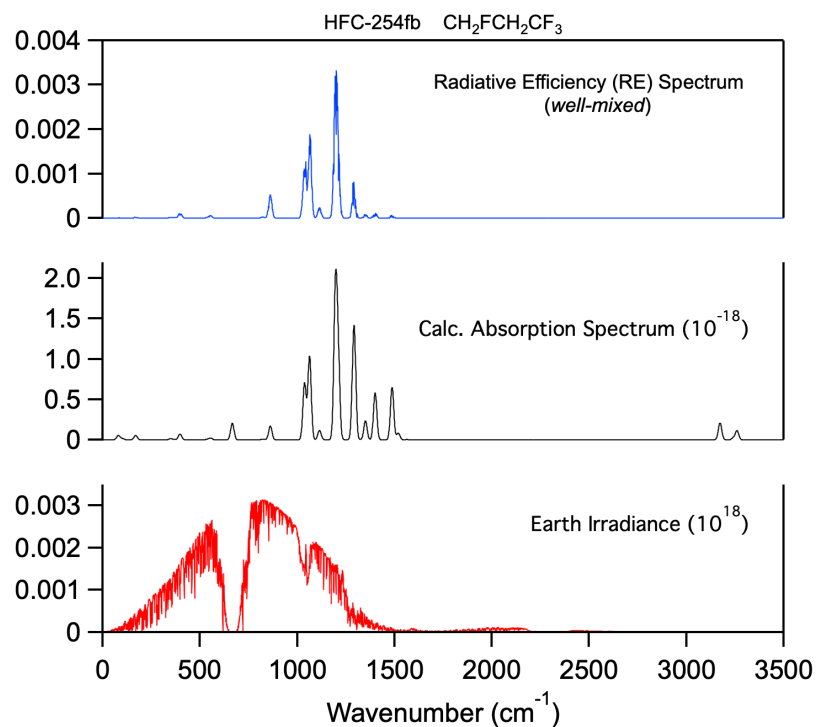
$$k_{\text{Rec}}(T) = NA$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
80	7.1
101	2.1
169	7
347	1.5
365	0.9
397	9.2
537	0.8
554	2.8
666	26.5
822	1
861	21.7
1037	89.5
1063	132.7
1114	15
1196	231.8
1210	124.1
1288	62.7
1293	126.6
1350	29.9
1400	74.8
1487	83.4
1519	10.8
1563	0.5
3170	13.6
3175	14.3
3241	3.4
3260	14.5

Radiative Efficiency Spectrum



HFC-263ca

Molecular Formula: CH₃-CF₂-CH₂F
 CAS RN: 811-94-9
 Molecular Weight: 98.07

Global Atmospheric Lifetime (years): 3.67
 Tropospheric Atmospheric Lifetime (years): 3.81
 Stratospheric Atmospheric Lifetime (years): 98

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.142	0.141
Global Warming Potential (GWP _H):		
GWP ₂₀		1187
GWP ₁₀₀		324
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		554
GTP ₅₀		62
GTP ₁₀₀		45

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 1.38 \times 10^{-14}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 9.81 \times 10^{-15}$$

$$\tau_{\text{Global}}^{\text{OH}} = 3.68 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 3.81 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 112.7 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 5.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 740 \text{ years}$$

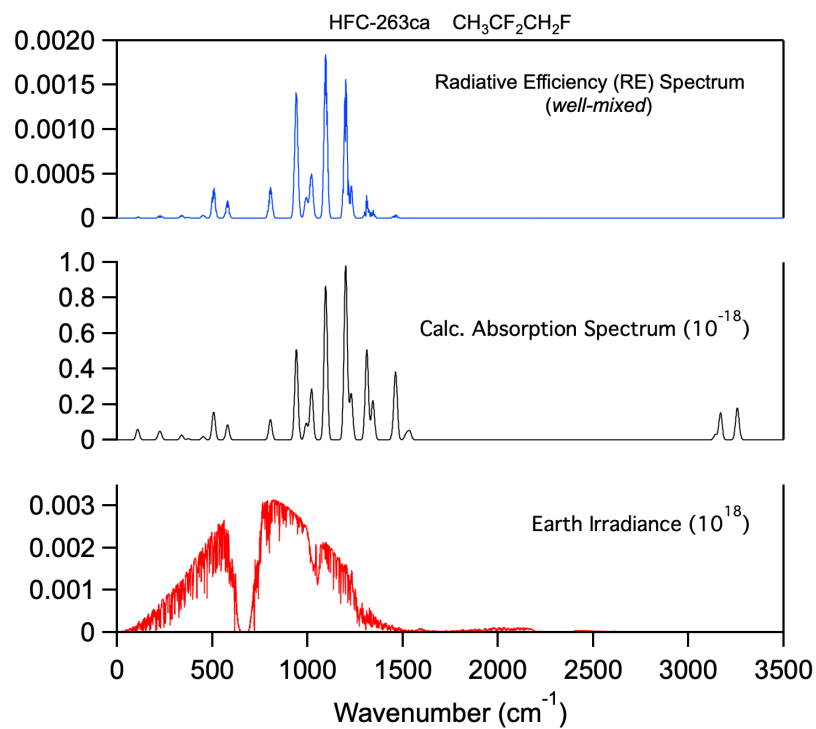
$$k_{\text{Rec}}(T) = NA$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
108	7.6
220	3.2
228	3.7
339	3.4
374	0.7
452	2.3
507	19.9
580	10.9
805	14.7
941	65.6
993	12
1021	36.6
1095	111.3
1200	125.9
1229	33.2
1311	65.2
1343	28.2
1454	8.8
1463	43.6
1516	3.1
1526	2.5
1537	5.3
3141	3.8
3168	19.6
3253	5.9
3256	15.5
3265	3.6

Radiative Efficiency Spectrum



HFC-263ea

Molecular Formula: CH₂F-CHF-CH₂F
 CAS RN: 66794-36-3
 Molecular Weight: 98.07

Global Atmospheric Lifetime (years): 0.53
 Tropospheric Atmospheric Lifetime (years): 0.55
 Stratospheric Atmospheric Lifetime (years): 25

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.104	0.071
Global Warming Potential (GWP _H):		
GWP ₂₀		87
GWP ₁₀₀		24
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		27
GTP ₅₀		4
GTP ₁₀₀		3

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 8.85 \times 10^{-14}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 6.84 \times 10^{-14}$$

$$\tau_{\text{Global}}^{\text{OH}} = 0.54 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 0.55 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 25 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 5.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 740 \text{ years}$$

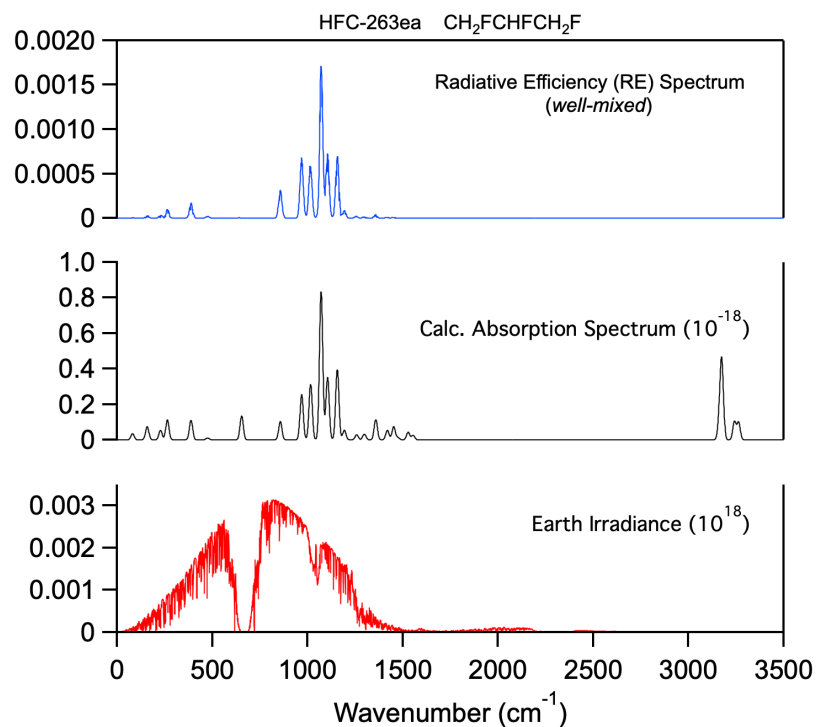
$$k_{\text{Rec}}(T) = NA$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
81	4.4
158	9.5
228	6.8
264	14.4
388	14.1
475	1.3
654	17.2
857	13.3
969	32.7
1016	39.8
1071	106.8
1105	44.9
1156	50.5
1193	7
1258	3.7
1298	4.1
1358	14.5
1419	6.9
1452	9.5
1474	1.6
1528	5.4
1554	3.2
3159	7
3171	37.7
3178	25.6
3241	13.1
3263	12.8

Radiative Efficiency Spectrum



HFC-263eb

Molecular Formula: CH₃-CHF-CHF₂
 CAS RN: 66794-35-2
 Molecular Weight: 98.07

Global Atmospheric Lifetime (years): 1.09
 Tropospheric Atmospheric Lifetime (years): 1.12
 Stratospheric Atmospheric Lifetime (years): 36

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.142	0.118
Global Warming Potential (GWP _H):		
GWP ₂₀		298
GWP ₁₀₀		81
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		97
GTP ₅₀		14
GTP ₁₀₀		11

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 4.43 \times 10^{-14}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 3.33 \times 10^{-14}$$

$$\tau_{\text{Global}}^{\text{OH}} = 1.09 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 1.12 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 37.5 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 5.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 740 \text{ years}$$

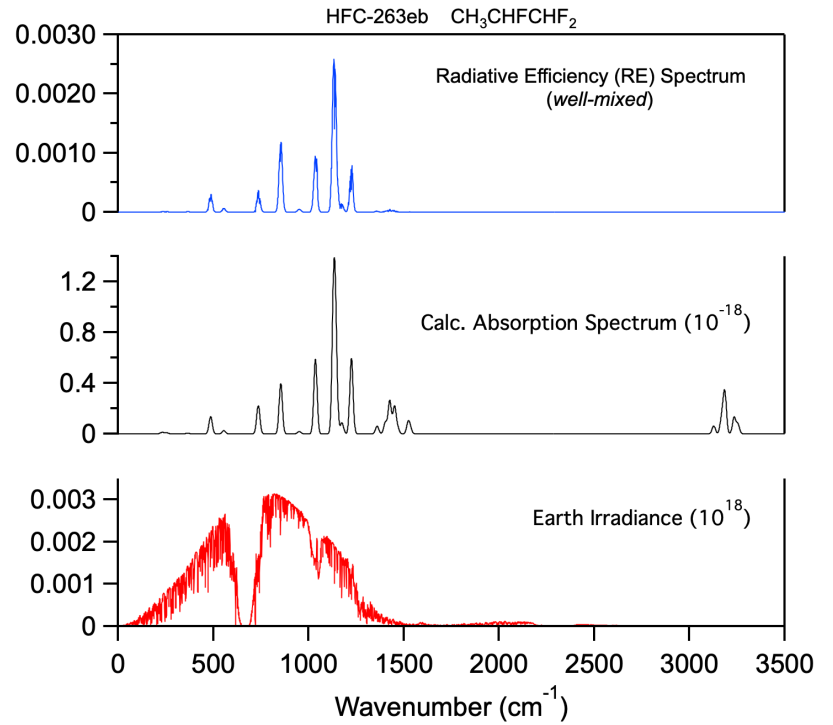
$$k_{\text{Rec}}(T) = NA$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
90	0.2
227	0.8
236	0.9
256	1
365	0.8
486	17.4
555	3.3
736	28.6
854	51.1
951	2.4
1036	75.5
1132	137.2
1143	77.8
1175	11.3
1225	76.7
1360	7.7
1403	11.4
1426	33.5
1451	27.1
1467	5.8
1523	10.9
1534	4.8
3127	8
3169	16
3185	41.6
3234	16.8
3254	9.5

Radiative Efficiency Spectrum



HFC-263fa

Molecular Formula: CH₂F-CH₂-CHF₂
 CAS RN: 24270-67-5
 Molecular Weight: 98.07

Global Atmospheric Lifetime (years): 1.07
 Tropospheric Atmospheric Lifetime (years): 1.10
 Stratospheric Atmospheric Lifetime (years): 35

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.152	0.126
Global Warming Potential (GWP _H):		
GWP ₂₀		311
GWP ₁₀₀		85
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		102
GTP ₅₀		14
GTP ₁₀₀		12

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 4.51 \times 10^{-14}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 3.39 \times 10^{-14}$$

$$\tau_{\text{Global}}^{\text{OH}} = 1.07 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 1.10 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 36.8 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 5.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 740 \text{ years}$$

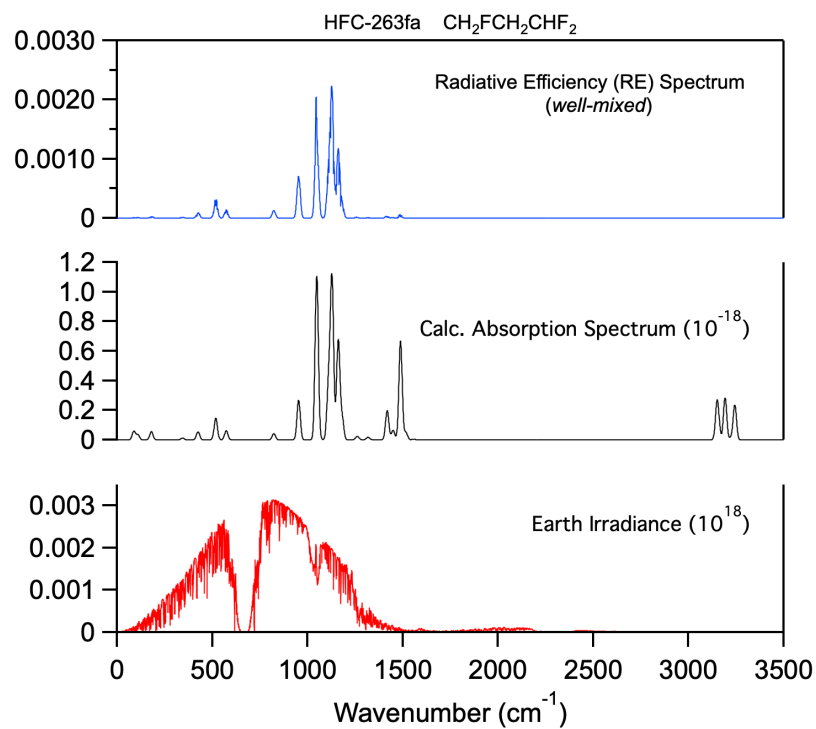
$$k_{\text{Rec}}(T) = NA$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
88	7.4
109	4.3
180	7.2
344	1.5
425	6.8
518	18.8
573	8
823	5.3
953	34.5
1048	142.4
1110	48.3
1128	139
1161	86
1181	19.4
1261	3.1
1317	2.2
1335	0.1
1418	25.5
1449	8.3
1488	85.8
1516	6.6
1557	0.5
3149	27.1
3157	10.7
3192	36.5
3224	1.9
3243	30.2

Radiative Efficiency Spectrum



HFC-263fb

Molecular Formula: CH₃-CH₂-CF₃
 CAS RN: 421-07-8
 Molecular Weight: 98.07

Global Atmospheric Lifetime (years): 1.64 (*1.1*)
 Tropospheric Atmospheric Lifetime (years): 1.69 (*1.16*)
 Stratospheric Atmospheric Lifetime (years): 50.3 (*40*)

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.154	0.138 (<i>0.10</i>)

Global Warming Potential (GWP _H):	
GWP ₂₀	522 (<i>250</i>)
GWP ₁₀₀	142 (<i>68</i>)

Global Temperature Change Potentials (GTP _H):	
GTP ₂₀	183 (<i>83</i>)
GTP ₅₀	25 (<i>12</i>)
GTP ₁₀₀	20 (<i>9.5</i>)

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂
 * Italic values in () taken from WMO-2018

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$k_{\text{SAR}}(298 \text{ K}) = 3.00 \times 10^{-14}$	$k_{\text{Rec}}(T) = 3.7 \times 10^{-12} \exp(-1290/T)$
$k_{\text{SAR}}(272 \text{ K}) \approx 2.21 \times 10^{-14}$	$k_{\text{Rec}}(298 \text{ K}) = 4.9 \times 10^{-14}$
	$k_{\text{Rec}}(272 \text{ K}) = 3.22 \times 10^{-14}$
$\tau_{\text{Global}}^{\text{OH}} = 1.64 \text{ years}$	
$\tau_{\text{Trop}}^{\text{OH}} = 1.69 \text{ years}$	
$\tau_{\text{Strat}}^{\text{OH}} = 54.1 \text{ years}$	

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

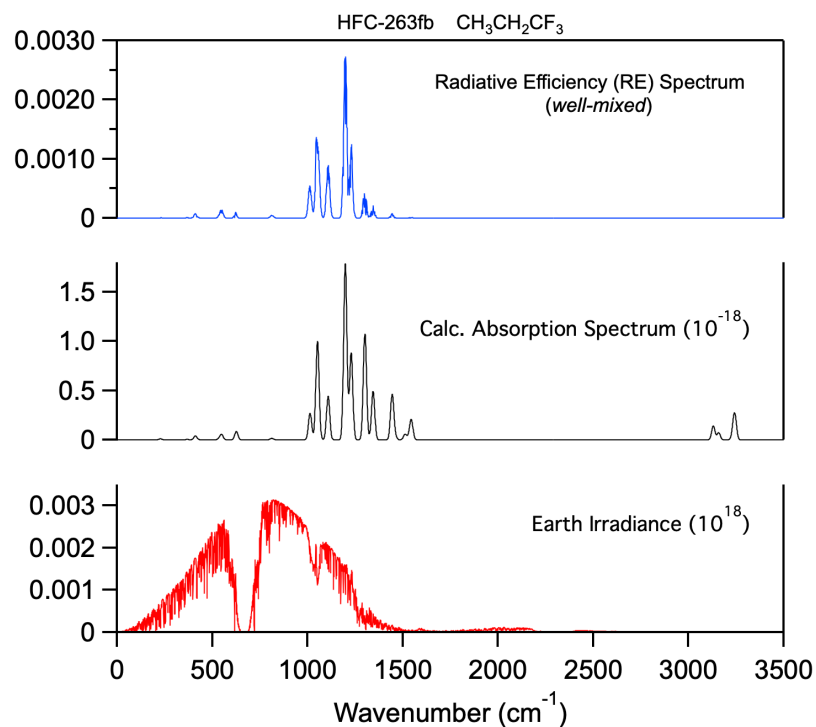
$k_{\text{Est}}(T) = 5.0 \times 10^{-11}$	$k_{\text{Rec}}(T) = NA$
$\tau_{\text{O}(\text{1D})} = 740 \text{ years}$	



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
101	0.1
218	0.1
228	1.1
368	0.5
411	5.2
535	0.9
548	7.2
626	11
812	1.7
816	0.2
1013	34.4
1052	128.2
1108	56.5
1198	228.9
1229	113.1
1301	138.1
1344	63.3
1444	58.2
1459	4.7
1512	7.4
1535	4.8
1545	24
3130	18
3158	9.3
3224	0.4
3237	18.1
3245	21.2

Radiative Efficiency Spectrum



HFC-272ca

Molecular Formula: CH₃-CF₂-CH₃
 CAS RN: 420-45-1
 Molecular Weight: 80.08

Global Atmospheric Lifetime (years): 6.42 (9)
 Tropospheric Atmospheric Lifetime (years): 6.72 (9.7)
 Stratospheric Atmospheric Lifetime (years): 144 (185)

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.102	0.105 (0.07)

Global Warming Potential (GWP _H):	
GWP ₂₀	1821 (1580)
GWP ₁₀₀	518 (480)

Global Temperature Change Potentials (GTP _H):	
GTP ₂₀	1130 (1140)
GTP ₅₀	126 (163)
GTP ₁₀₀	72 (69)

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂
 * Italic values in () taken from WMO-2018

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 8.09 \times 10^{-15}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 5.57 \times 10^{-15}$$

$$\tau_{\text{Global}}^{\text{OH}} = 6.49 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 6.72 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 187.8 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 6.0 \times 10^{-11}$$

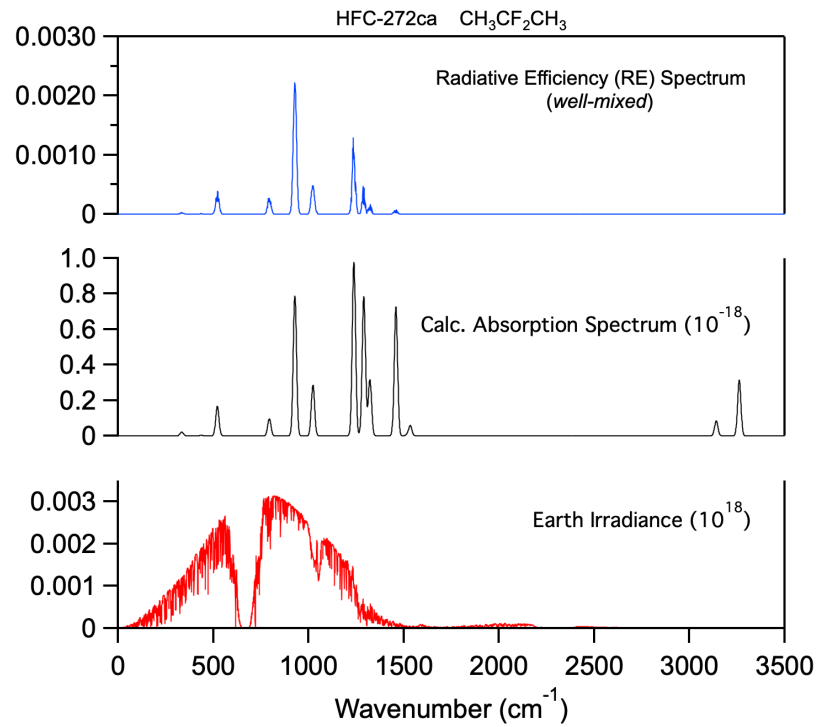
$$k_{\text{Rec}}(T) = NA$$

$$\tau_{\text{O}(\text{1D})} = 617 \text{ years}$$

Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
201	0
255	0.1
334	2.7
357	0
437	0.4
521	3.6
521	17.8
794	12.3
928	101.2
961	0
1023	36.7
1032	0
1238	125.8
1290	100.8
1322	40.7
1458	34
1459	59.4
1512	0
1517	0.7
1530	0
1534	7.4
3139	6.2
3142	4.8
3254	0
3260	20.5
3261	7.5
3263	12.9

Radiative Efficiency Spectrum



HFC-272ea

Molecular Formula: CH₃-CHF-CH₂F
 CAS RN: 62126-90-3
 Molecular Weight: 80.08

Global Atmospheric Lifetime (years): 0.38
 Tropospheric Atmospheric Lifetime (years): 0.38
 Stratospheric Atmospheric Lifetime (years): 25

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.092	0.055
Global Warming Potential (GWP _H):		
GWP ₂₀		58
GWP ₁₀₀		16
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		18
GTP ₅₀		3
GTP ₁₀₀		2

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 1.25 \times 10^{-13}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 9.82 \times 10^{-14}$$

$$\tau_{\text{Global}}^{\text{OH}} = 0.37 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 0.38 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 25 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 6.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 617 \text{ years}$$

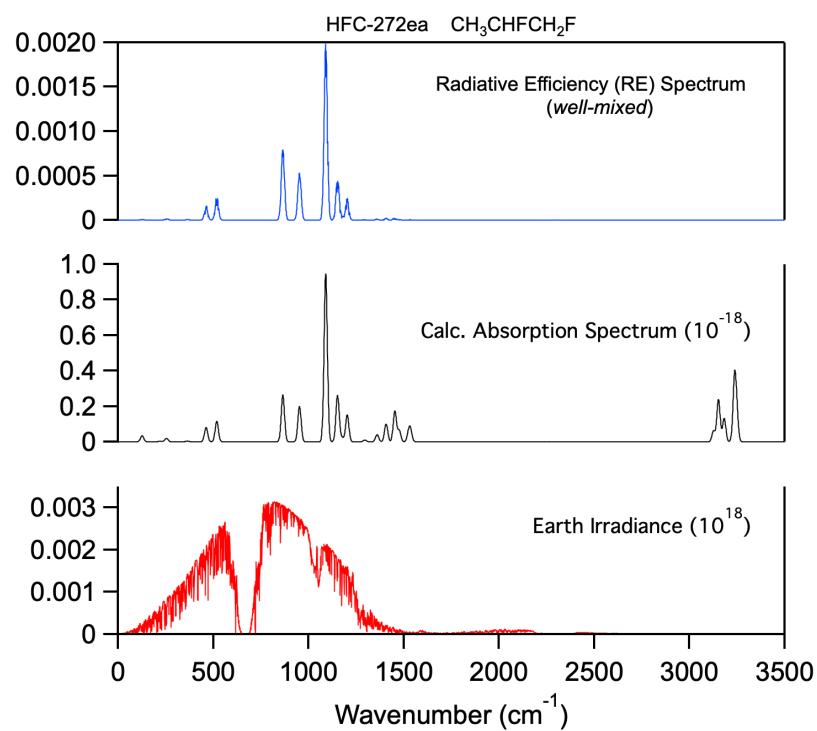
$$k_{\text{Rec}}(T) = NA$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
126	4.4
221	0.5
254	2.5
363	0.6
462	10.3
518	14.9
865	33.8
952	24.4
958	1.3
1090	121.6
1152	33.3
1175	3.1
1203	19.6
1295	1.2
1360	5
1407	12.9
1453	22.2
1476	8
1525	3.1
1529	4.6
1536	5.6
3126	7.8
3152	30.7
3182	17
3229	0.6
3237	45.7
3249	14

Radiative Efficiency Spectrum



HFC-272fa

Molecular Formula: CH₂F-CH₂-CH₂F
 CAS RN: 462-39-5
 Molecular Weight: 80.08

Global Atmospheric Lifetime (years): 0.19
 Tropospheric Atmospheric Lifetime (years): 0.19
 Stratospheric Atmospheric Lifetime (years): 25

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.089	0.037
Global Warming Potential (GWP _H):		
GWP ₂₀		20
GWP ₁₀₀		5
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		6
GTP ₅₀		1
GTP ₁₀₀		1

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 2.48 \times 10^{-13}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 1.99 \times 10^{-13}$$

$$\tau_{\text{Global}}^{\text{OH}} = 0.19 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 0.19 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 25 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 6.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 617 \text{ years}$$

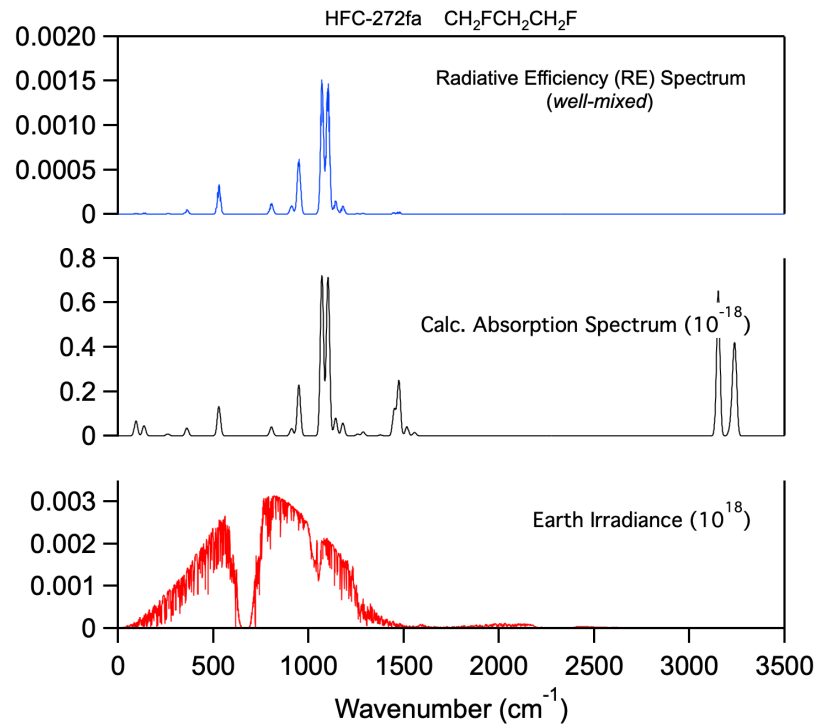
$$k_{\text{Rec}}(T) = NA$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
94	8.6
136	5.9
261	1.1
361	4.5
529	17
805	5.2
911	4.2
949	29.5
1070	92.8
1102	91.6
1142	10.3
1180	7.4
1258	1
1287	2.3
1337	0.1
1377	0.5
1450	15.3
1474	31.8
1516	5.3
1554	1.2
1560	0.8
3142	4.7
3150	33.8
3152	47.9
3212	3.6
3229	29.4
3241	39.2

Radiative Efficiency Spectrum



HFC-272fb

Molecular Formula: CH₃-CH₂-CHF₂
 CAS RN: 430-61-5
 Molecular Weight: 80.08

Global Atmospheric Lifetime (years): 0.71
 Tropospheric Atmospheric Lifetime (years): 0.73
 Stratospheric Atmospheric Lifetime (years): 25

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.103	0.077
Global Warming Potential (GWP _H):		
GWP ₂₀		153
GWP ₁₀₀		42
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		48
GTP ₅₀		7
GTP ₁₀₀		6

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 6.73 \times 10^{-14}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 5.15 \times 10^{-14}$$

$$\tau_{\text{Global}}^{\text{OH}} = 0.71 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 0.73 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 25.3 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 6.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 617 \text{ years}$$

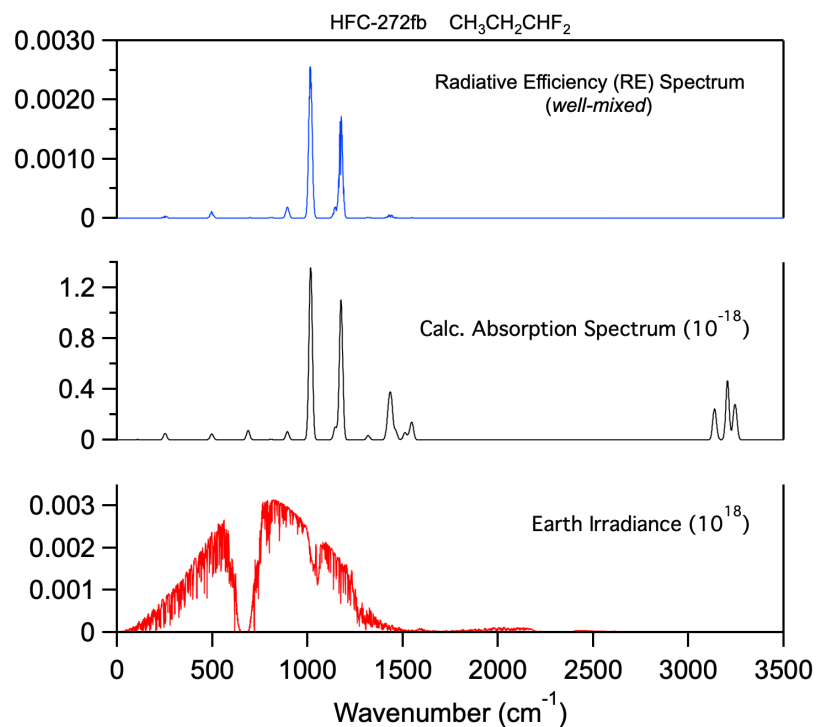
$$k_{\text{Rec}}(T) = NA$$



Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
108	0.3
217	0
252	6.5
390	0.1
497	5.9
688	9.5
808	0.5
894	8.2
1012	31.2
1017	146.9
1145	12.8
1174	66.3
1177	77.8
1318	4.3
1416	3.2
1426	27.2
1439	36.7
1462	9.3
1511	7.3
1534	4.7
1548	16.7
3134	23.5
3143	11.9
3204	51.6
3208	9.3
3239	21.2
3249	21.3

Radiative Efficiency Spectrum



HFC-281ea

Molecular Formula: CH₃-CHF-CH₃
 CAS RN: 420-26-8
 Molecular Weight: 62.09

Global Atmospheric Lifetime (years): 0.13 (27 days)
 Tropospheric Atmospheric Lifetime (years): 0.16 (27 days)
 Stratospheric Atmospheric Lifetime (years): 25

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.050	0.019
Global Warming Potential (GWP _H):		
GWP ₂₀		11
GWP ₁₀₀		3
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		3
GTP ₅₀		0.50
GTP ₁₀₀		0.40

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂
 * Italic values in () taken from WMO-2018

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{SAR}}(298 \text{ K}) = 2.95 \times 10^{-13}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 2.38 \times 10^{-13}$$

$$\tau_{\text{Global}}^{\text{OH}} = 0.16 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 0.16 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 25 \text{ years}$$

$$k_{\text{Rec}}(T) = 3.0 \times 10^{-12} \exp(-490/T)$$

$$k_{\text{Rec}}(298 \text{ K}) = 5.8 \times 10^{-13}$$

$$k_{\text{Rec}}(272 \text{ K}) = 4.95 \times 10^{-13}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 7.0 \times 10^{-11}$$

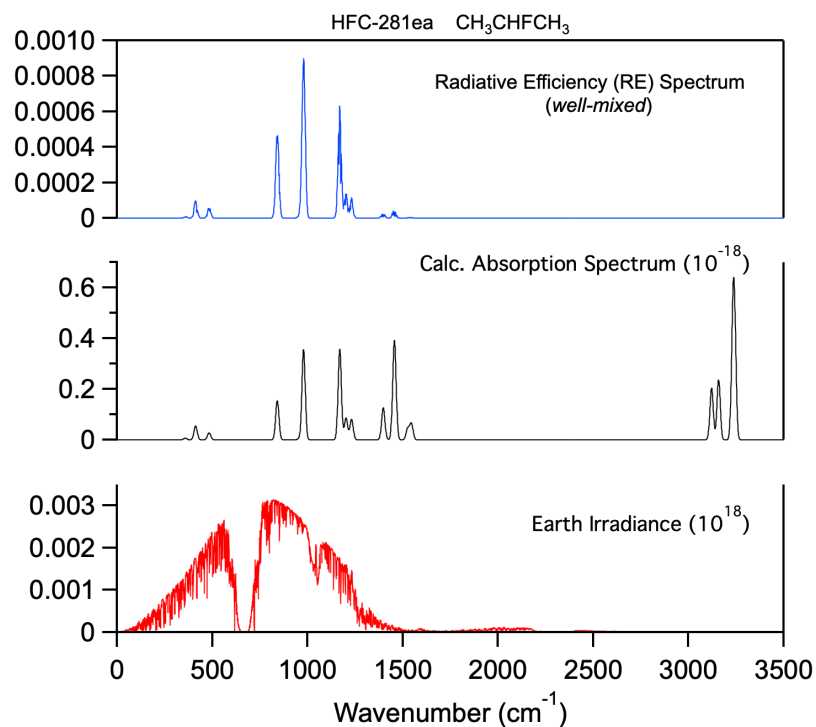
$$\tau_{\text{O}(\text{1D})} = 528 \text{ years}$$

$$k_{\text{Rec}}(T) = NA$$

Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
210	0
269	0.1
358	0.8
412	7.1
483	3.5
841	19.8
955	0.4
964	0
979	45.8
1169	45.9
1202	11
1231	10.4
1397	15.6
1404	0.9
1453	21.3
1458	31.1
1516	0
1520	0.2
1526	5.5
1545	8.2
3120	16.3
3123	10.3
3158	30.4
3227	0.2
3233	47.2
3240	18.4
3243	29.1

Radiative Efficiency Spectrum



HFC-281fa

Molecular Formula: CH₃-CH₂-CH₂F
 CAS RN: 460-13-9
 Molecular Weight: 62.09

Global Atmospheric Lifetime (years): 0.13
 Tropospheric Atmospheric Lifetime (years): 0.13
 Stratospheric Atmospheric Lifetime (years): 25

	<i>Well-mixed</i>	<i>Lifetime and Stratosphere adjusted</i>
Radiative Efficiency (RE):	0.053	0.016
Global Warming Potential (GWP _H):		
GWP ₂₀		8
GWP ₁₀₀		2
Global Temperature Change Potentials (GTP _H):		
GTP ₂₀		2
GTP ₅₀		0.35
GTP ₁₀₀		0.29

* RE units: W m² ppb⁻¹
 * GWP and GTP: Relative to CO₂

Atmospheric Loss Processes *****

OH Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Rec}}(T) = NA$$

$$k_{\text{SAR}}(298 \text{ K}) = 3.49 \times 10^{-13}$$

$$k_{\text{SAR}}(272 \text{ K}) \approx 2.84 \times 10^{-13}$$

$$\tau_{\text{Global}}^{\text{OH}} = 0.13 \text{ years}$$

$$\tau_{\text{Trop}}^{\text{OH}} = 0.13 \text{ years}$$

$$\tau_{\text{Strat}}^{\text{OH}} = 25 \text{ years}$$

O(¹D) Reactivity (cm³ molecule⁻¹ s⁻¹)

$$k_{\text{Est}}(T) = 7.0 \times 10^{-11}$$

$$\tau_{\text{O}(\text{1D})} = 528 \text{ years}$$

$$k_{\text{Rec}}(T) = NA$$

Calculated Infrared Spectrum

Band Center (cm ⁻¹)	Band Strength (km mole ⁻¹)
142	2.8
225	1.9
324	1.1
484	4.7
786	1.1
904	6.3
943	4.1
994	58.8
1116	47.4
1149	3.8
1202	1.8
1293	0.6
1328	0.9
1408	1.7
1453	7.2
1459	13.1
1507	3.8
1530	6.6
1543	8.8
1552	1.2
3117	30.2
3125	17.6
3143	45.2
3190	13.2
3217	24.8
3223	62.5
3236	24.8

Radiative Efficiency Spectrum

