

1.A.3.a i (ii) - International Civil Aviation: Cruise

Short description

Category Code	Method					AD					EF				
1.A.3.a i (ii)	T1, T2, T3					NS, M					CS, D, M				
Key Category	SO ₂	NO _x	NH ₃	NMVOC	CO	BC	Pb	Hg	Cd	Diox	PAH	HCB	TSP	PM ₁₀	PM _{2.5}
1.A.3.a i (ii)	not included in key category analysis														

In NFR category 1.A.3.a i (ii) - International Civil Aviation: Cruise emissions from international flights from German airports during cruise stage (above 3,000 feet of altitude) are reported.

In the following, information on sub-category specific activity data, (implied) emission factors and emission estimates are provided.

Methodology

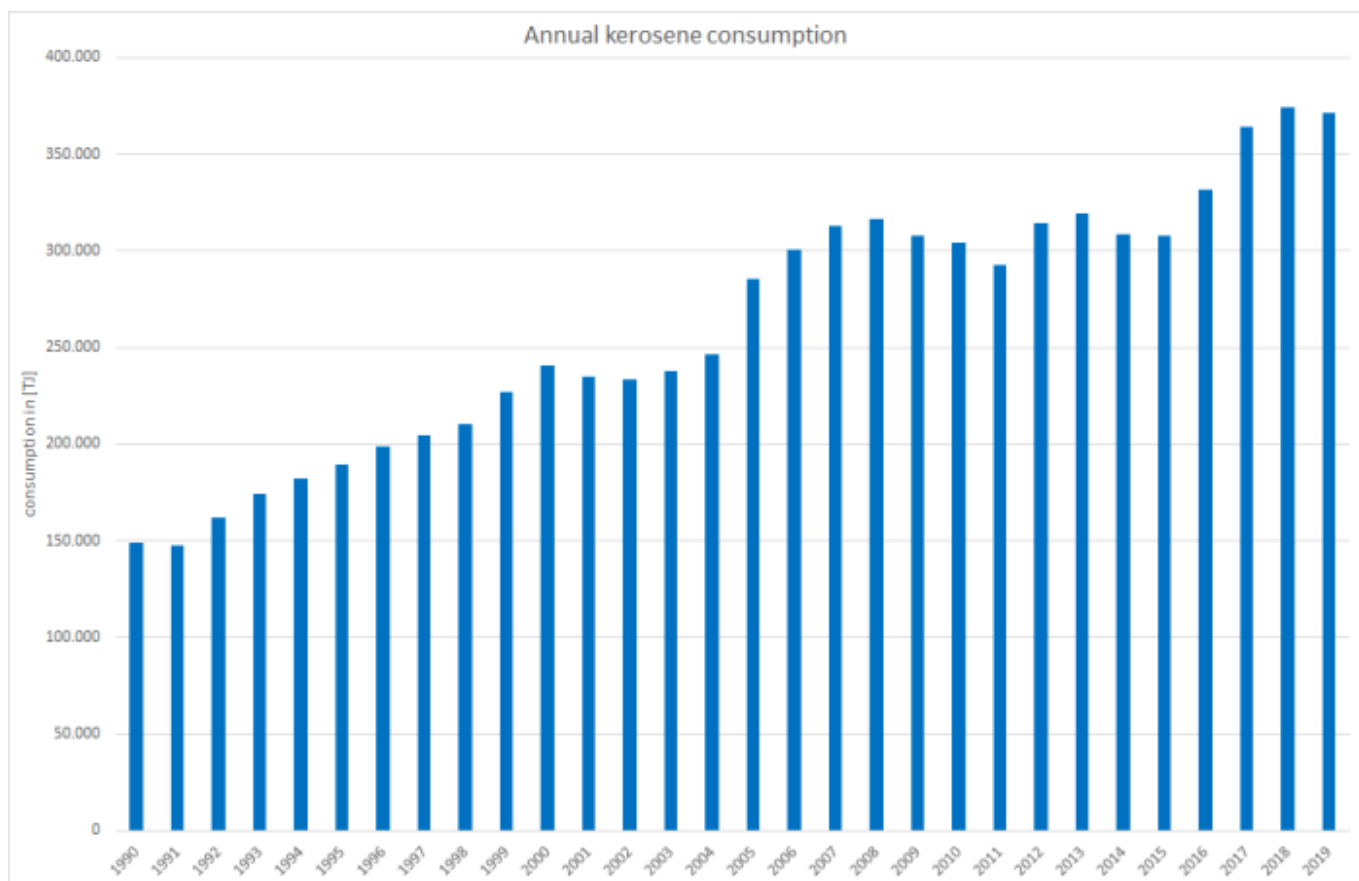
Activity Data

Specific jet kerosene consumption during LTO-stage is calculated within TREMOD AV as described in the superordinate chapter on civil aviation.

Table 1: annual jet kerosene consumption during cruise-stage, in terajoules

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Jet kerosene	149,007	189,185	240,680	285,709	301,032	312,607	316,629	307,916	304,544	292,898	314,325	319,548	308,755	307,982	331,809	363,932	374,434	371,033	171,306
Avgas	494	211	220	149	146	138	138	126	124	106	97.9	86.4	76.1	98.6	36.0	36.4	32.2	23.4	12.1

source: Knörr et al. (2021c) ¹⁾ and Gores (2021) ²⁾



	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Submission 2021	149,007	189,185	240,680	285,709	301,032	312,607	316,629	307,916	304,544	292,898	314,325	319,548	308,755	307,982	331,809	363,932	374,434	371,033
Submission 2020	149,007	189,185	240,680	285,709	301,032	312,607	316,629	307,916	304,544	292,898	314,325	319,548	308,755	307,982	331,809	363,932	374,434	371,552
absolute change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-519
relative change	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-0.14%
AVGAS																		
Submission 2021	494	211	220	149	146	138	138	126	124	106	97.9	86.4	76.1	98.6	36.0	36.4	32.2	23.4
Submission 2020	464	161	173	91.6	87.2	76.8	82.5	75.8	76.8	68.1	60.4	48.6	40.0	58.5	16.2	16.2	12.1	6.55
absolute change	29.8	50.1	46.6	56.9	59.2	60.9	55.4	49.8	47.3	37.5	37.4	37.8	36.1	40.1	19.8	20.2	20.1	16.9
relative change	6.42%	31.1%	26.9%	62.2%	67.8%	79.4%	67.2%	65.7%	61.6%	55.0%	61.9%	77.7%	90.3%	68.7%	122.1%	125%	166%	258%

In parallel, the majority of **country-specific emission factors** applied for 2019 has been revised within TREMOD AV.

Table 4: Revised country-specific emission-factors 2019, in [kg/TJ]

	NH ₃	NM VOC	NO _x	SO ₂	BC	PM	CO
KEROSENE							
Submission 2022	3,97	4,26	376	19,6	1,73	3,61	34,1
Submission 2021	3,97	4,25	375	19,6	1,75	3,65	34,6
absolute change	0,00	0,01	0,14	0,00	-0,02	-0,04	-0,5
relative change	0,00%	0,35%	0,04%	0,00%	-1,13%	-1,13%	-1,51%
AVGAS							
Submission 2022	NE	466	81,7	0,46	0,46	3,08	29164
Submission 2021	NE	467	82,2	0,46	0,46	3,08	29108
absolute change	0,00	-0,90	-0,47	0,00	0,00	0,00	56,1
relative change		-0,19%	-0,57%	0,00%	0,06%	0,06%	0,19%



For more information on recalculated emission estimates for Base Year and 2019, please see the pollutant specific recalculation tables following chapter [8.1 - Recalculations](#).

Uncertainties

For uncertainties information, please see [main chapter](#) on civil aviation.

Planned improvements

For information on planned improvements, please see [main chapter](#) on civil aviation.

²⁾ Gores (2021): Inventartool zum deutschen Flugverkehrsinventar 1990-2018, im Rahmen der Aktualisierung des Moduls TREMOD-AV im Transportemissionsmodell TREMOD, Berlin, 2021.

³⁾ Knörr, W., Schacht, A., & Gores, S. (2010): Entwicklung eines eigenständigen Modells zur Berechnung des Flugverkehrs (TREMOD-AV) : Endbericht. Endbericht zum F+E-Vorhaben 360 16 029, URL: <https://www.umweltbundesamt.de/publikationen/entwicklung-eines-modells-zur-berechnung>; Berlin & Heidelberg, 2012.

⁵⁾ EMEP/EEA, 2019: EMEP/EEA air pollutant emission inventory guidebook 2019, <https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/1-energy/1-a-combustion/1-a-3-a-aviation/view>; Copenhagen, 2019.