

AVHRR DATA SET CURATION - FDR4AVHRR

ESA project: FDR4AVHRR

Fundamental Data Record (FDR) based on 40 years of AVHRR 1km (LAC) data

Focus: data integration and software development

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CEOS WGISS-58 Session 4: Heritage Datasets Recovery (DSIG)

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ESA Online Dissemination – AVHRR L1B data

https://tpm-ds.eo.esa.int/oads/access/collection/NOAA_AVHRR_L1B_LAC

The screenshot shows the ESA Online Dissemination interface. At the top, the ESA logo and 'Online Dissemination' are visible, along with 'European Space Agency'. A navigation bar includes 'Help | Third Party Missions' and 'Not signed in'. Below this, there are 'Collections' and 'Login' buttons. The main content area is titled 'AVHRR L1B (1.1 km)' and includes an 'Info' button. The text describes the collection-based search service and lists search functions: 'Search in collection by treeview', 'Search in collection by filename', and 'Geographical search (area of interest and metadata search)'. It also mentions that data can be reached through area definition on a map and metadata search.

The screenshot shows the product details page for AVHRR L1B (1.1 km) data. It features a 'Tree view: year, month and day' section with an 'Info' button. The collection name is 'AVHRR L1B (1.1 km)'. The metadata includes: Collection: AVHRR L1B (1.1 km), Year: 1985, Month: 05, Day: 24. There are 3 available products, with the first one being 'N09_RPRO_AVH_L1B_1P_19850524T131432_19850524T132907_002301_v0100.ZIP'. Below this, there are links for 'Download Product', 'Product Info', 'Browse', 'Download Metadata File', and 'Download Quality Report'. A small satellite image is shown. At the bottom, a table lists the following metadata:

Start Date:	1985-05-24T13:14:32Z
Stop Date:	1985-05-24T13:29:07Z
Orbit:	2301
Orbit Direction:	ASCENDING
Product Type:	AVH_L1B_1P
Satellite:	NOAA 09

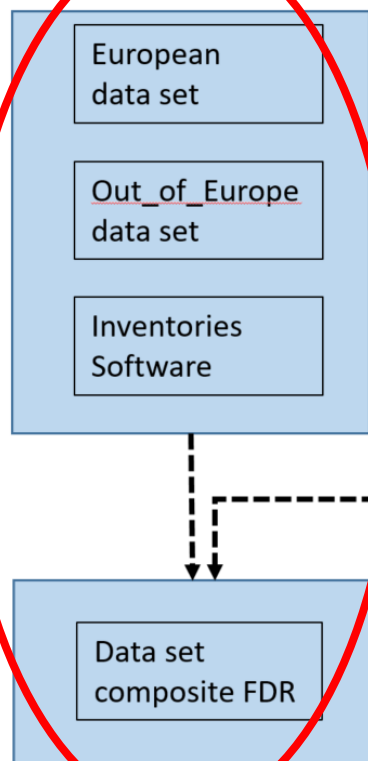
<https://doi.org/10.5270/AVH-f1i8784>

FDR4AVHRR – Curation Project

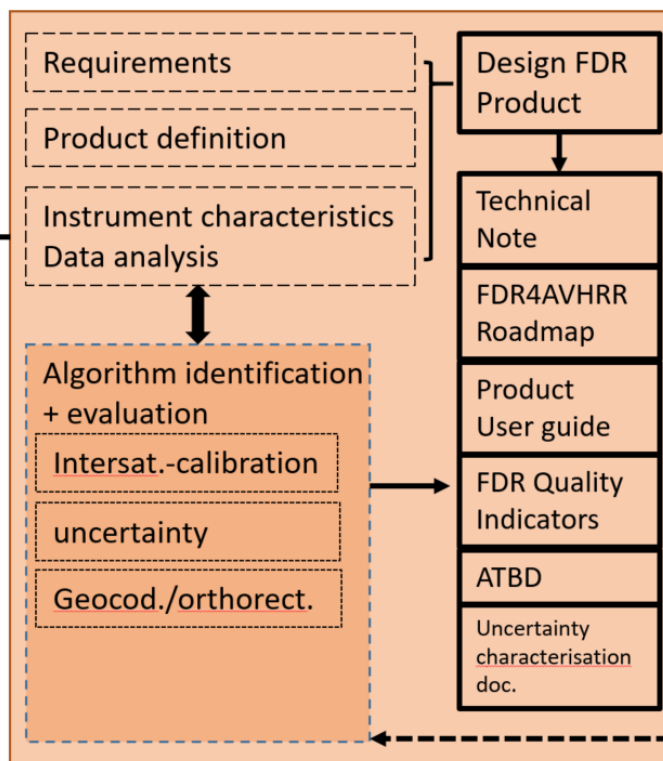
- > KO: 26 January 2024; End of project: November 2025
- > Consortium: UniBe (PI), NPL, SMHI
- > Objective: generation of a FDR based on AVHRR data and to make all data accessible via ESA dissemination service
 - Tasks:
 - **Extend the European data set with additional data from UniBe (2021 – 2024)**
 - **Integrate global data from South Africa, Argentina, etc. and from the 1km Land Project (1992 – 1999)**
 - Develop a module “uncertainty” to be added to open source software PyGAC
 - Develop a module “orthorectification” to be added to open source software PyGAC
 - Improve the inter-satellite calibration for all channels
 - Reprocessing of all data (Europe, global) to level1c
 - Validation and quality assessment
 - Transfer all data to ESA for archiving and dissemination
 - Co-operation with EUMETSAT MetOp-reprocessing team (bi-monthly meetings)

Project Logic: Overview and Tasks

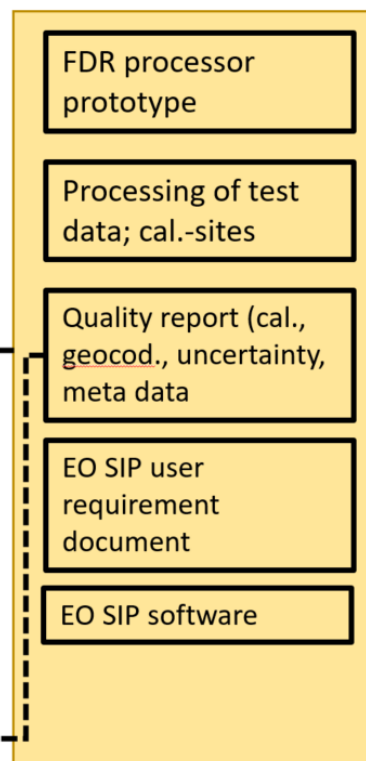
Task 1
Extend AVHRR archive
Processing line



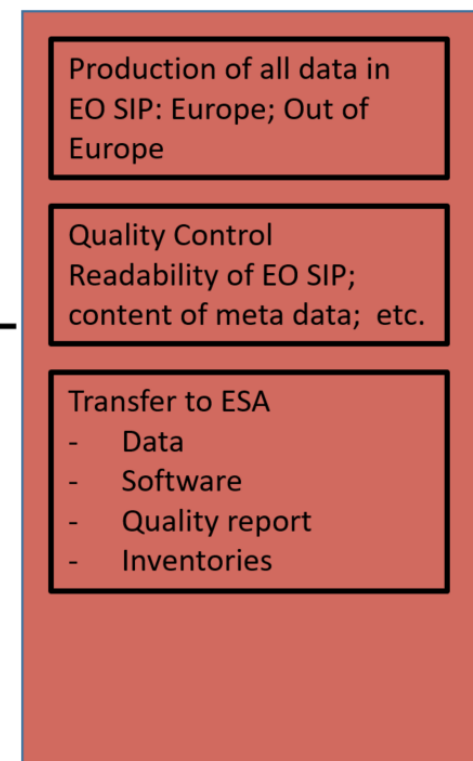
Task 2 + 3
FDR product definition
Preparatory activities



Task 4
FDR pilot development



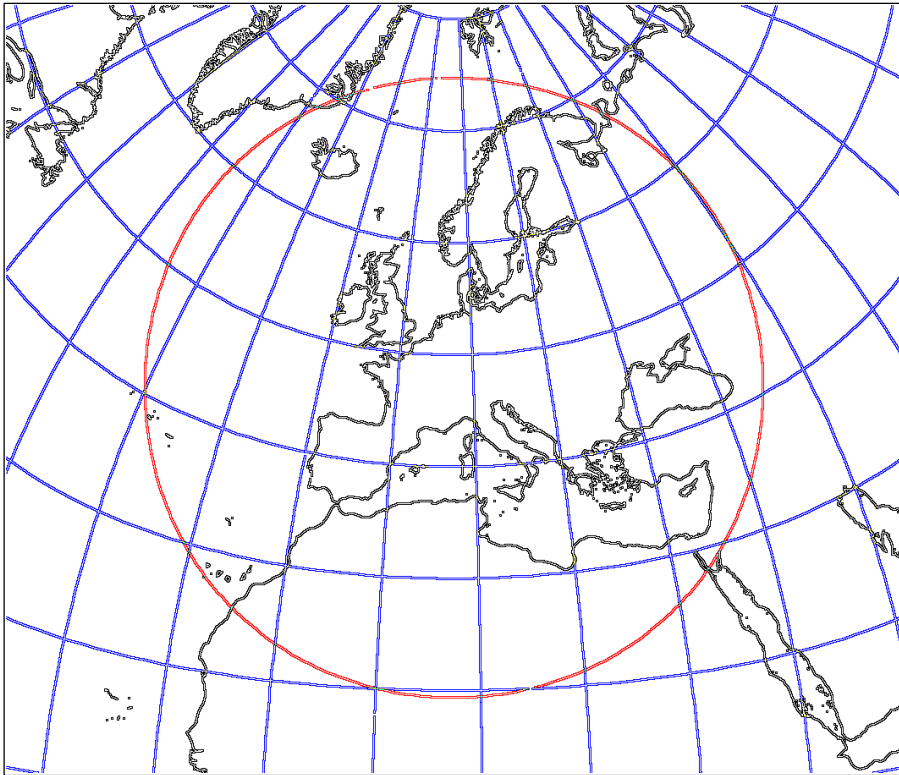
Task 5
FDR4AVHRR
Baseline implementation



Task 1: Extend the AVHRR archive (Europe; global)

AVHRR (1km) to be included in the FDR4AVHRR project

> Europe

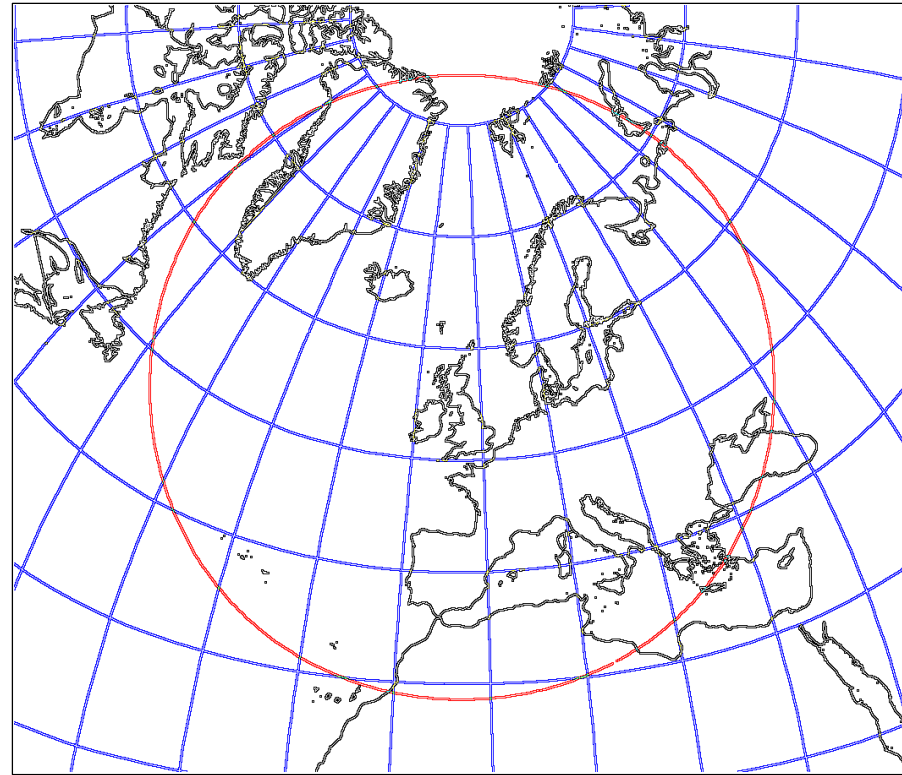


Bern (BRN), Switzerland

1980 – 2024

250.000 data sets;

incl. Berlin, ESA and DDE (1981-1988)



Dundee (DDE), Scotland

1979 – 2019

235.540 data sets

Task 1 - Extend the ESA AVHRR LTDP datasets

Goal 1 - Integrate new data 2021-2024

- - data over Europe
- recorded by the University of Bern (BRN)

- 2021-2023

	<i>N15</i>	<i>N18</i>	<i>N19</i>	<i>MOA</i>	<i>MOB</i>	<i>MOC</i>	<i>Total</i>
2021	626	453	1006	337	1023	1019	4464
2022	702	556	845	0	1038	1038	4179
2023	793	630	591	0	1044	1045	4103

- 2024: TBD

Task 1 - Extend the ESA AVHRR LTDP datasets

Goal 2 - Integrate Dundee archive

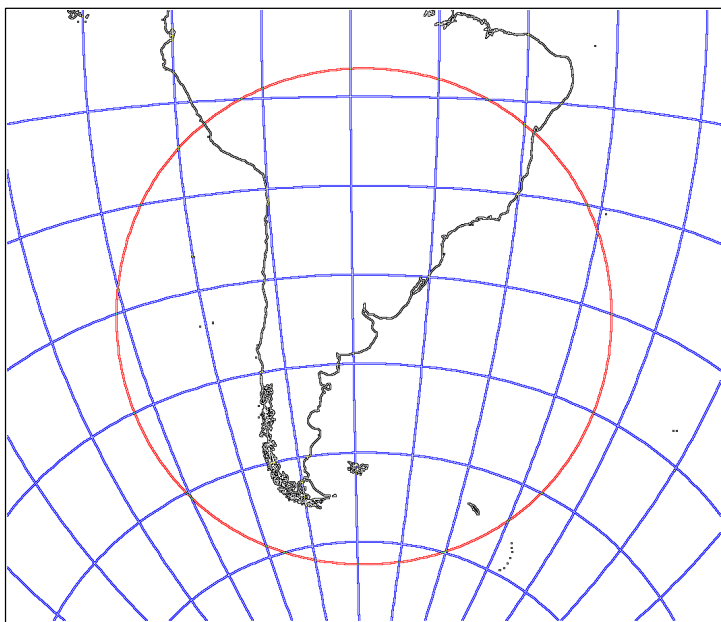
- recorded by the Dundee Satellite Station (DDE)
- from 1979 (TIROS-N) to 2018 (N19)
- ~ 115.000 recordings
- excerpt from 2012-2018

	N16	N18	N19
2012	1872	0	2946
2013	1	0	2968
2014	2	41	2943
2015	0	9	2972
2016	0	0	2974
2017	0	0	2971
2018	0	0	2882

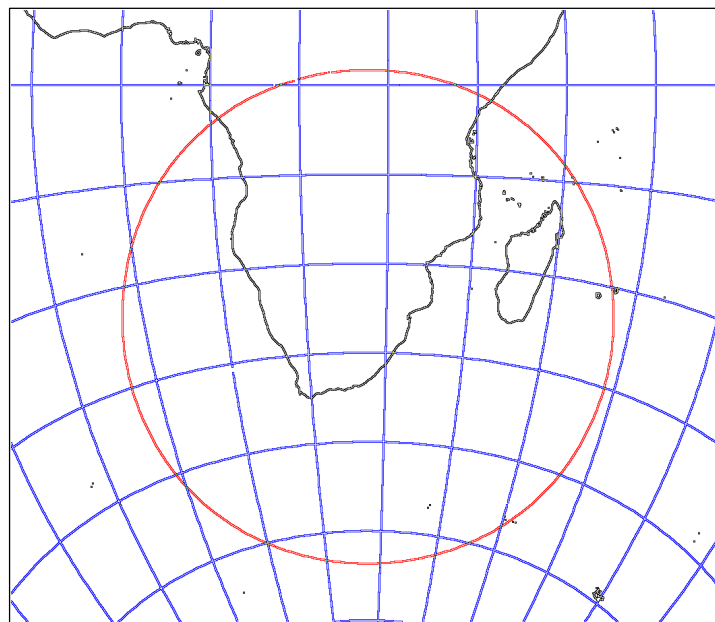
- Develop a procedure to support users with additional data
 - Check for redundancy (orbit, day, time)
 - Check for quality
 - Decision for integration into final data archive

Global AVHRR (1km) to be included in the FDR4AVHRR project

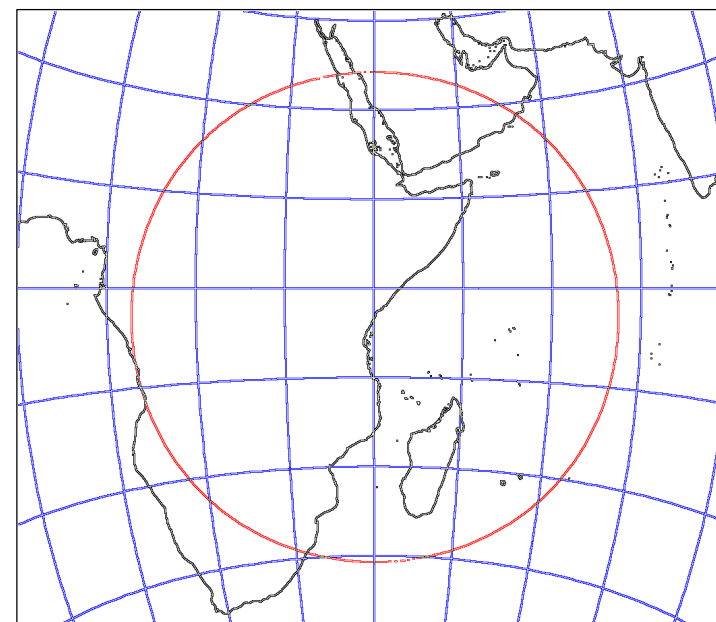
- > Argentina, South Africa, Kenya to be integrated in the frame of FDR4AVHRR
- > Additional 1km AVHRR data can be included



Buenos Aires (BAA), Argentina
 Download completed
 N. products: 25504
 Volume: 1.02TB
 Coverage: 1995-2017



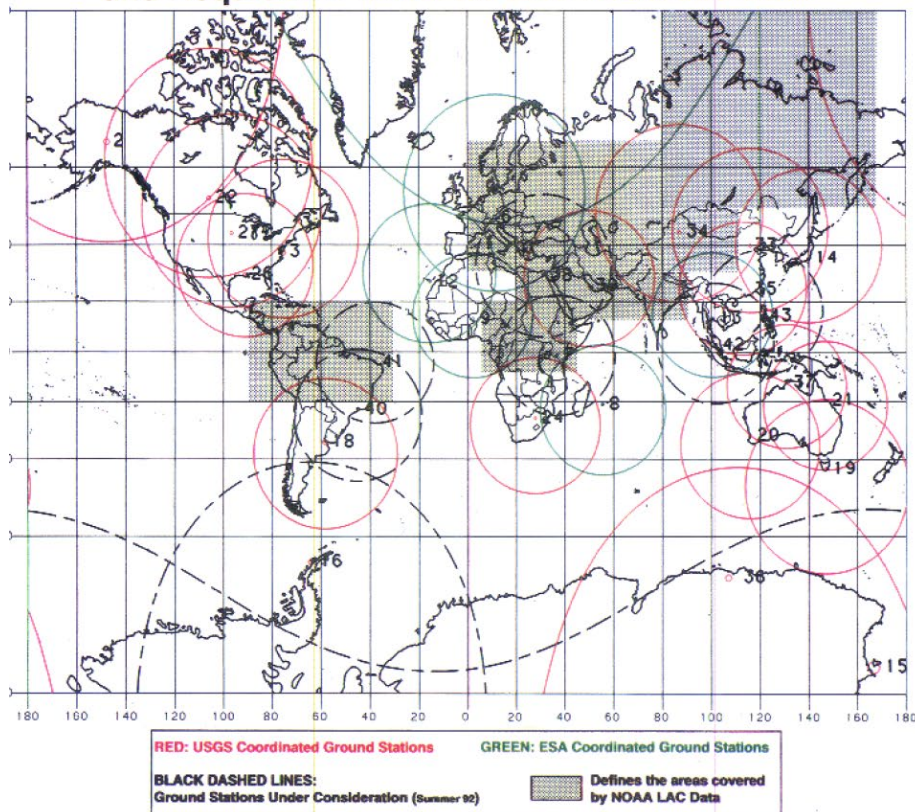
Hartebeesthoek (HBK), South Africa
 Download completed
 N. products: 7684
 Volume: 465GB
 Coverage: 1985-2009



Malindi, Kenya (operated by ESA)
 All DLT tapes transcribed.
 N. products: 8452
 Volume: 614GB
 Coverage: 2001-2009

Global 1km AVHRR data

Global Land 1km AVHRR Data Set Project HRPT Ground Station Network (as of April 1, 1992) and Acquisition Areas for LAC Recorded Data



HRPT Receiving Station	CEOS Receiving Station Codes	Latitude/Longitude	HRPT Receiving Station Coordinator
Gilmore Creek, Alaska	GIL	64°58' S 147°30' E	NOAA
Casey, Antarctica	CFQ (CASY)	66°17' S 110°32' E	USGS
Terranova Bay, Antarctica	TNB	74°25' S 164°04' E	ESA
Buenos Aires, Argentina	BAA	34°24' S 58°18' W	USGS
Darwin, Australia	DAR	12°23' S 130°44' E	USGS
Hobart, Tasmania, Australia	HBT	42°48' S 147°18' E	USGS
Perth, Australia	PTH	32°06' S 115°53' E	USGS
Townsville, Australia	TSV	19°18' S 146°48' E	USGS
Cachoeira Paulista, Brazil	CPA	22°45' S 45°00' W	USGS
Prince Albert, Canada	PAS	53°12' N 105°55' W	USGS
Maspalomas, Canary Islands	MPS	27°46' N 15°38' W	ESA
Beijing, China	BJG	40°00' N 115°00' E	USGS
Urumqi, China	UQC	45°00' N 85°00' E	USGS
Guanzhou, China	GZC	25°00' N 115°00' E	USGS
Cairo, Egypt	CRO	30°00' N 31°14' E	ESA
La Reunion (France)	RUN	20°52' S 55°28' E	ESA
Oberpfaffenhofen, Germany	OPF	48°03' N 11°09' E	ESA
Scanzano, Italy	SCZ	37°54' N 13°21' E	ESA
Tokyo University, Japan	TK2	36°00' N 140°00' E	USGS
Nairobi, Kenya	NRB	01°15' S 36°45' E	ESA
Kuala Lumpur, Malaysia	KLM	3°00' N 102°00' E	ESA
Ulan Bator, Mongolia	UBM	48°00' N 107°00' E	USGS
Niamey, Niger	NMY	13°32' N 02°05' E	ESA
Tromsø, Norway	TMS	69°39' N 18°56' E	ESA
Manila, Philippines	MNL	14°23' N 121°02' E	ESA
Dhahran, Saudi Arabia	DSA	26°13' N 50°00' E	USGS
Jeddah, Saudi Arabia	JSA	21°30' N 39°15' E	USGS
N'Gaoundere, Cameroon	NGC	7°15' N 13°34' E	USGS
Hartebeesthoek, South Africa	HBK	25°53' S 27°42' E	USGS
Baton Rouge, Louisiana, USA	BTR	30°24' N 91°10' W	USGS
Sioux Falls, South Dakota, USA	SFL	43°44' N 96°37' W	USGS
Wallops Island, Virginia, USA	NWI	37°52' N 75°27' W	NOAA
Local Area Coverage	LAC	On-board recorders	NOAA

N11:

April 1992 – December 1993; ~8.700 images

N14:

February 1994 – September 1999; ~23.000 images

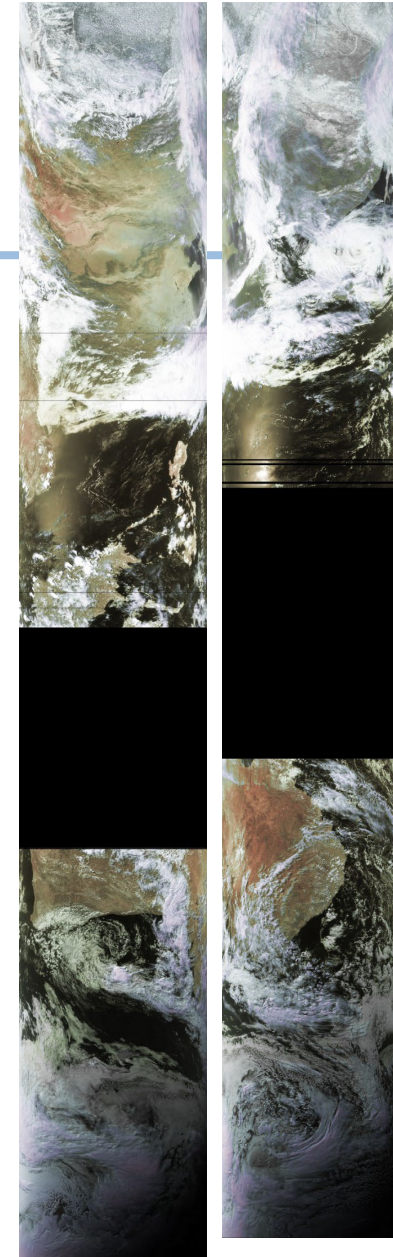
Figure 1: AVHRR ground station network for the global land project (left) and the listing of the receiving stations around the world, where the stations under responsibility of ESA are marked in orange (right).

Global 1km AVHRR data

N11: April 1992 – December 1993; ~8.700 images

N14: February 1994 – September 1999; ~23.000 images

- > roadblocks: .ARCH-format, stitched swaths
- > → no possibility for geocoding and calibration
- > develop a decoder tool
- > develop a tool to "un-stitch" the images
- > develop a processing line from decoding the data to packing into L1B EO-SIPs
- > Calibration and geocoding of all L1B files (pyGAC)
- > **ESA FDR4AVHRR project: CCN1 started in August to develop a processing line for the global .ARCH data**

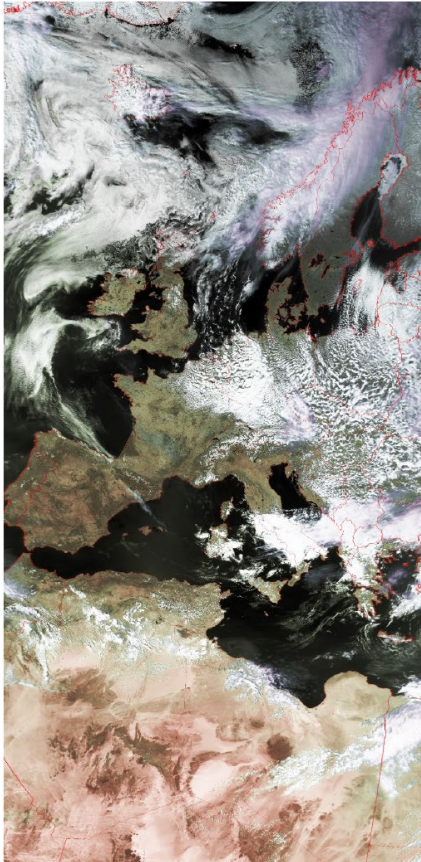


Examples of stitched swaths

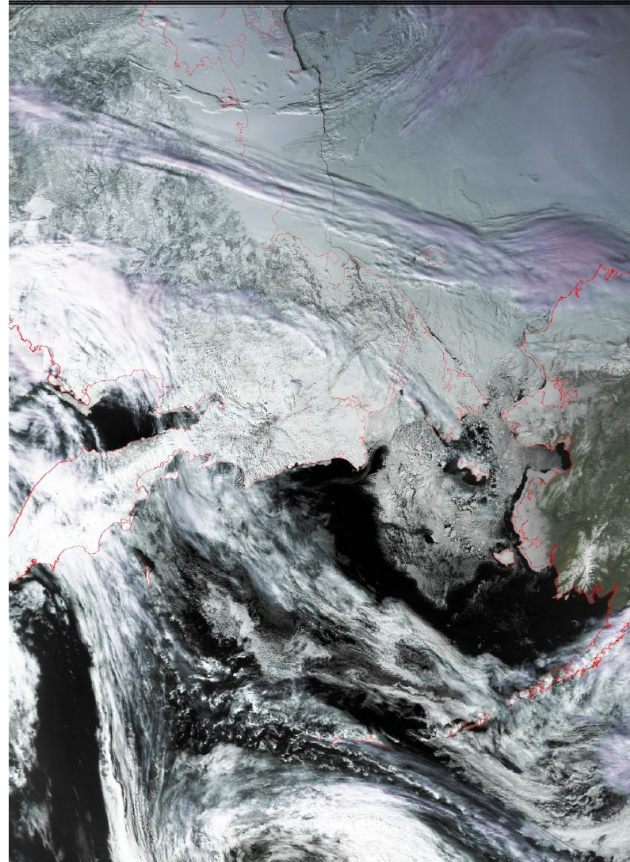
N14, 1997-04-12; N11, 1992-04-11

- > ARCH => develop a decoder tool => HMF => L1B => JPG
- > Decoder tool works for single swath data (un-stitched)

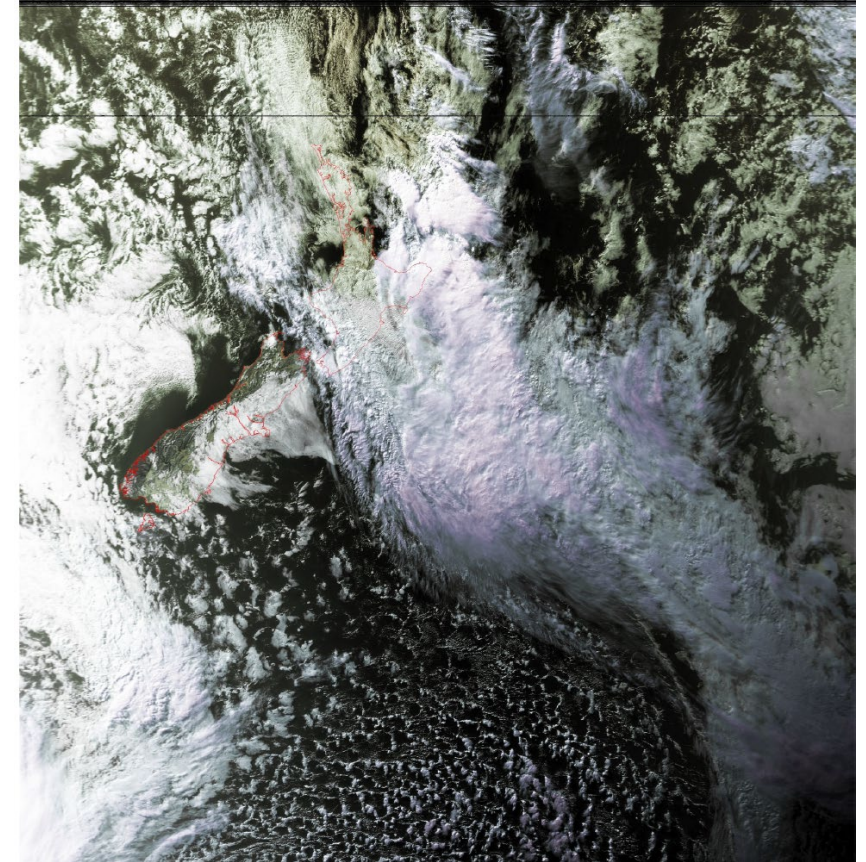
recorded at ESA



recorded at Gilmore
Creek, Alaska;



recorded at Hobart, Tasmania
- New Zealand



Quality assessment and validation

Tasks and Deliverables for FDR4AVHRR project

- > ***Task 3: preparatory activities (ongoing until Oct 2024)***
 -
 - **D3b: A document describing the FDR quality indicators, the Test Data sets, and outlining the approach for conducting the data quality check and validation;**

 - > ***Task 4: FDR4AVHRR Pilot development activities (start Aug 2024)***
 - R18. Generate Test Data Sets (e.g., few months of data) to be validated;
 - R19. Perform data quality checks on the TDS including the comparison of radiance measurements over Pseudo Invariant Calibration Sites;
 - Output of Task 4
 - **D4a:** FDR4AVHRR Test data set (TIR, VNIR);
 - **D4b:** FDR4AVHRR TDS data quality report;
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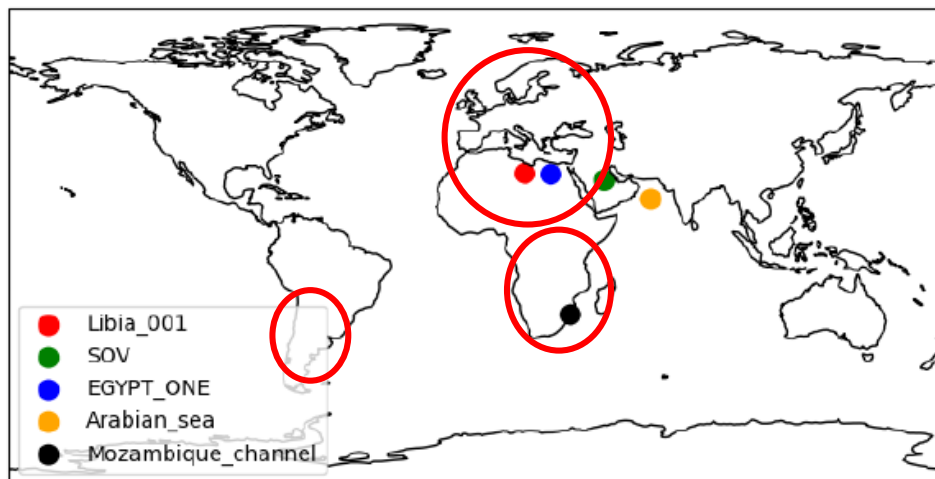
FDR4AVHRR - Quality control and validation

- > Validation strategy
 - Quality control: consistency, completeness and integrity of FDR product
 - Validation of calibration
 - Validation of geocoding
 - > Results and figures to be added to the Product User Guide (PUG)
 - D4b: FDR4AVHRR Test Data Set quality report
 - > Definition of measures to be added to the meta files; content and structure to be defined in close cooperation with ESA dissemination team.
-

Targets for validation of calibration and long term stability

Table 3: List of specific locations used

Site name	Longitude	Latitude
Libia_0001	16.276	27.474
SOV	46.41	24.91
EGYPT_ONE	26.1	27.12
Arabian_sea	64.1,	17.75
Mozambique_channel	33.55	-25.9



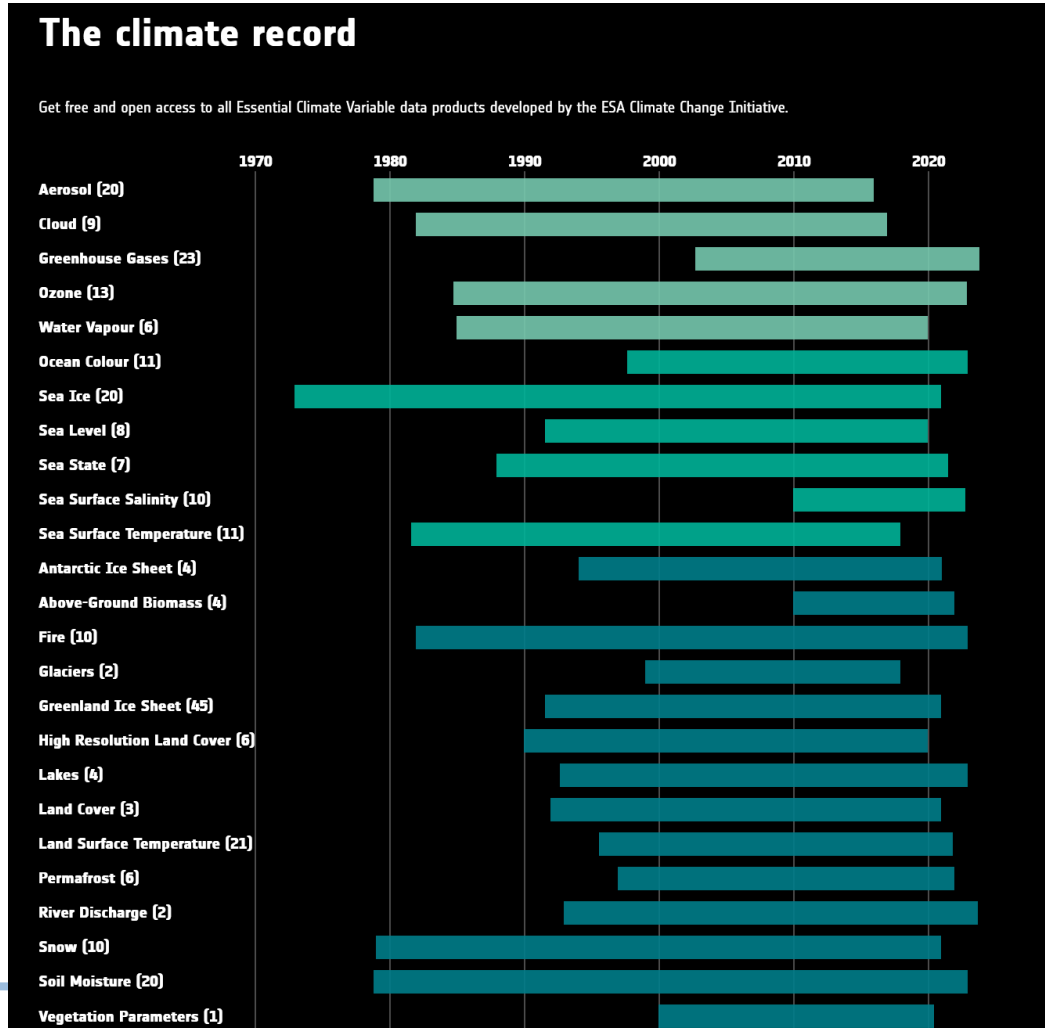
PyGAC AVHRR FDR Release 1 Validation Report (ID 1282616 v2)

+ Algeria sites

- EUMETSAR FDR team supports the validation activity with additional sites:
 - South Africa
 - Argentina

Summary

End of Project (Nov.2025): approx. 500.000 1-km AVHRR level1c data will be transferred to ESA for later accessibility via ESA dissemination service.



The new FDR4AVHRR project will be a major contribution for ESA CCI's / CLIMATE-SPACE etc. and all studies related to Essential Climate Variables.

Due to

- Improved calibration
- Improved geocoding
- Validation
- Included uncertainty
- Improved open-source software PyGAC
- Extended 1km-AVHRR data set (Europe, global)