



EarthCARE 2026 Science and Validation workshop

8–12 June 2026 | Rhodes House | Oxford, UK

ECOMIP Update: Toward Revealing Vertical Velocity Structures in Deep Convection through EarthCARE–Kilometer-Scale Model Synergy

Masaki Satoh^{1,2}, Woosub Roh¹, Shunsuke Aoki³, Takuji Kubota³, Jin-de Huang¹, Tomoki Miyakawa¹

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3 Earth Observation Research Center, JAXA

EarthCARE and model comparisons & ECOMIP

Protocol and strategy

ECOMIP Quicklook images

Status of the model results

Summary and implications, what's next

The protocol paper, now ready to be submitted:

“ECOMIP: The EarthCARE-ORCESTRA Model Intercomparison Project”

By Woosub Roh, Masaki Satoh, Romain Fiévet, Mark D. Fielding, Robin J. Hogan,
Bjorn Stevens, Takuji Kubota, and Hajime Okamoto

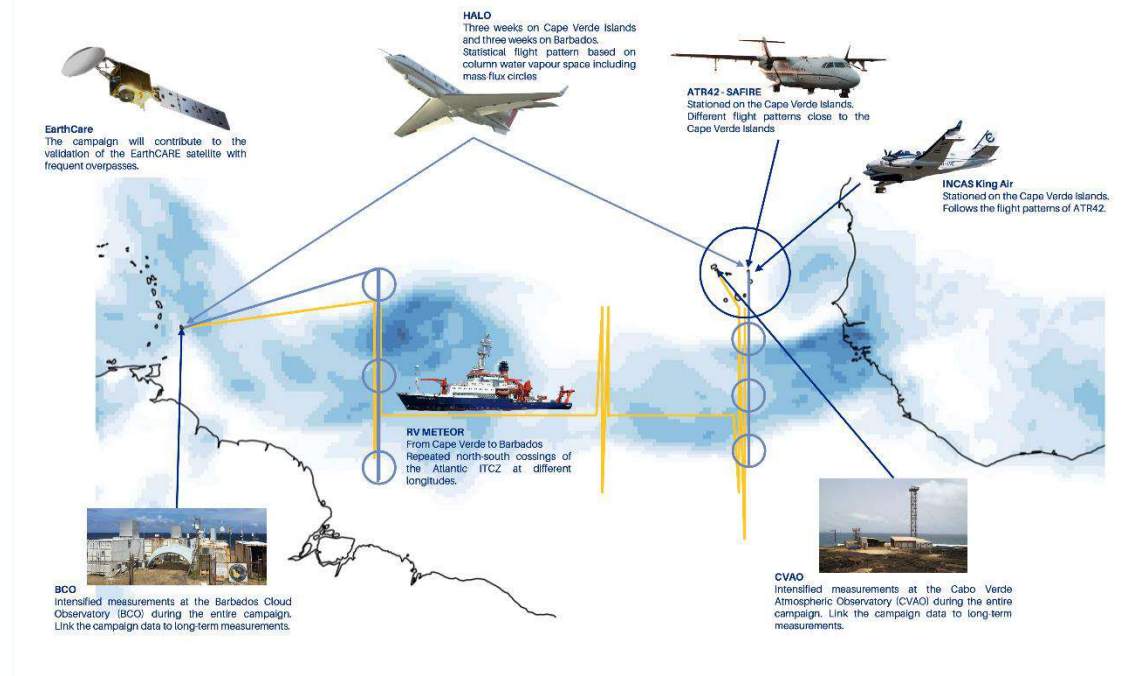
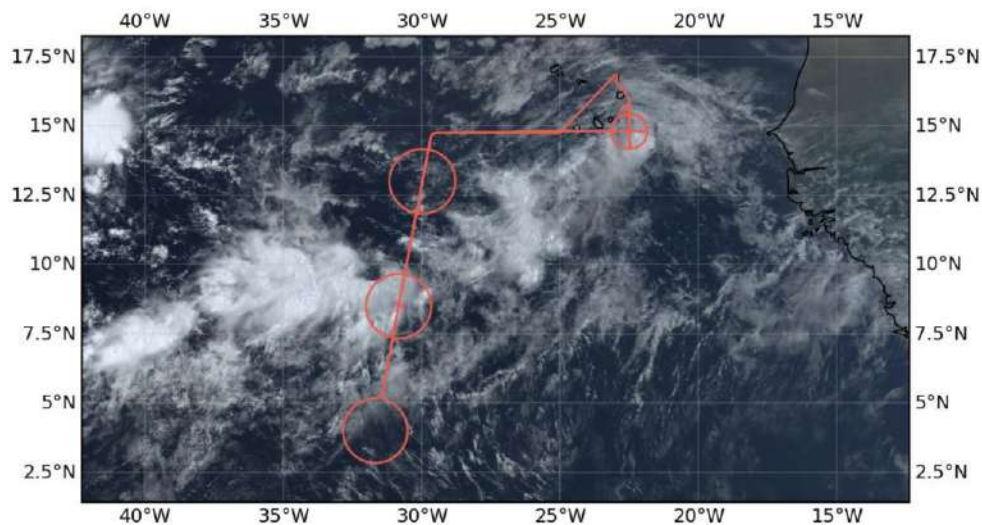
to be submitted to ACP.

ECOMIP: EarthCARE-ORCESTRA Model Intercomparison



August-September, 2024

https://www.eorc.jaxa.jp/EARTHCARE/about/ec_intro_j.htm **3 Sep. 2024**



The EarthCARE observation data are expected to play an important role in evaluating global kilometer-scale models and constraining physical parameters and processes within them. This year, both NICAM and ICON have conducted simulations for the golden case on September 3, 2024, and we are currently preparing a proposal paper based on these results. We also plan to carry out intercomparison studies with other research groups.

ECOMIP: The EarthCARE-ORCESTRA Model Intercomparison Project



Setting	Descriptions
Horizontal resolution	Less than 5 km(*)
Vertical resolution	Not specified
Model	Global or regional atmosphere model
Output interval	3D: 30 mins, 2D: 10 mins for Phase 1 3: 3 hours, 2D: 30 mins for Phase 2 and 3
Initialization of land and ocean	Arbitrary up to each group
Initial data	00UTC the 1day before the target case time
Domain size for the regional model	2°S – 22°N, 10°W – 62°W
Initial	ERA5 or IFS 9 km

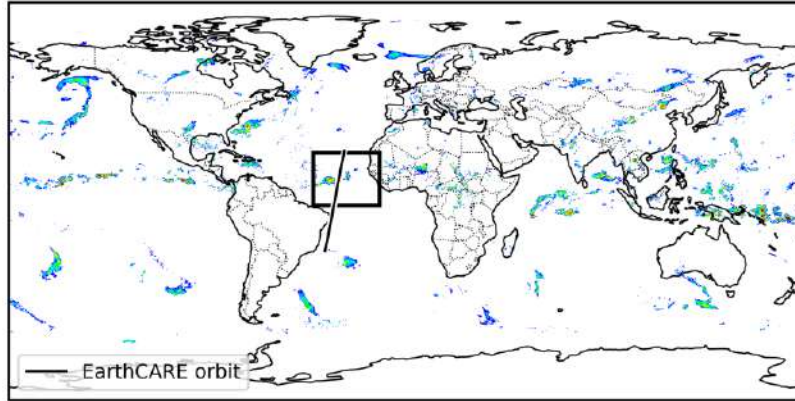
Phase	Objectives and Description	Target Cases / Duration
Phase 1 – Case Studies	Direct comparison and interpretation of EarthCARE and ORCESTRA observations to improve understanding of convection, cloud microphysics, and aerosol–cloud interactions.	2-day simulations. Mandatory: 3 Sep 2024 targeted for deep convection Optional: Additional events selected based on participant interests.
Phase 2 – Free-run Simulations	Conduct two-month continuous simulations for statistical evaluation of model performance and intercomparison under natural variability.	Around 2 months
Phase 3 – Constrained Free-run Simulations	Perform free-run experiments with observationally constrained parameters (e.g., terminal velocity, hydrometeor density) derived from EarthCARE/ORCESTRA insights, to examine their impact on radiation, precipitation, convection, and cloud statistics. A common configuration will be applied across models.	Around 2 months

Roh et al. (2026, to be submitted)

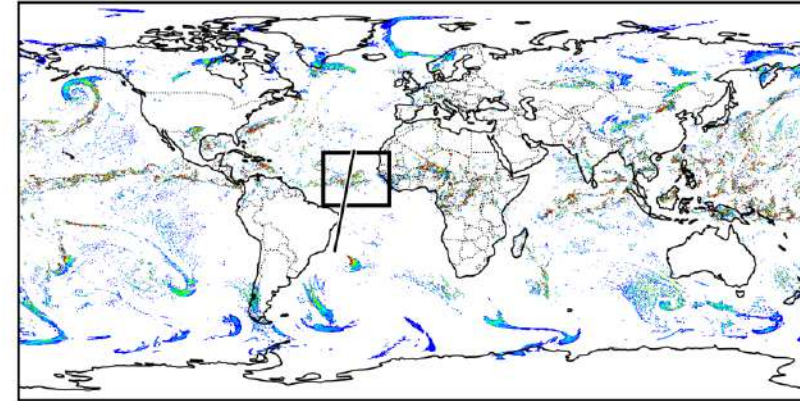
ECOMIP: The EarthCARE-ORCESTRA Model Intercomparison Project



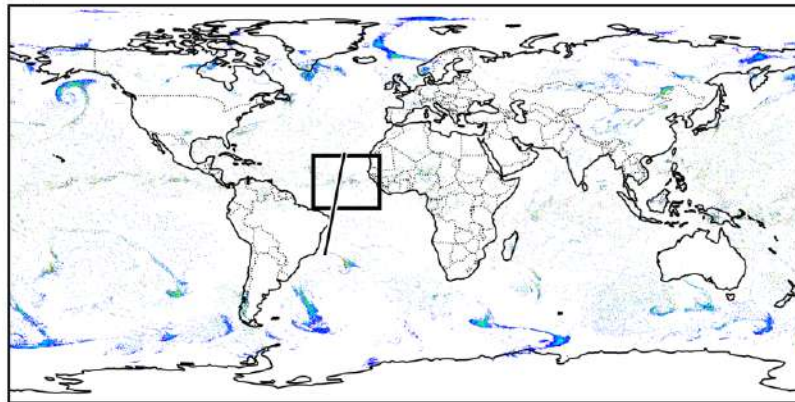
a) GSMP



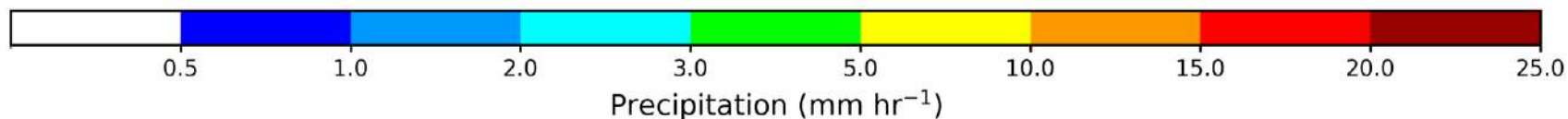
b) NICAM



c) ICON



Roh et al. (2026, to be submitted)

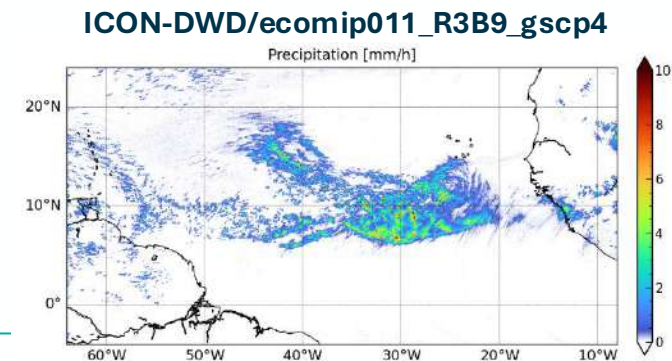
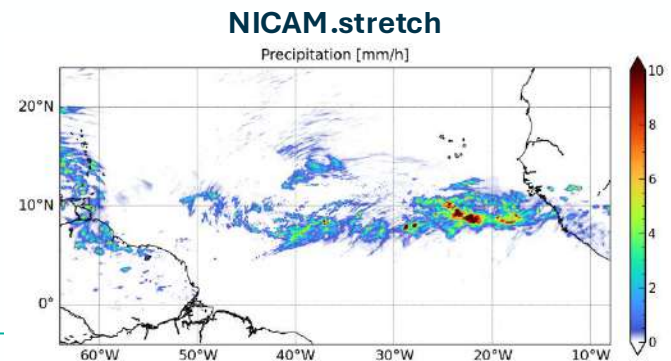
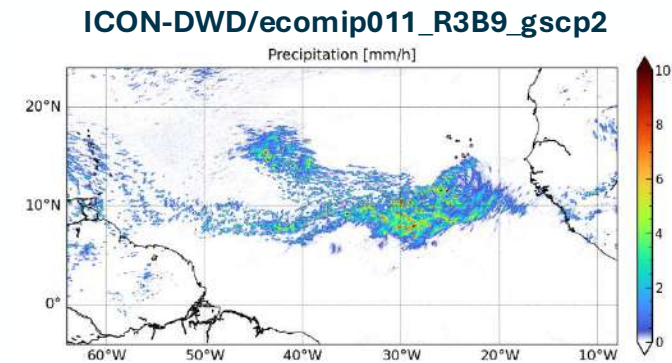
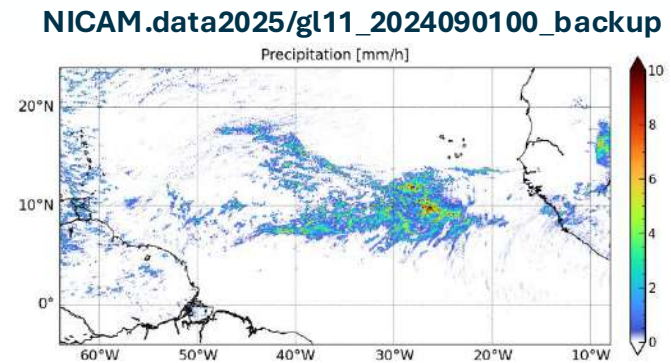
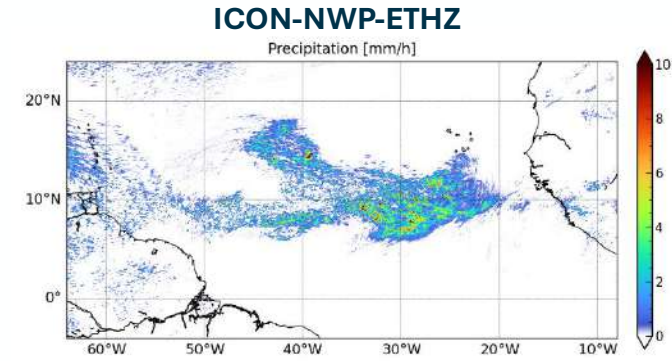
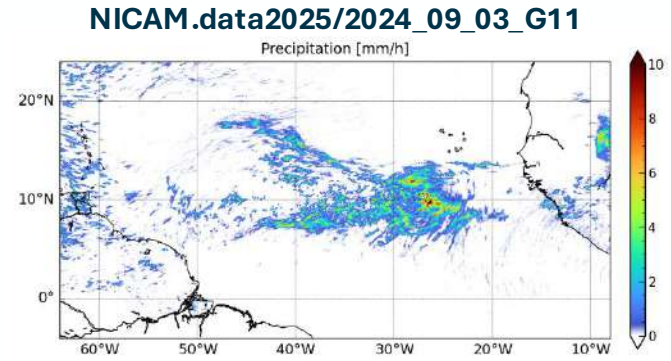
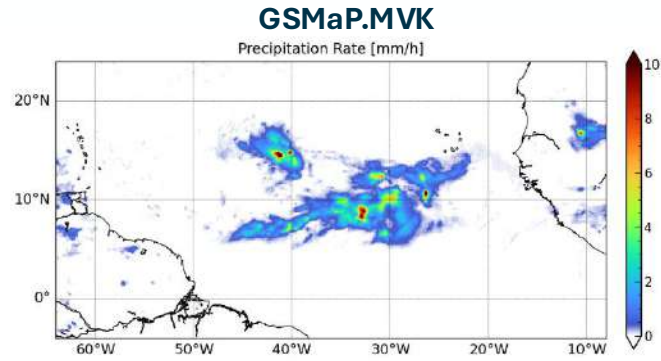


List of models



Model	subdir	ECOMIP domain (2D)	ECOMIP domain (3D)	EC-grid data	comments
nicam.data2025	2024_09_03_G11	○ (Precip, OLR, OSR)	○ (p,T,qv,qc,qi,q _r ,q _s ,q _g ,u,v,w)		
	gl11_2024090100_backup	○ (Precip, OLR, OSR)	○ (p,T,qv,qc,qi,q _r ,q _s ,q _g ,u,v,w)		
nicam.stretch	-	○ (Precip, OLR, OSR)	○ (p,T,qv,qc,qi,q _r ,q _s ,q _g ,u,v,w+α)	○	
ICON-NWP-ETHZ	-	○ (Precip, OLR, OSR)	○ (p,T,qv,qc,qi,q _r ,q _s ,q _g ,u,v,w)		
ICON-DWD	ecomip011_R3B9_gscp2	○ (Precip, OLR, OSR)	○ (p,T,qv,qc,qi,q _r ,q _s ,q _g ,u,v,w+α)	○	(*)
	ecomip011_R3B9_gscp4	○ (Precip, OLR, OSR)	○ (p,T,qv,qc,qi,q _r ,q _s ,q _g ,u,v,w+α)	○	(*)
ICON-MPI	-	-	-	-	Checking the file contents
IFS	4km	○ (Precip, OLR, OSR)	○ (p,T,qv,qc,qi,q _r ,q _s ,q _{conv} ,u,v,w+α)		
	9km	○ (Precip, OLR, OSR)	○ (p,T,qv,qc,qi,q _r ,q _s ,q _{conv} ,u,v,w+α)		
asuca	-	○ (Precip, OLR, OSR)	○ (p,T,qv,qc,qi,q _r ,q _s ,q _g ,u,v,ω)		
GRIST	-	○ (Precip, OLR, OSR)	○ (p,T,qv,qc,qi,q _r ,q _s ,q _g ,u,v,ω+α)	○	(*)
UKMO-GA9cpCASIM	-	○ (Precip, OLR, OSR)	○ (p,T,qv,q _{ice} ,q _{liquid} ,u,v,w+α)		
UKMO_RAL3	UKMO_RAL3_FIXED	-	-	-	Checking the file contents
	UKMO_RAL3_SOLINSOL	-	-	-	Checking the file contents
AROME	-	△ (Precip, OLR, OSR)	○ (p,T,RH, qc,qi,q _r ,q _s ,q _g ,u,v,ω)		Preparing for “TOA incident solar radiation” ; narrow domain; (*)
ARP-GEM2	-	○ (Precip, OLR, OSR)	× (T,qv,qc,qi,q _r ,q _s ,u,v,w)		No pressure or geometric height is provided; only the vertical-coordinate formula terms (ap, b) are stored, and it is unclear how to derive the vertical coordinate from them.

Daily mean precipitation [mm/h]

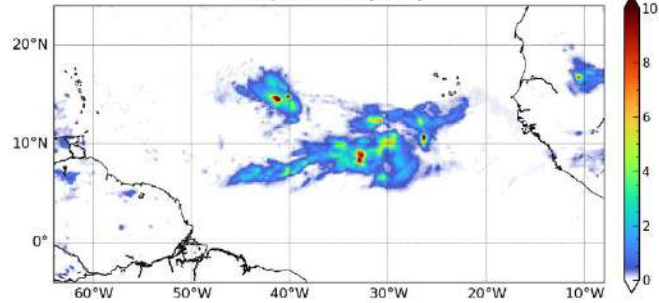


Daily mean precipitation [mm/h]



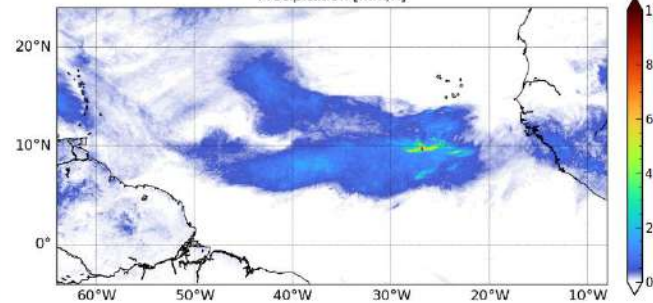
GSMaP.MVK

Precipitation Rate [mm/h]



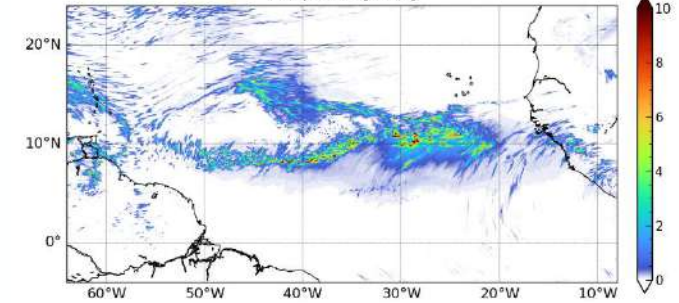
IFS/4km

Precipitation [mm/h]



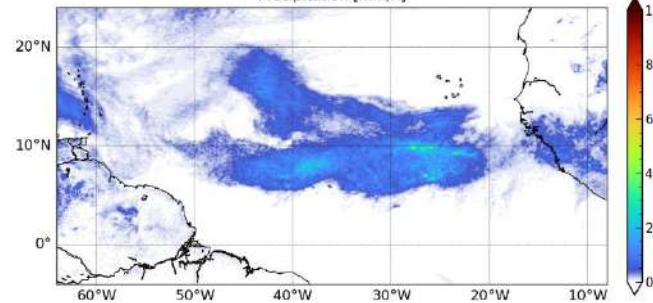
UKMO-GA9cpCASIM

Precipitation [mm/h]



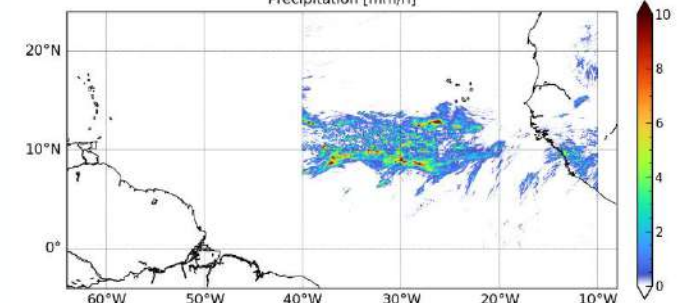
IFS/9km

Precipitation [mm/h]



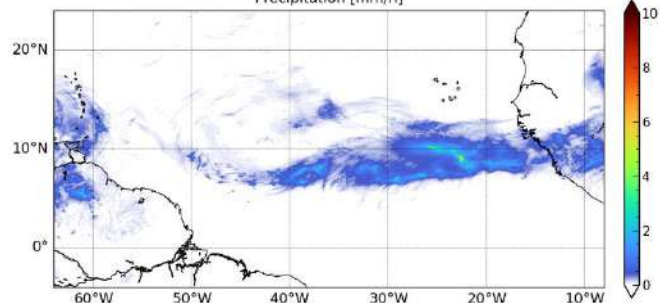
AROME

Precipitation [mm/h]



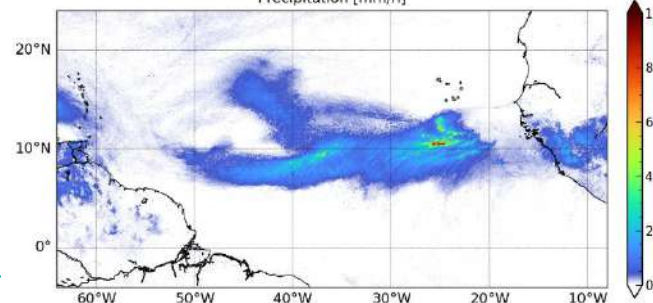
asuca

Precipitation [mm/h]



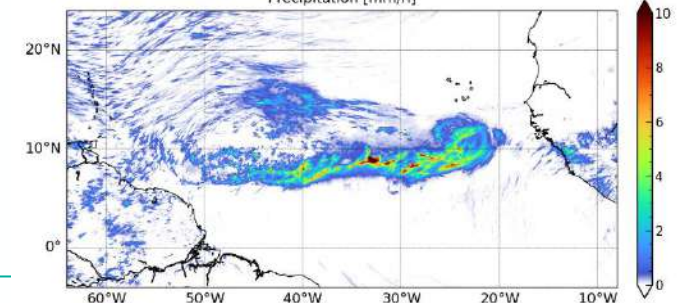
GRIST

Precipitation [mm/h]



ARP-GEM2

Precipitation [mm/h]

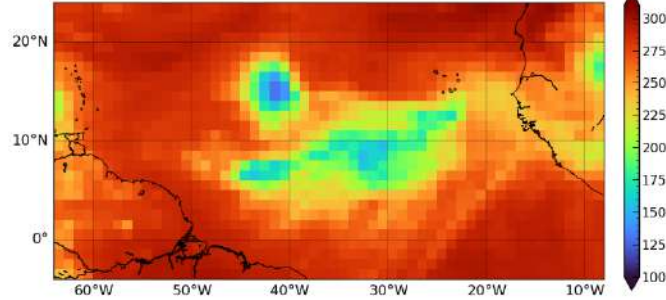


Daily mean OLR [W/m²]



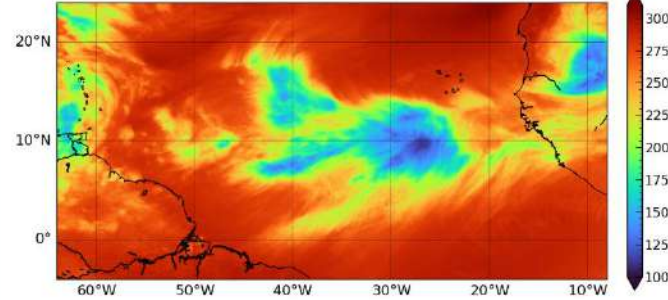
CERES/CER_SYN1deg-Day

Observed All-Sky TOA LW Flux [W/m²]



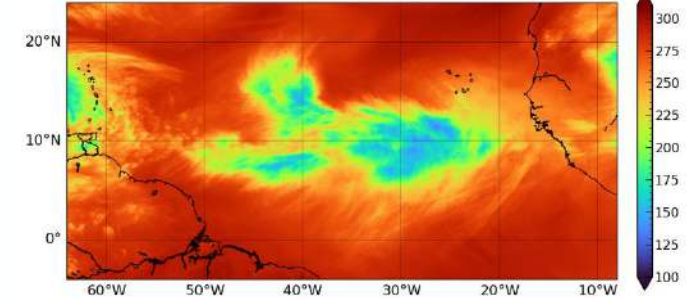
NICAM.data2025/2024_09_03_G11

upward LW at TOA [W/m²]



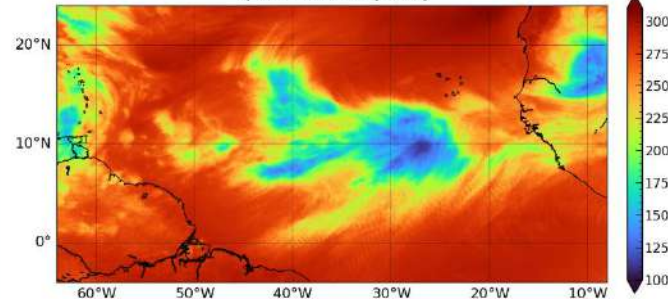
ICON-NWP-ETHZ

longwave upward flux [W/m²]



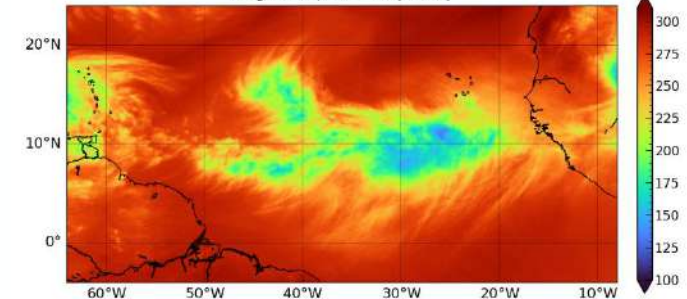
NICAM.data2025/gl11_2024090100_backup

upward LW at TOA [W/m²]



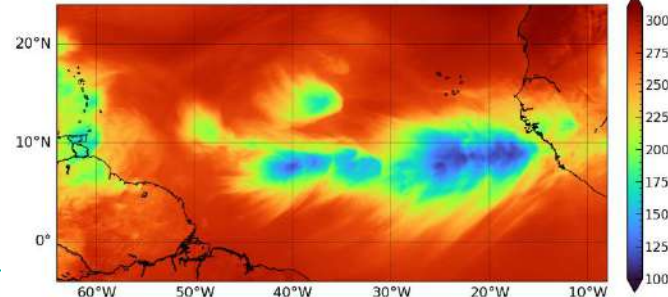
ICON-DWD/ecomip011_R3B9_gscp2

longwave upward flux [W/m²]



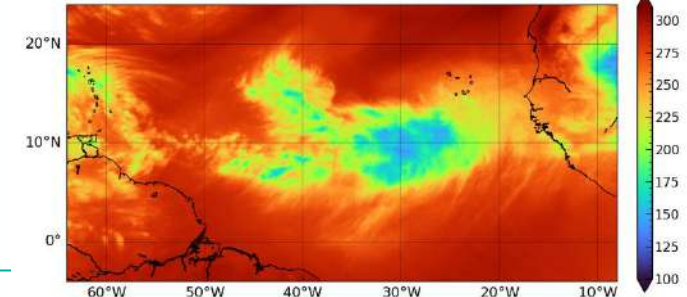
NICAM.stretch

upward LW at TOA [W/m²]



ICON-DWD/ecomip011_R3B9_gscp4

longwave upward flux [W/m²]

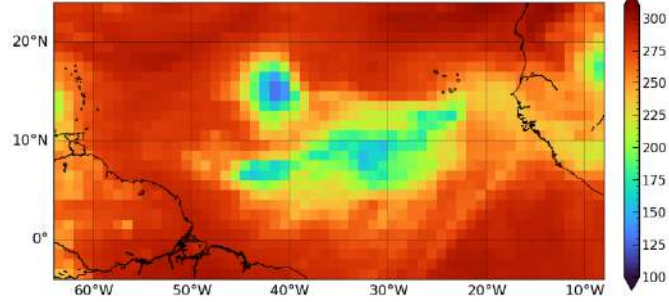


Daily mean OLR [W/m²]



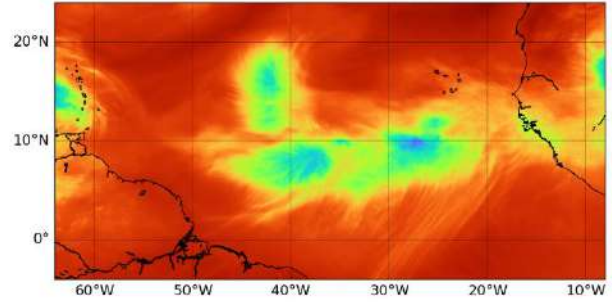
CERES/CER_SYN1deg-Day

Observed All-Sky TOA LW Flux [W/m²]



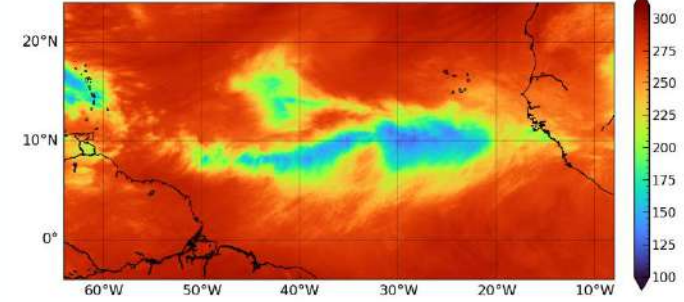
IFS/4km

TOA upwelling longwave flux [W/m²]



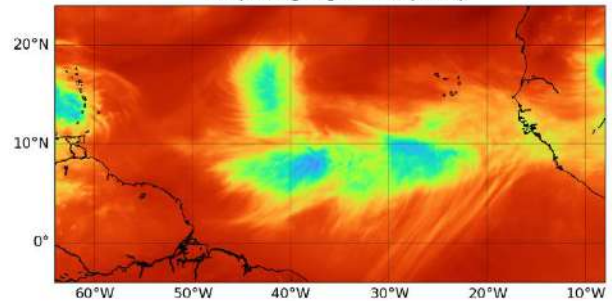
UKMO-GA9cpCASIM

OLR [W/m²]



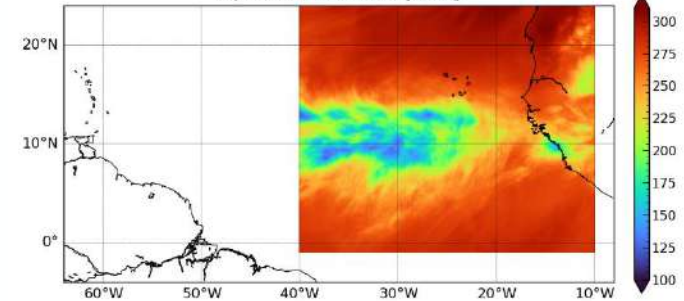
IFS/9km

TOA upwelling longwave flux [W/m²]



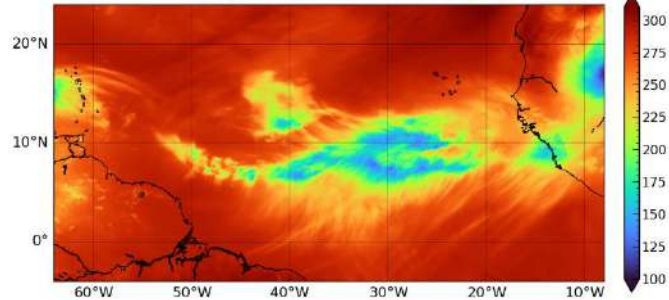
AROME

Top net thermal radiation [W/m²]



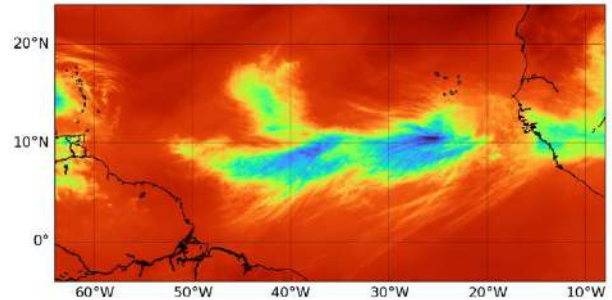
asuca

mean_top_net_long_wave_radiation_flux [W/m²]



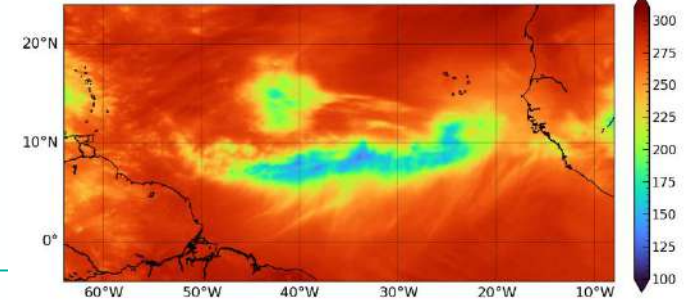
GRIST

OLR [W/m²]



ARP-GEM2

Upward longwave radiation at TOA [W/m²]

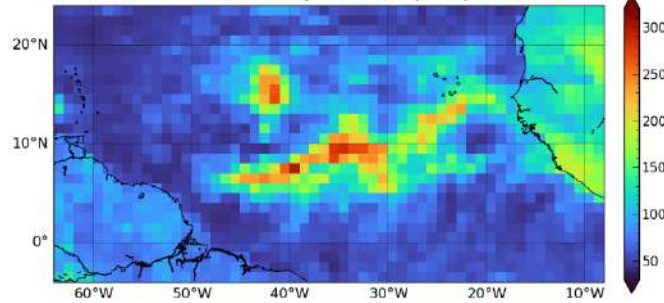


Daily mean OSR [W/m²]



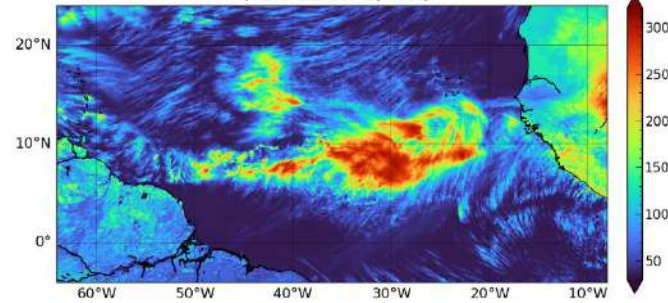
CERES/CER_SYN1deg-Day

Observed All-Sky TOA SW Flux [W/m²]



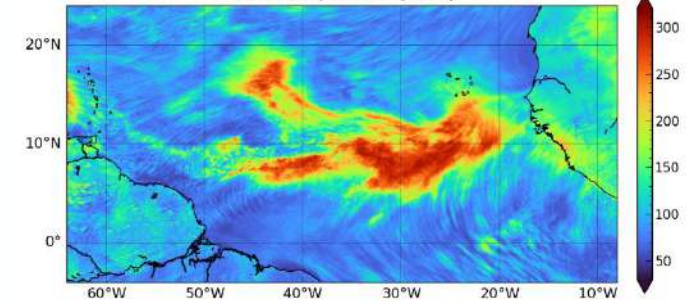
NICAM.data2025/2024_09_03_G11

upward SW at TOA [W/m²]



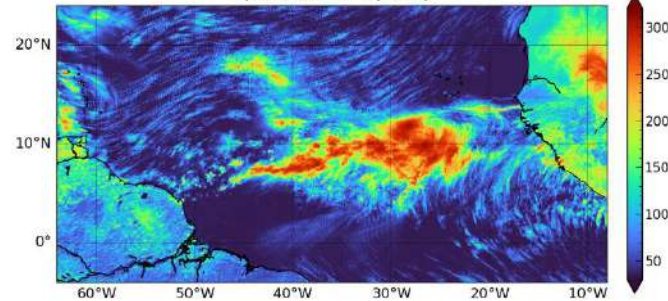
ICON-NWP-ETHZ

shortwave upward flux [W/m²]



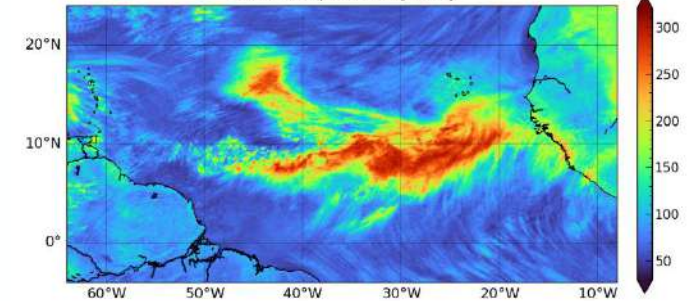
NICAM.data2025/gl11_2024090100_backup

upward SW at TOA [W/m²]



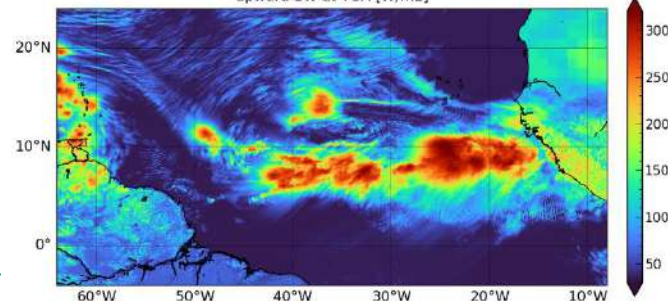
ICON-DWD/ecomip011_R3B9_gscp2

shortwave upward flux [W/m²]



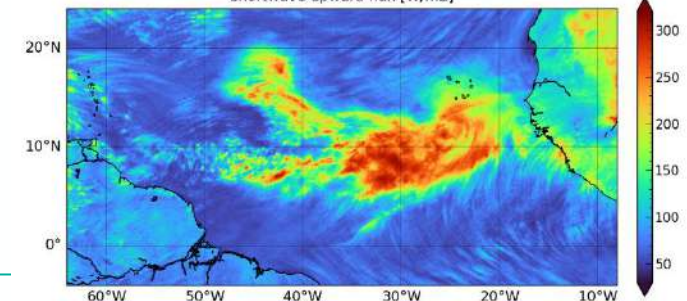
NICAM.stretch

upward SW at TOA [W/m²]



ICON-DWD/ecomip011_R3B9_gscp4

shortwave upward flux [W/m²]

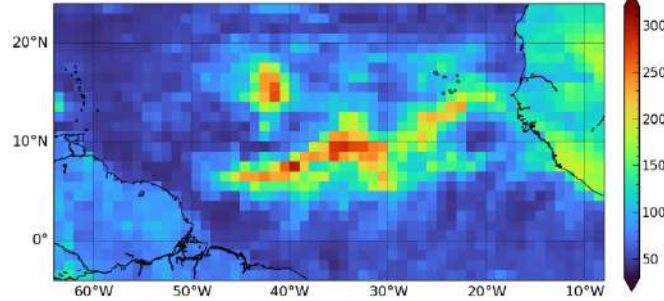


Daily mean OSR [W/m²]



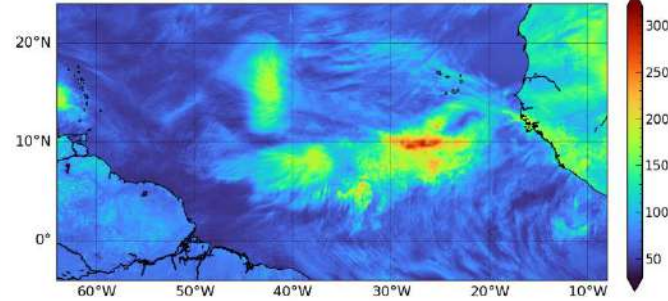
CERES/CER_SYN1deg-Day

Observed All-Sky TOA SW Flux [W/m²]



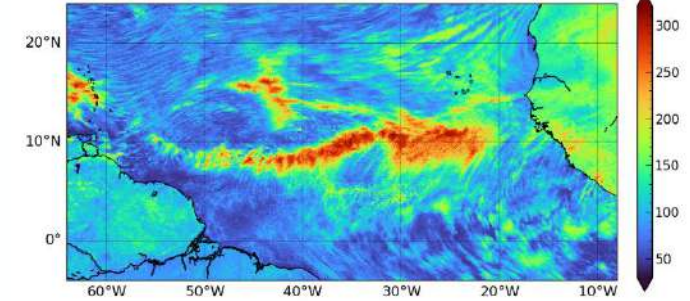
IFS/4km

TOA upwelling shortwave flux [W/m²]



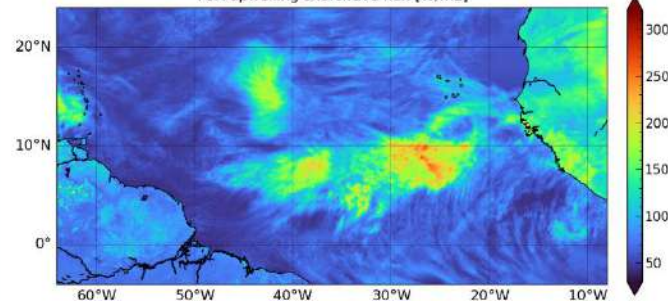
UKMO-GA9cpCASIM

Outgoing Shortwave Radiation [W/m²]



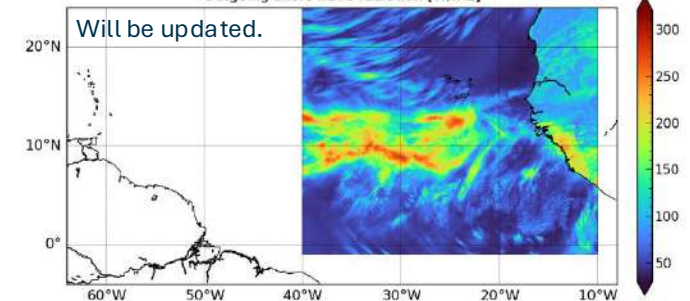
IFS/9km

TOA upwelling shortwave flux [W/m²]



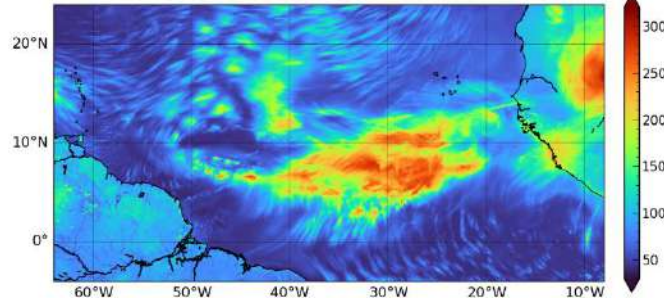
AROME

Outgoing short wave radiation [W/m²]



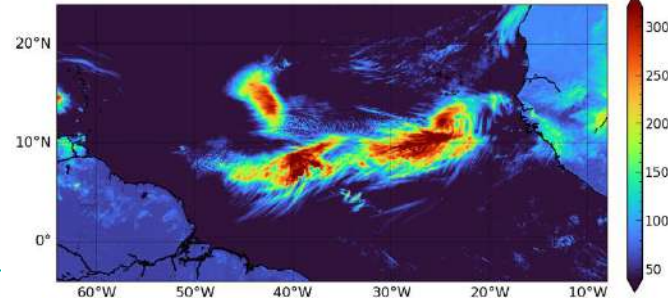
asuca

mean_top_net_long_wave_radiation_flux [W/m²]



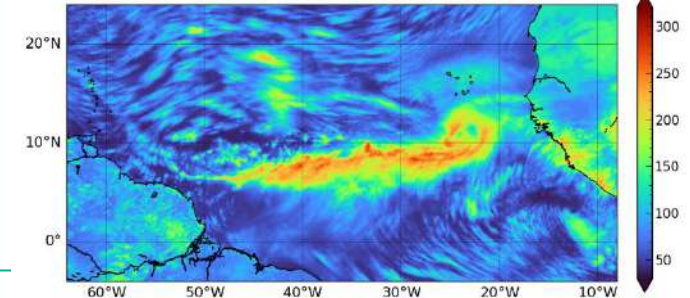
GRIST

OSR [W/m²]



ARP-GEM2

Upward shortwave radiation at TOA [W/m²]



EarthCARE overpass



Cross sections are plotted along 4° S– 15° N.

For each horizontal grid point of EC JSG, the nearest model grid point is selected.

Ice water content (IWC) is calculated from q_i , q_s , q_g , and air density.

Liquid water content (LWC) is calculated from q_c , q_r , and air density.

The units of the variables and related information were determined based on the attributes provided in the netCDF files.

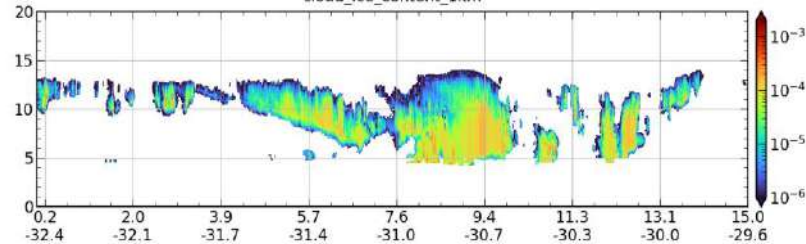
When vertical cross-section data are already available, those datasets are used (ICON-DWD, GRIST, NICAM stretch, IFS).

Contoured Frequency by Altitude Diagrams (CFADs) are also shown following the cross sections.

IWC [kg/m³] (EC overpass 01520E)

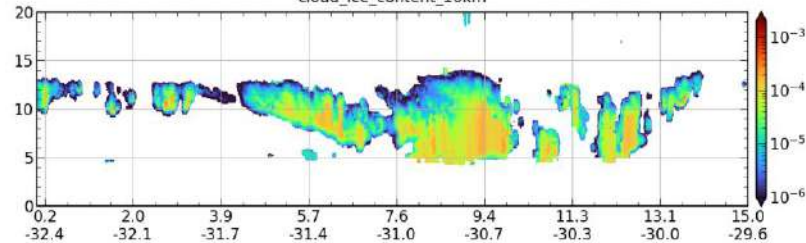
AC_CLP 1km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_ice_content_1km



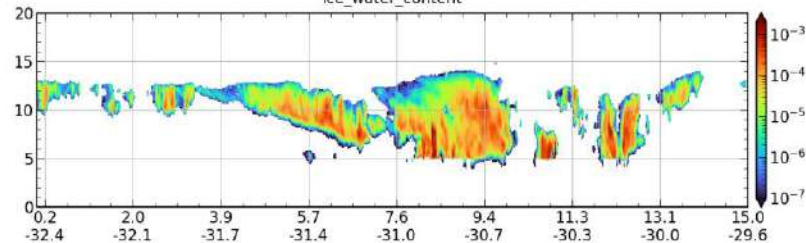
AC_CLP 10km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_ice_content_10km



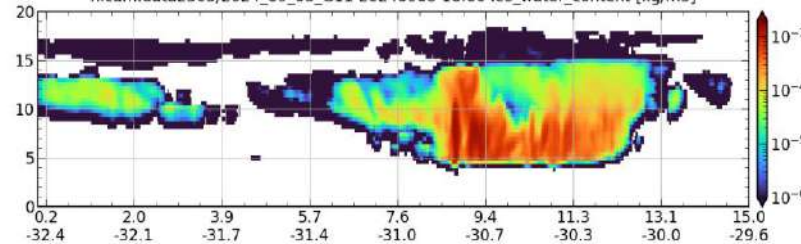
ACM_CAP

ECA_E_ACM_CAP_2BS_20240903T1605_20240903T1616_01520E_vBa.h5
ice_water_content



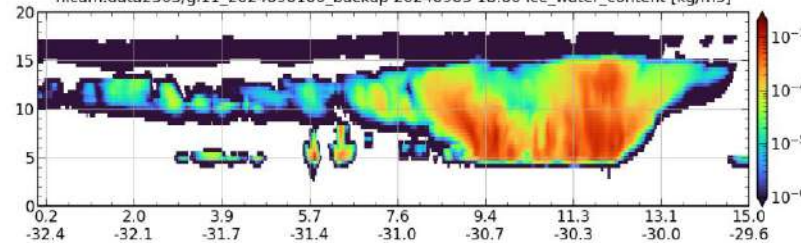
NICAM.data2025/2024_09_03_G11

nicam.data2505/2024_09_03_G11 20240903 16:00 ice_water_content [kg/m³]



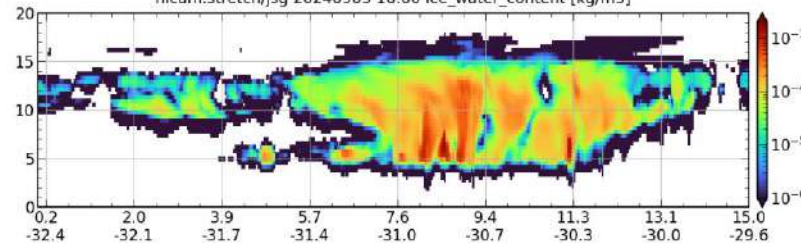
NICAM.data2025/gl11_2024090100_backup

nicam.data2505/gl11_2024090100_backup 20240903 18:00 ice_water_content [kg/m³]



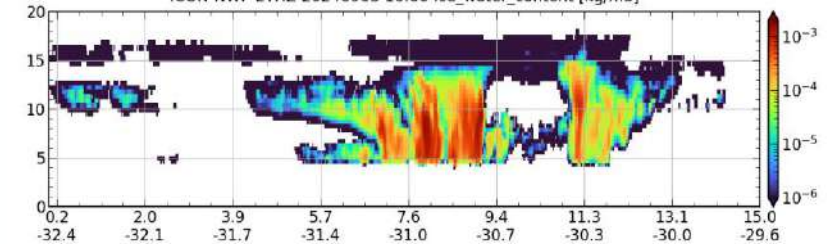
NICAM.stretch

nicam.stretch/jsg 20240903 16:00 ice_water_content [kg/m³]



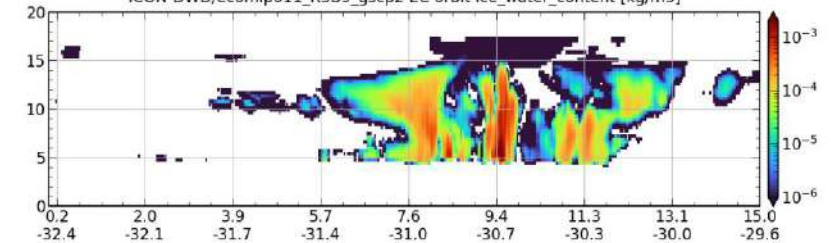
ICON-NWP-ETHZ

ICON-NWP-ETHZ 20240903 16:00 ice_water_content [kg/m³]



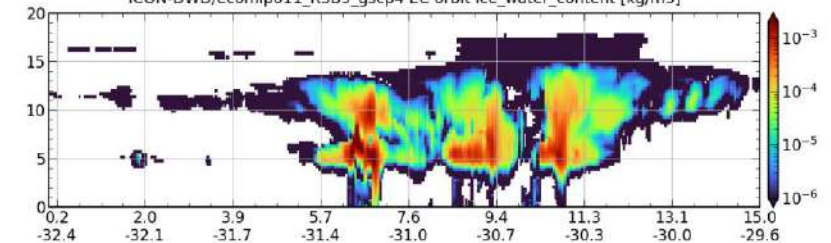
ICON-DWD/ecomip011_R3B9_gscp2

ICON-DWD/ecomip011_R3B9_gscp2 EC orbit ice_water_content [kg/m³]



ICON-DWD/ecomip011_R3B9_gscp4

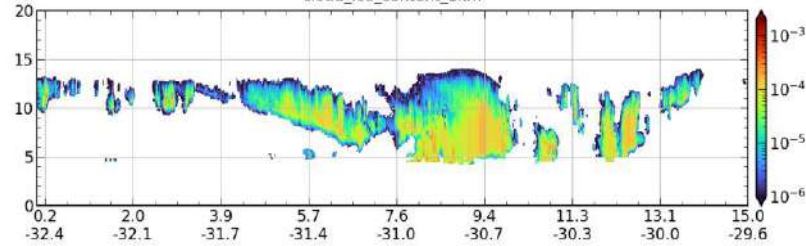
ICON-DWD/ecomip011_R3B9_gscp4 EC orbit ice_water_content [kg/m³]



IWC [kg/m³] (EC overpass 01520E)

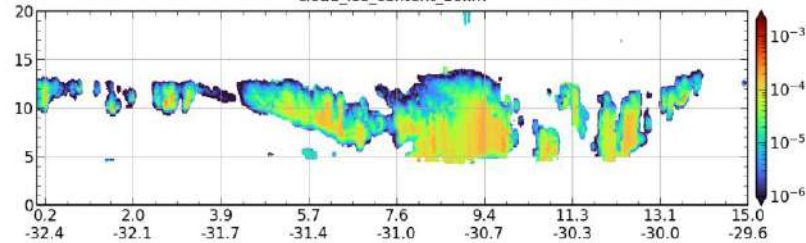
AC_CLP 1km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_ice_content_1km



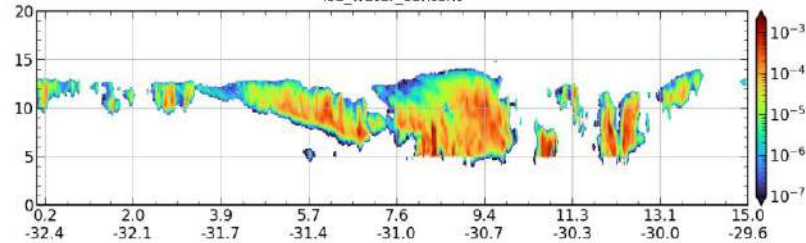
AC_CLP 10km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_ice_content_10km



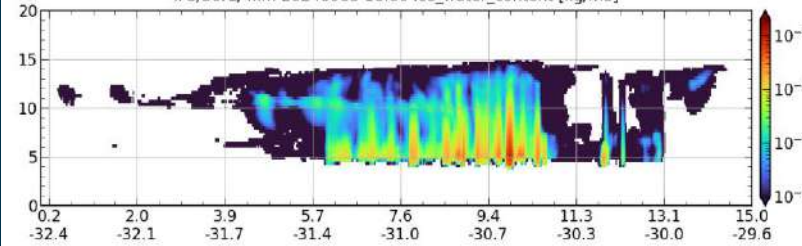
ACM_CAP

ECA_E_ACM_CAP_2BS_20240903T1605_20240903T1616_01520E_vBa.h5
ice_water_content



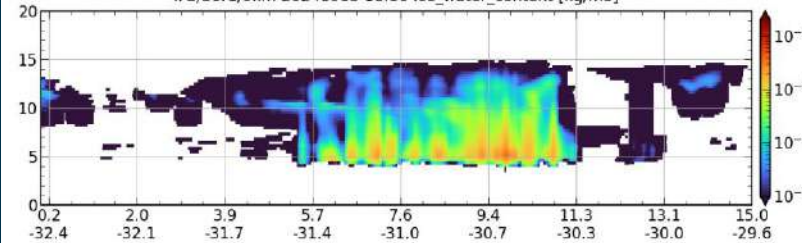
IFS/4km

IFS/50r1/4km 20240903 16:00 ice_water_content [kg/m³]



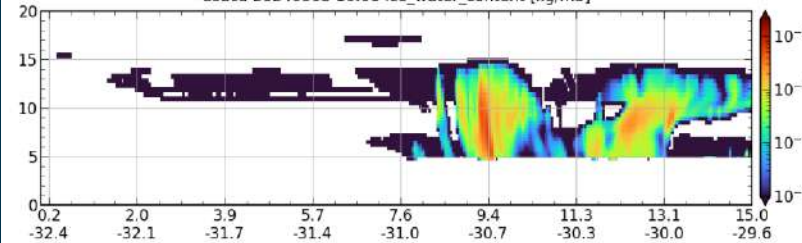
IFS/9km

IFS/50r1/9km 20240903 16:00 ice_water_content [kg/m³]



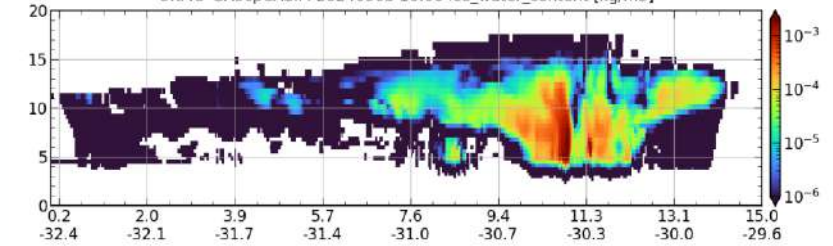
asuca

asuca 20240903 16:00 ice_water_content [kg/m³]



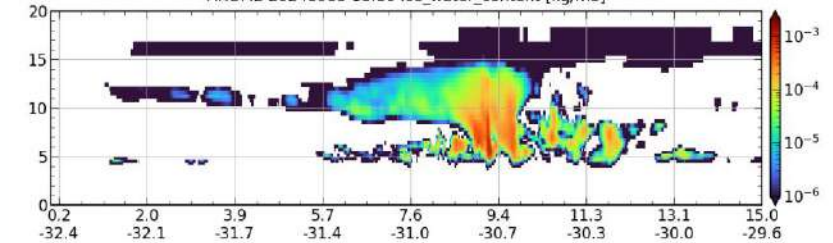
UKMO-GA9cpCASIM

UKMO-GA9cpCASIM 20240903 16:00 ice_water_content [kg/m³]



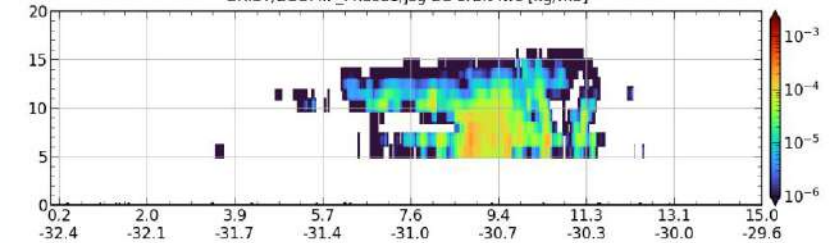
AROME

AROME 20240903 16:00 ice_water_content [kg/m³]



GRIST

GRIST/ECOMIP_Phase1/jsg EC orbit iwc [kg/m³]



IWC [kg/m³] (CFADs 01520E)

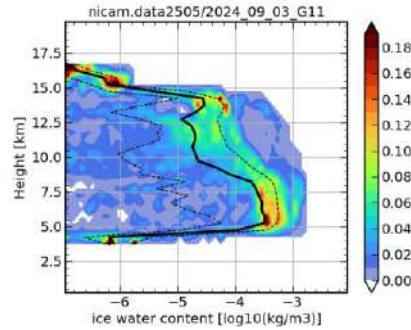
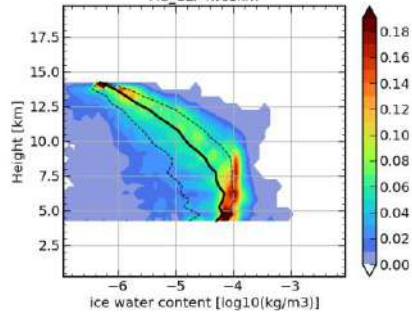


NICAM.data2505/

2024_09_03_G11

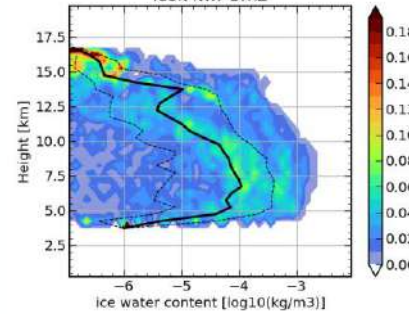
AC_CLP 1km

AC_CLP iwc1km



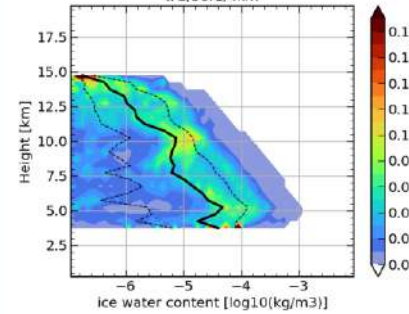
ICON-NWP-ETHZ

ICON-NWP-ETHZ



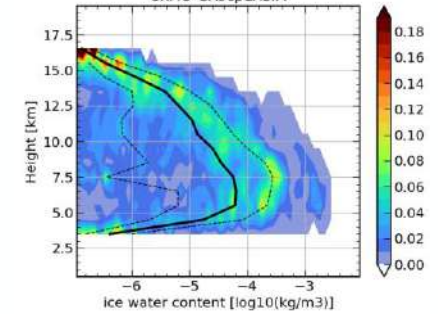
IFS/4km

IFS/50r1/4km



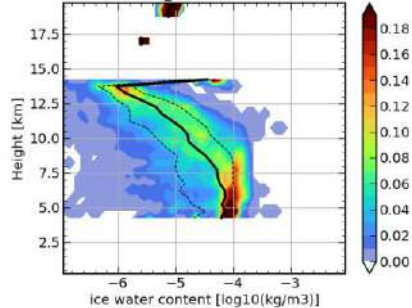
UKMO-GA9cpCASIM

UKMO-GA9cpCASIM

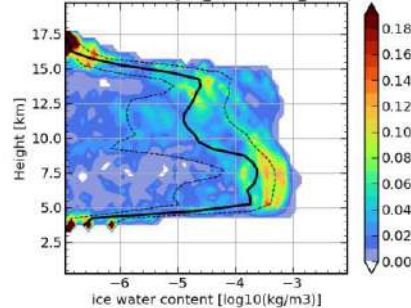


AC_CLP 10km

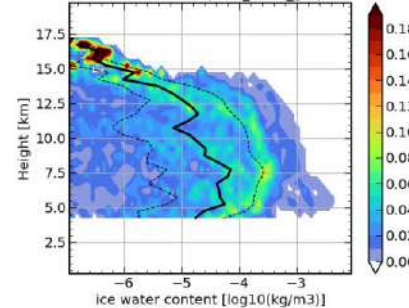
AC_CLP iwc10km



NICAM.data2505/
gl11 2024090100 backup

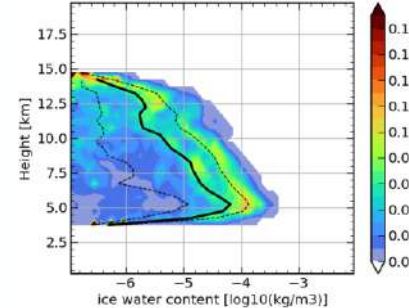


ICON-DWD/
ecomip011 R3B9 gscp2



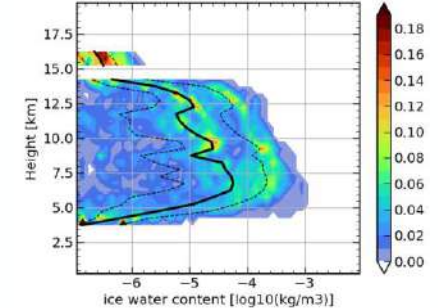
IFS/9km

IFS/50r1/9km



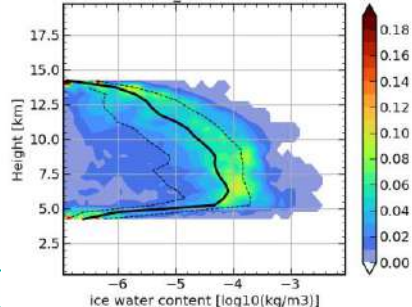
AROME

AROME



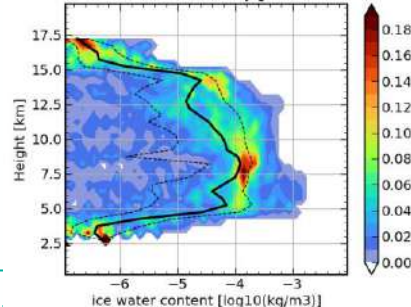
ACM_CAP

ACM_CAP iwc1km

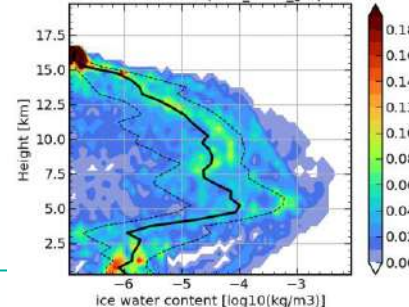


NICAM.stretch

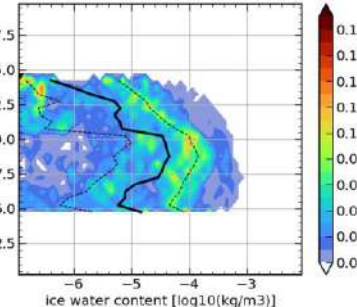
nicam.stretch/jsq



ICON-DWD/
ecomip011 R3B9 gscp4

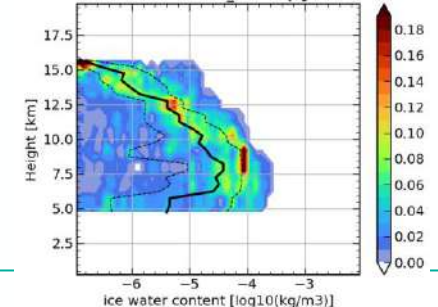


asuca



GRIST

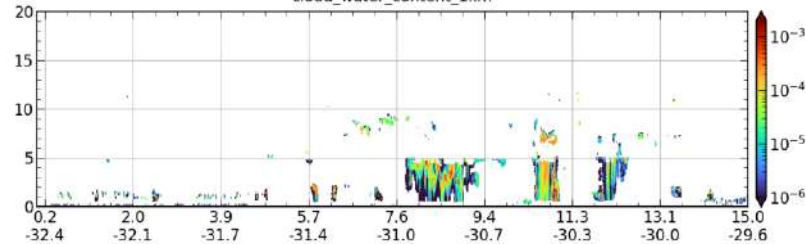
GRIST/ECOMP Phase1/jsq



LWC [kg/m³] (EC overpass 01520E)

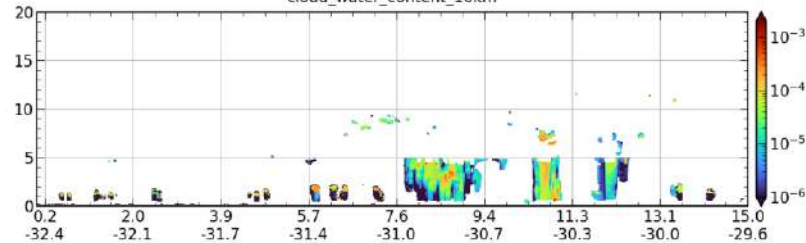
AC_CLP 1km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_water_content_1km



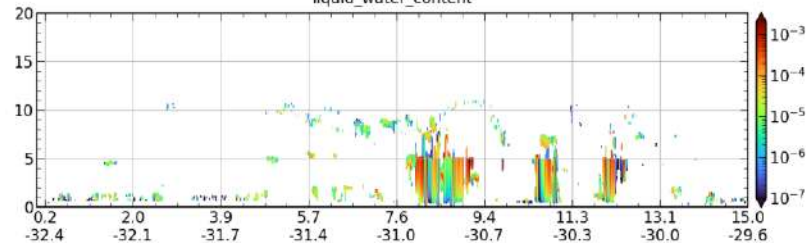
AC_CLP 10km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_water_content_10km



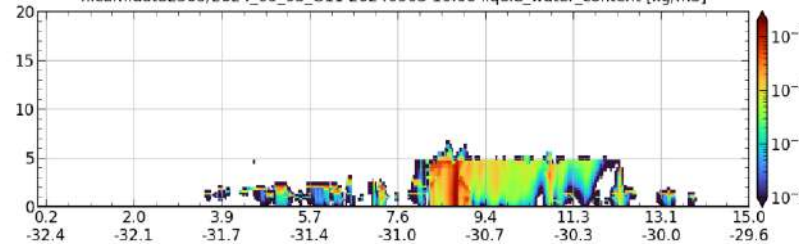
ACM_CAP

ECA_E_ACM_CAP_2BS_20240903T1605_20240903T1616_01520E_vBa.h5
liquid_water_content



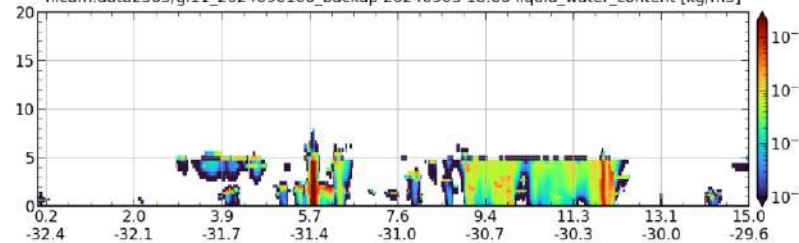
NICAM.data2025/2024_09_03_G11

nicam.data2505/2024_09_03_G11 20240903 16:00 liquid_water_content [kg/m³]



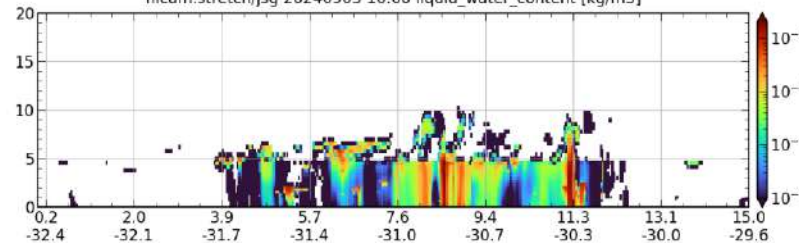
NICAM.data2025/gl11_2024090100_backup

nicam.data2505/gl11_2024090100_backup 20240903 18:00 liquid_water_content [kg/m³]



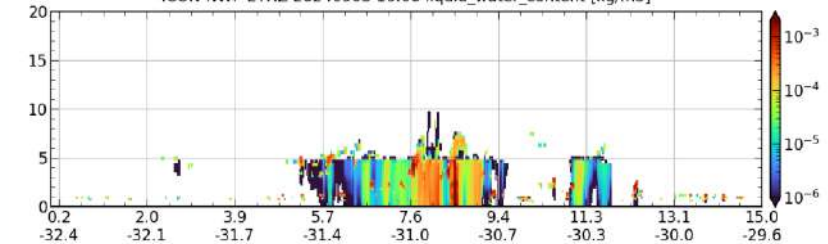
NICAM.stretch

nicam.stretch/jsg 20240903 16:00 liquid_water_content [kg/m³]



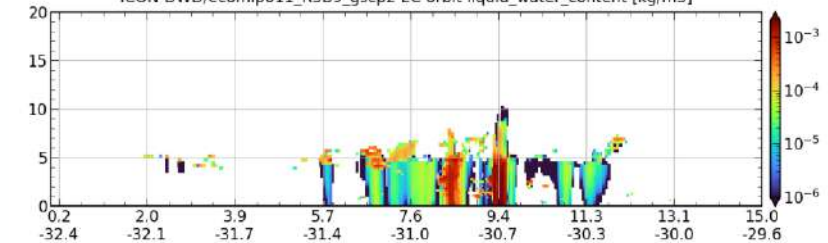
ICON-NWP-ETHZ

ICON-NWP-ETHZ 20240903 16:00 liquid_water_content [kg/m³]



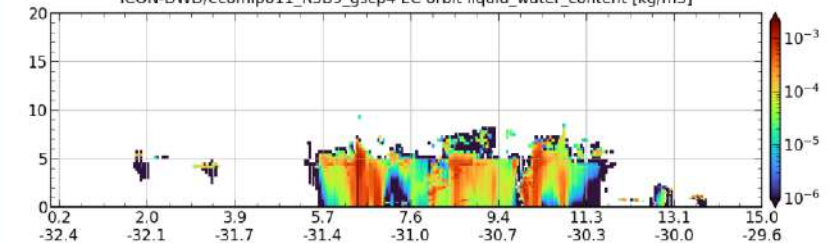
ICON-DWD/ecomp011_R3B9_gscp2

ICON-DWD/ecomp011_R3B9_gscp2 EC orbit liquid_water_content [kg/m³]



ICON-DWD/ecomp011_R3B9_gscp4

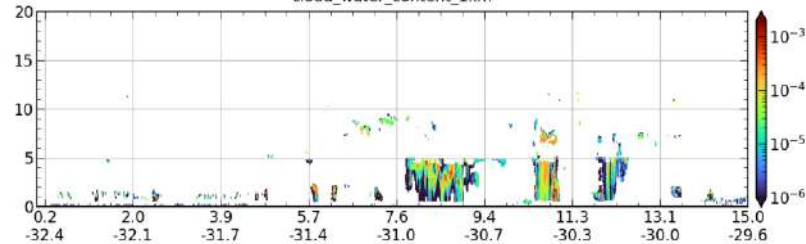
ICON-DWD/ecomp011_R3B9_gscp4 EC orbit liquid_water_content [kg/m³]



LWC [kg/m³] (EC overpass 01520E)

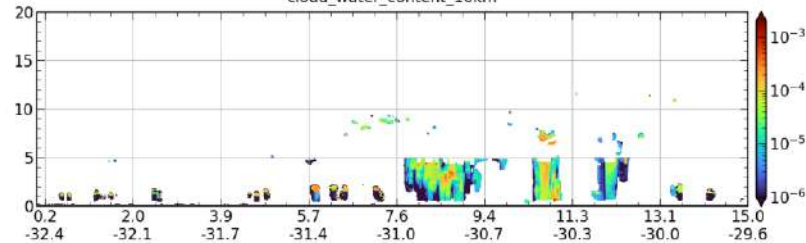
AC_CLP 1km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_water_content_1km



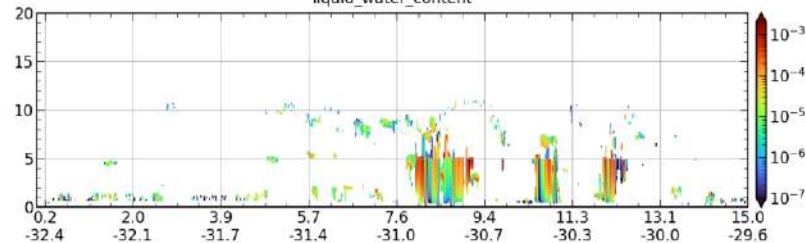
AC_CLP 10km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_water_content_10km



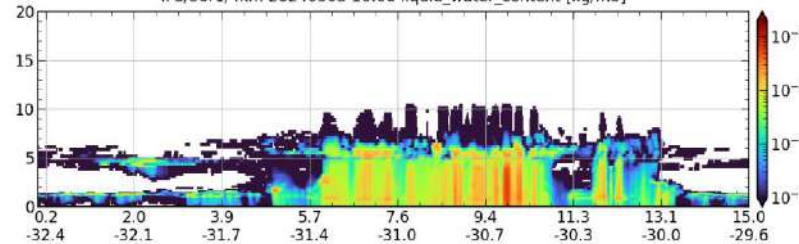
ACM_CAP

ECA_E_ACM_CAP_2BS_20240903T1605_20240903T1616_01520E_vBa.h5
liquid_water_content



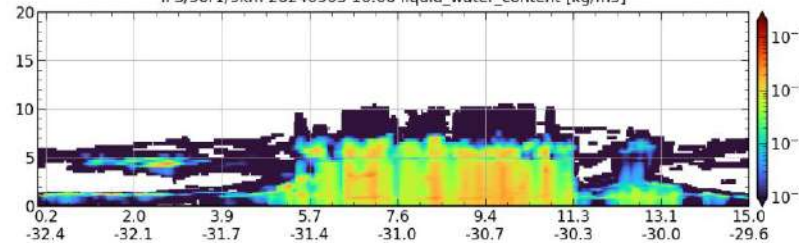
IFS/4km

IFS/50r1/4km 20240903 16:00 liquid_water_content [kg/m³]



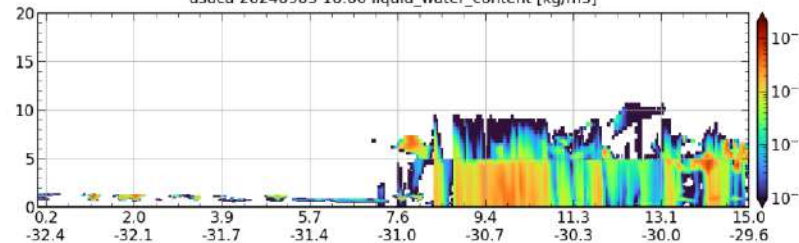
IFS/9km

IFS/50r1/9km 20240903 16:00 liquid_water_content [kg/m³]



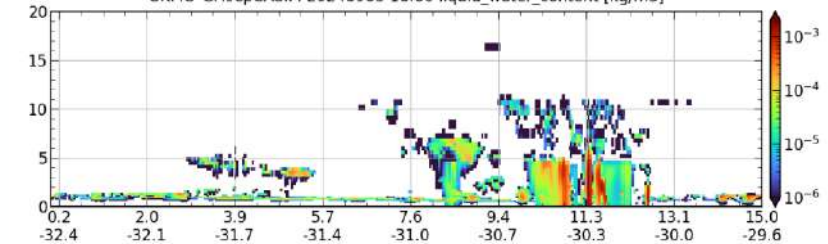
asuca

asuca 20240903 16:00 liquid_water_content [kg/m³]



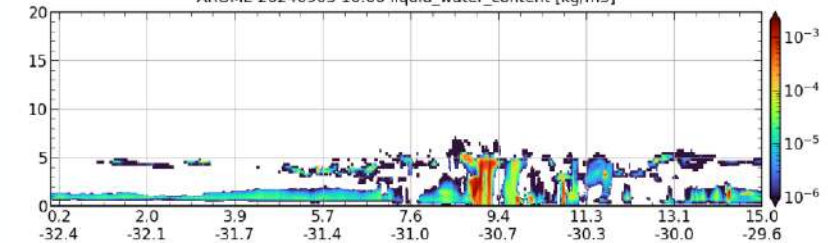
UKMO-GA9cpCASIM

UKMO-GA9cpCASIM 20240903 16:00 liquid_water_content [kg/m³]



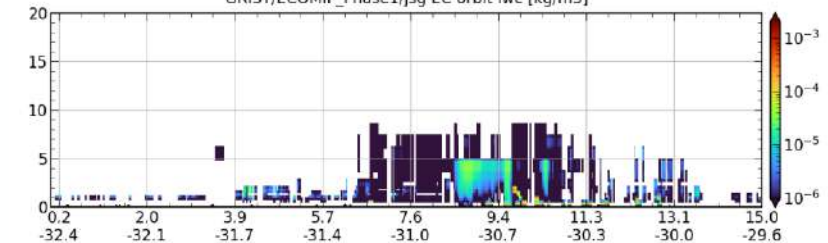
AROME

AROME 20240903 16:00 liquid_water_content [kg/m³]



GRIST

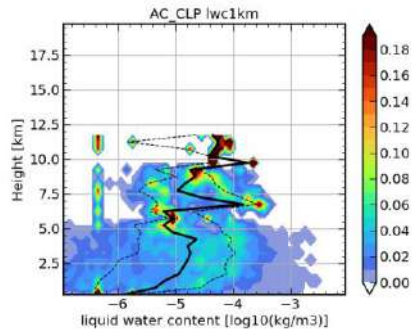
GRIST/ECOMIP_Phase1/jsg EC orbit lwc [kg/m³]



LWC [kg/m³] (CFADs 01520E)

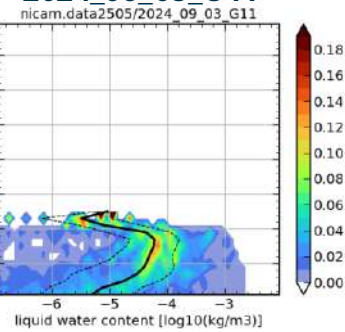


AC_CLP 1km

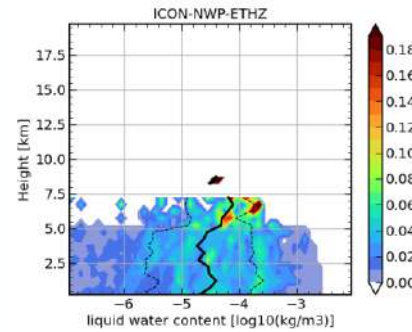


NICAM.data2025/

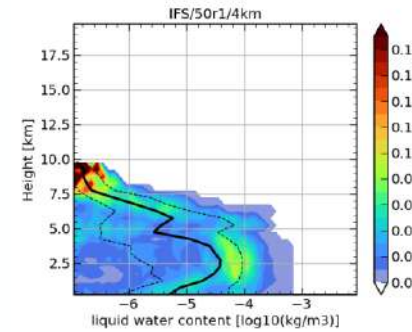
2024 09 03 G11



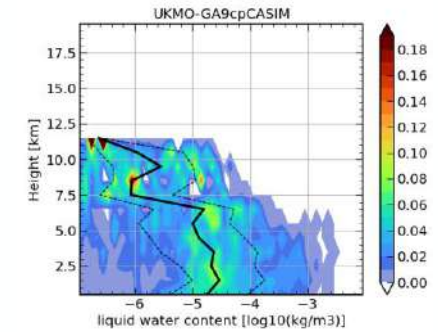
ICON-NWP-ETHZ



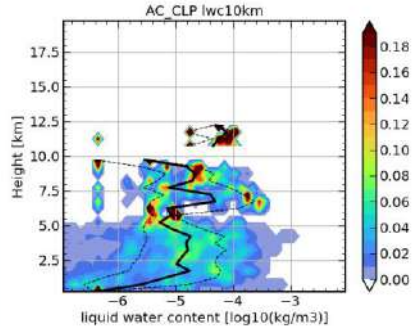
IFS/4km



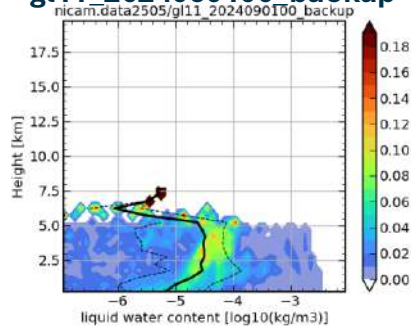
UKMO-GA9cpCASIM



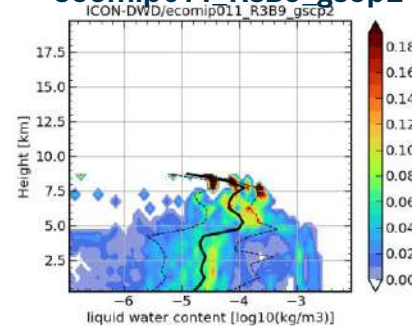
AC_CLP 10km



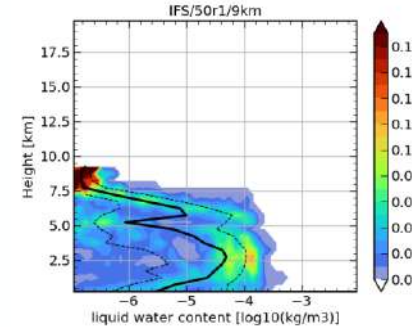
**NICAM.data2025/
gl11_2024090100 backup**



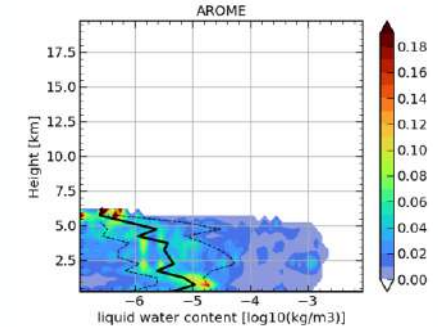
**ICON-DWD/
ecomip011 R3B9 gscp2**



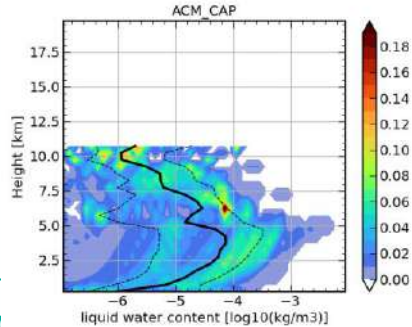
IFS/9km



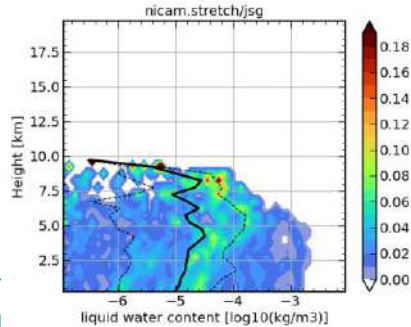
AROME



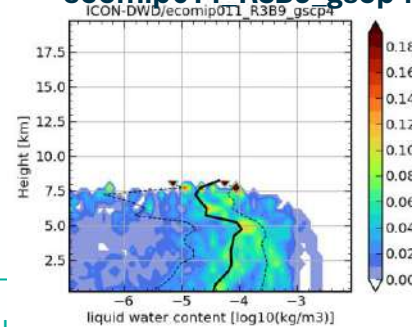
ACM_CAP



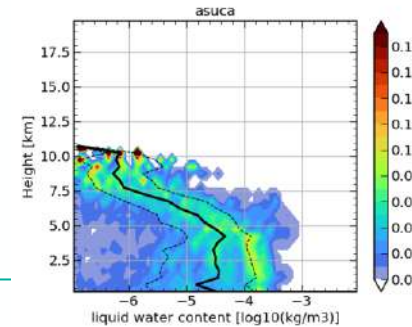
NICAM.stretch



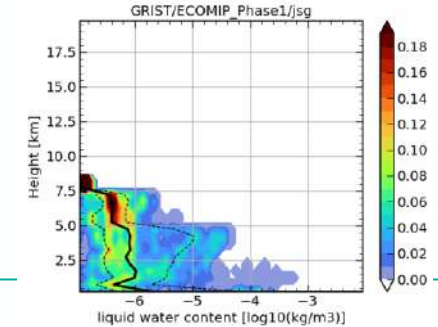
**ICON-DWD/
ecomip011 R3B9 gscp4**



asuca



GRIST

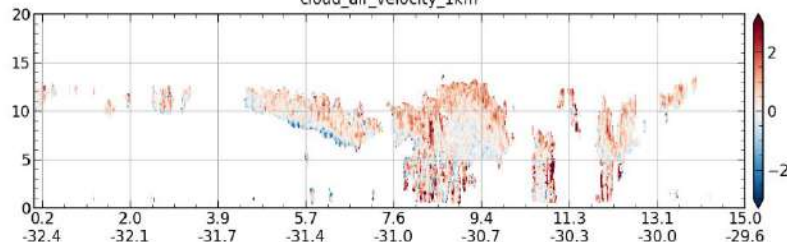


Vertical air motion [m/s] (EC overpass 01520E)



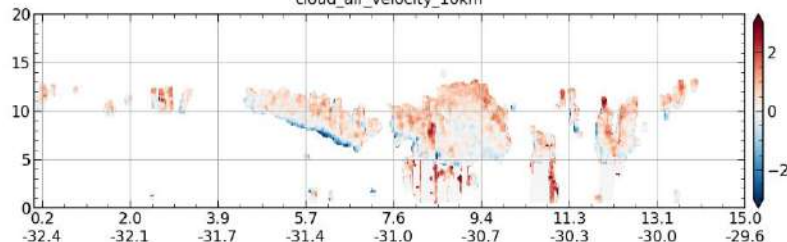
AC_CLP 1km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_air_velocity_1km



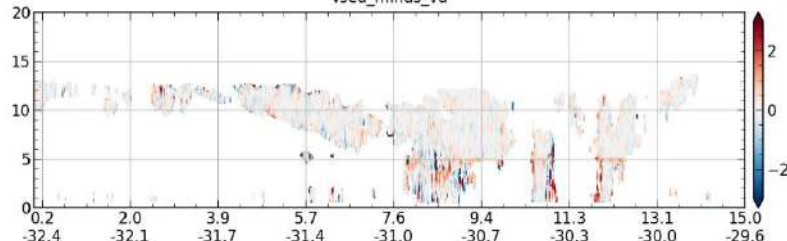
AC_CLP 10km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_air_velocity_10km



CPR_CD —(Vd—Vsed)

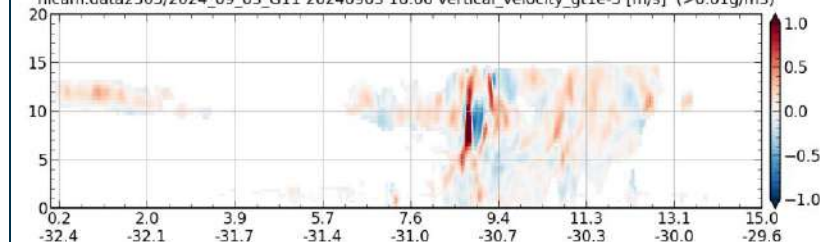
ECA_MXZZ_CPR_CD_2A_20240903T160523Z_20260407T184709Z_01520E.h5
vsed_minus_vd



Note that CPR-CD does not explicitly
provide vertical air motion.

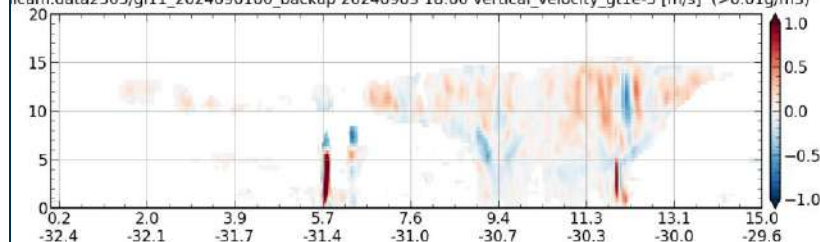
NICAM.data2025/2024_09_03_G11

nicam.data2505/2024_09_03_G11 20240903 16:00 vertical_velocity_gt1e-5 [m/s] (>0.01g/m3)



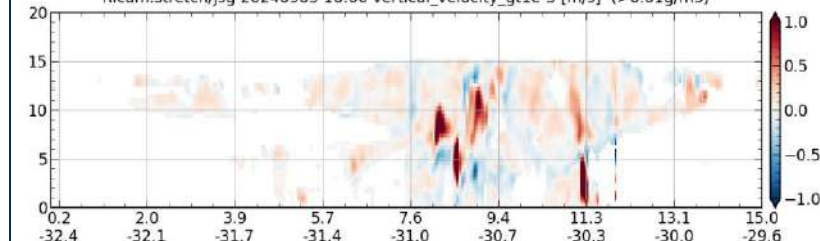
NICAM.data2025/gl11_2024090100_backup

nicam.data2505/gl11_2024090100_backup 20240903 18:00 vertical_velocity_gt1e-5 [m/s] (>0.01g/m3)



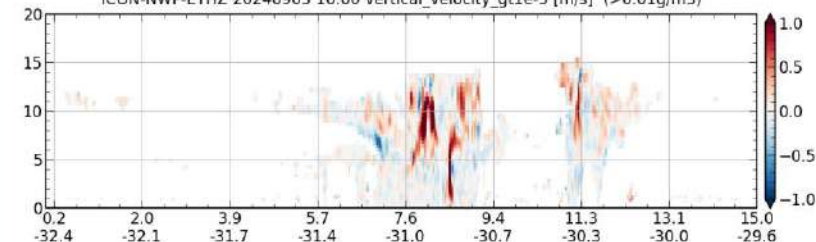
NICAM.stretch

nicam.stretch/jsj 20240903 16:00 vertical_velocity_gt1e-5 [m/s] (>0.01g/m3)



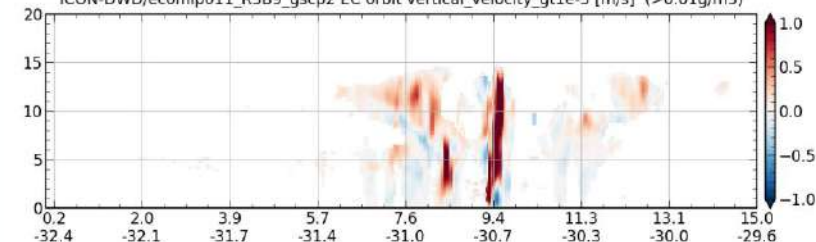
ICON-NWP-ETHZ

ICON-NWP-ETHZ 20240903 16:00 vertical_velocity_gt1e-5 [m/s] (>0.01g/m3)



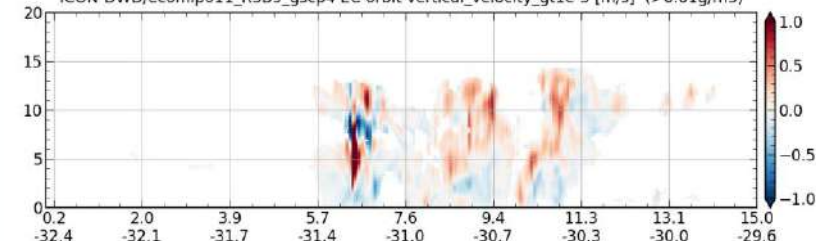
ICON-DWD/ecomip011_R3B9_gscp2

ICON-DWD/ecomip011_R3B9_gscp2 EC orbit vertical_velocity_gt1e-5 [m/s] (>0.01g/m3)



ICON-DWD/ecomip011_R3B9_gscp4

ICON-DWD/ecomip011_R3B9_gscp4 EC orbit vertical_velocity_gt1e-5 [m/s] (>0.01g/m3)



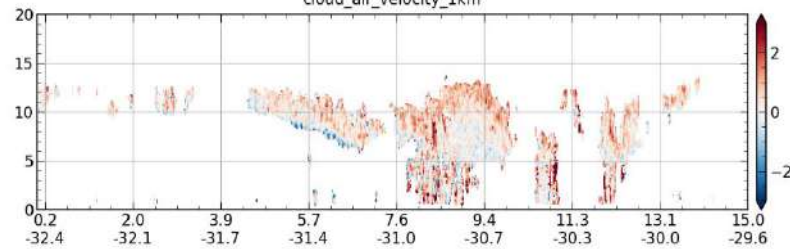
Only pixels with IWC+LWC>0.01g/m3 are shown

Vertical air motion [m/s] (EC overpass 01520E)



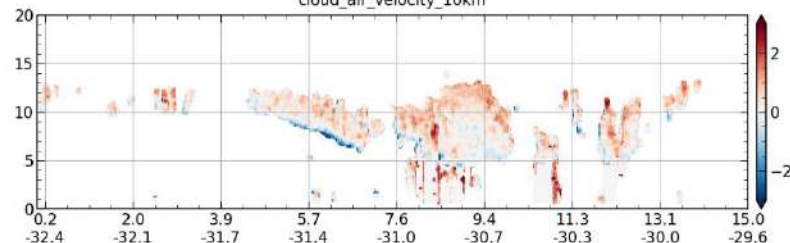
AC_CLP 1km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_air_velocity_1km



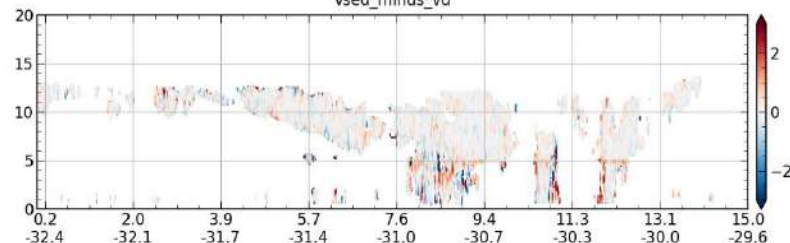
AC_CLP 10km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_air_velocity_10km



CPR_CD —(Vd—Vsed)

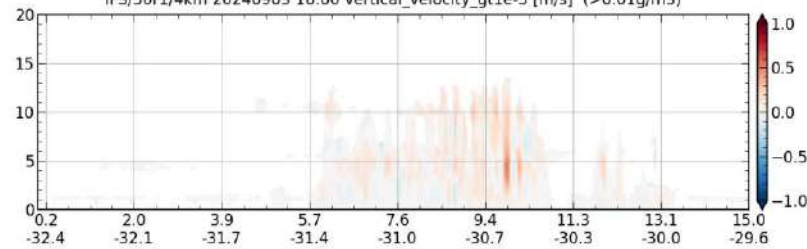
ECA_MXZZ_CPR_CD_2A_20240903T160523Z_20260407T184709Z_01520E.h5
vsed_minus_vd



Note that CPR-CD does not explicitly
provide vertical air motion.

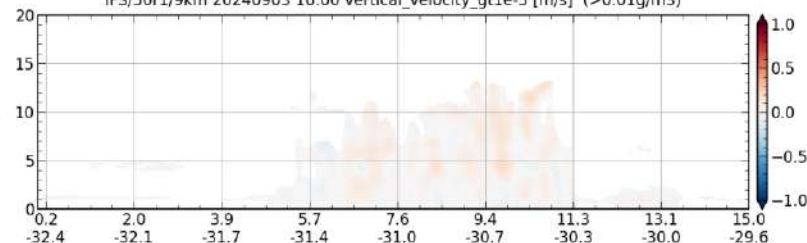
IFS/4km

IFS/50r1/4km 20240903 16:00 vertical_velocity_gt1e-5 [m/s] (>0.01g/m3)



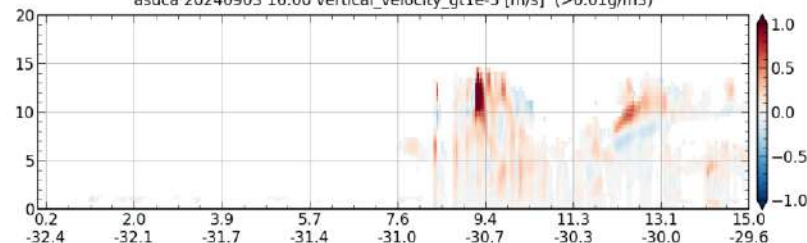
IFS/9km

IFS/50r1/9km 20240903 16:00 vertical_velocity_gt1e-5 [m/s] (>0.01g/m3)



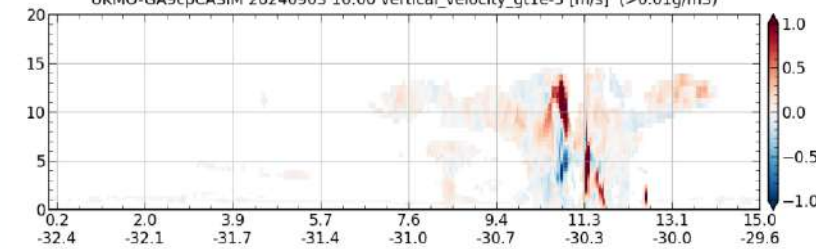
asuca

asuca 20240903 16:00 vertical_velocity_gt1e-5 [m/s] (>0.01g/m3)



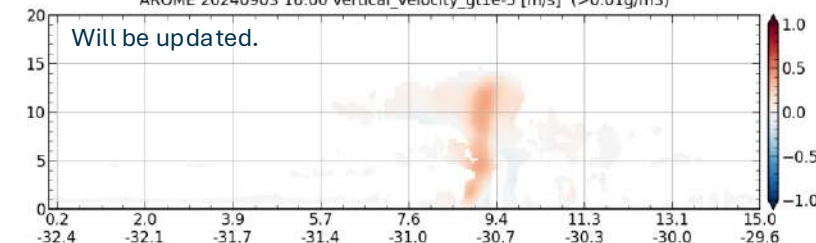
UKMO-GA9cpCASIM

UKMO-GA9cpCASIM 20240903 16:00 vertical_velocity_gt1e-5 [m/s] (>0.01g/m3)



AROME

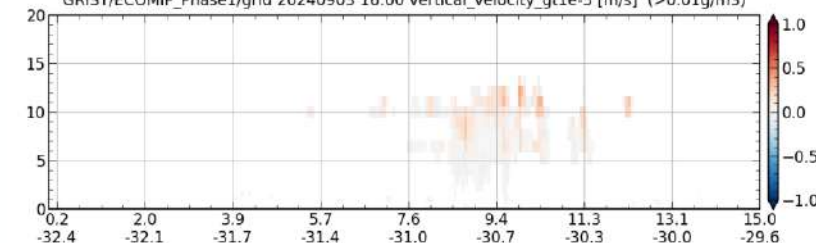
AROME 20240903 16:00 vertical_velocity_gt1e-5 [m/s] (>0.01g/m3)



Will be updated.

GRIST

GRIST/ECOMIP_Phase1/grid 20240903 16:00 vertical_velocity_gt1e-5 [m/s] (>0.01g/m3)

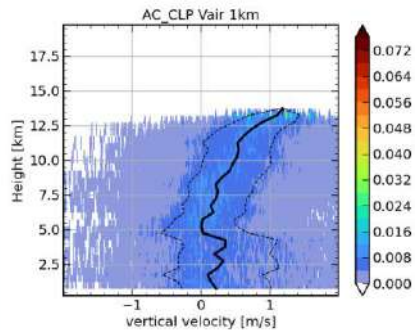


Only pixels with IWC+LWC>0.01g/m3 are shown

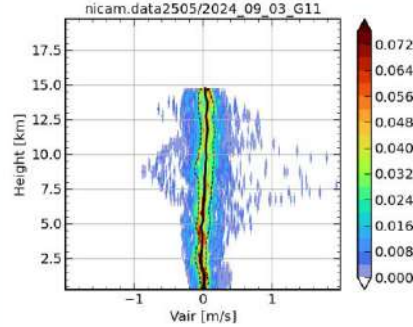
Vertical air motion [m/s] (CFADs 01520E)



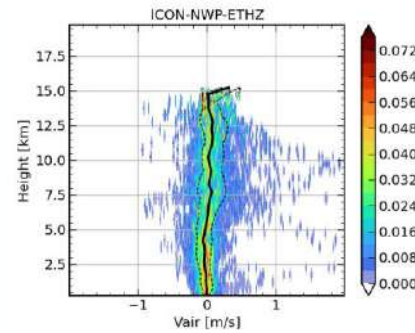
AC_CLP 1km



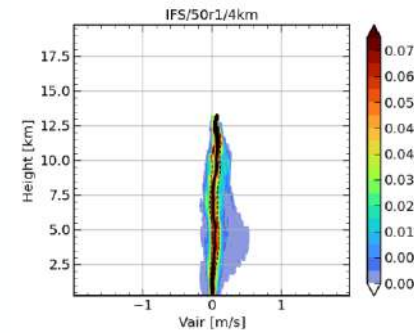
**NICAM.data2025/
2024_09_03_G11**



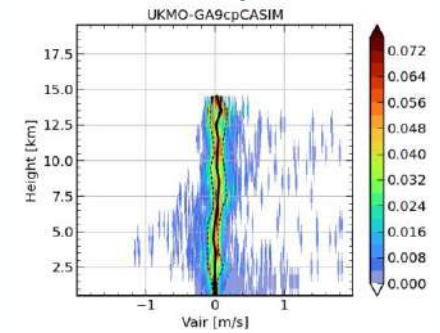
ICON-NWP-ETHZ



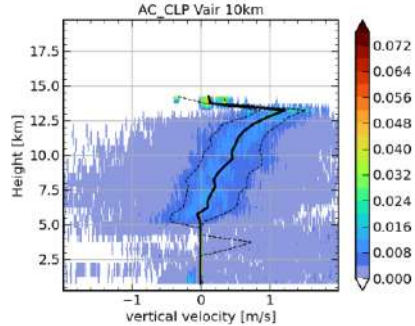
IFS/4km



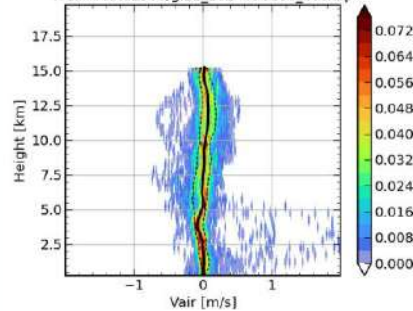
UKMO-GA9cpCASIM



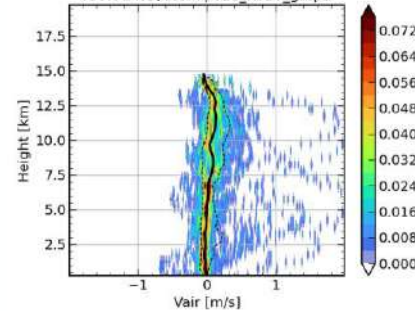
AC_CLP 10km



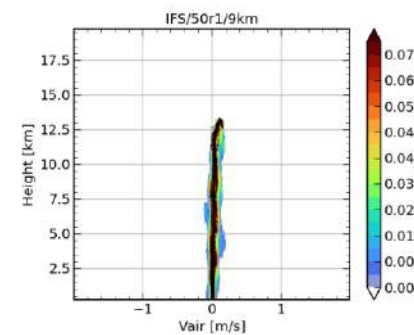
**NICAM.data2025/
gl11_2024090100_backup**



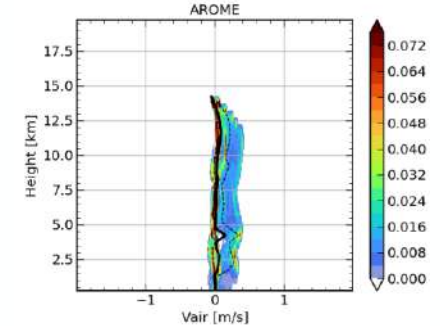
**ICON-DWD/
ecomip011_R3B9_gscp2**



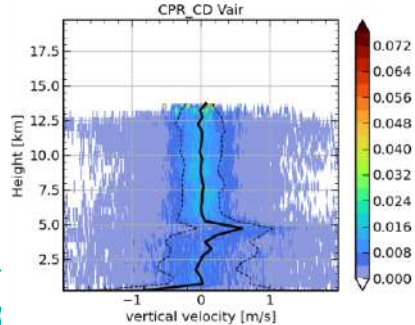
IFS/9km



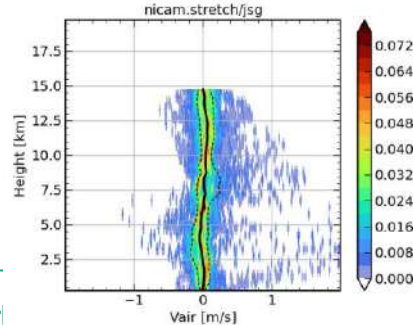
AROME



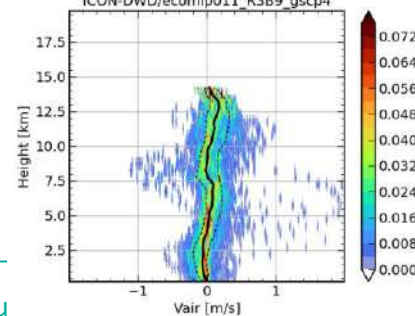
CPR_CD —(Vd—Vsed)



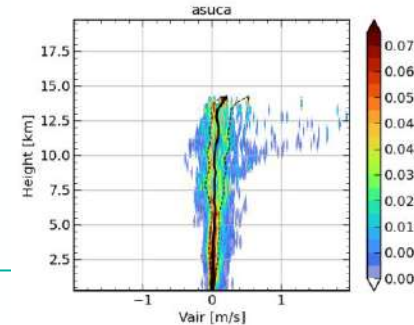
NICAM.stretch



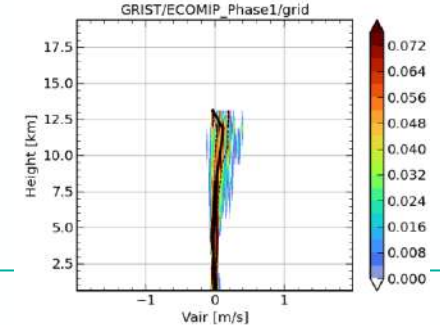
**ICON-DWD/
ecomip011_R3B9_gscp4**



asuca



GRIST

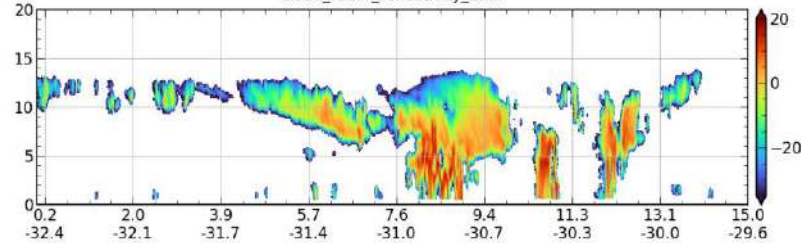


Z [dBZ] (EC overpass 01520E, Only datasets with the satellite simulator applied)

EarthCARE Observation

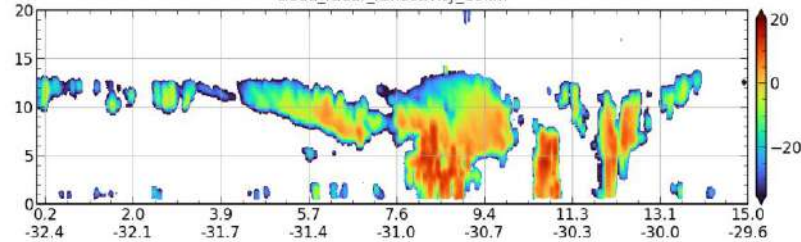
AC_CLP 1km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_radar_reflectivity_1km



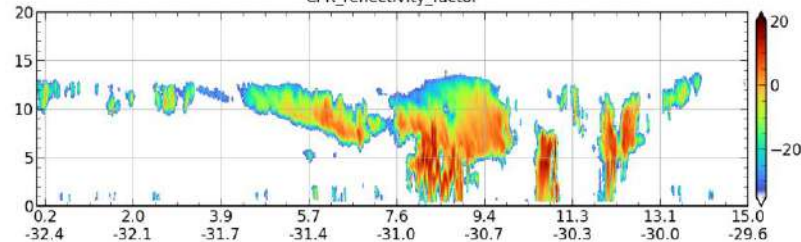
AC_CLP 10km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_radar_reflectivity_10km



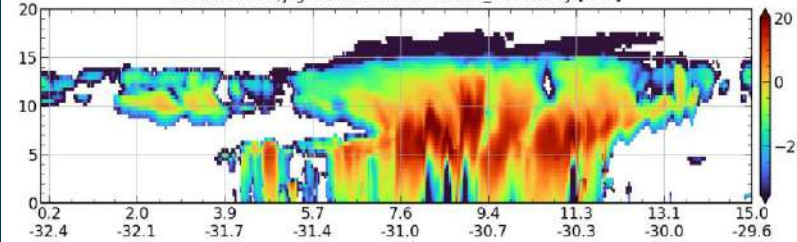
ACM_CAP

ECA_E_ACM_CAP_2BS_20240903T1605_20240903T1616_01520E_vBa.h5
CPR_reflectivity_factor



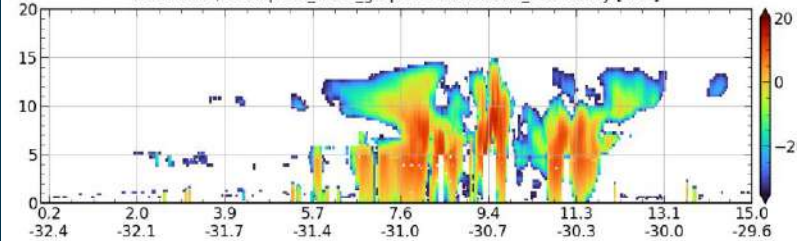
NICAM.stretch (Joint Simulator)

nicam.stretch/jsg 20240903 16:00 radar_reflectivity [dBZ]



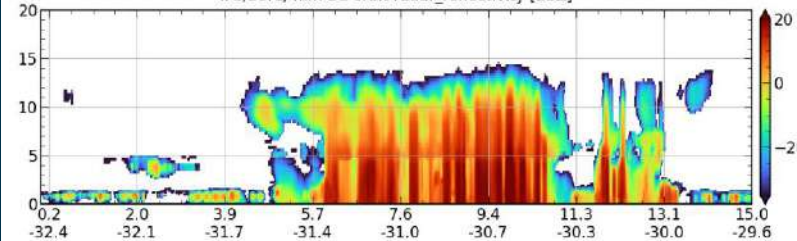
ICON-DWD/ecomip011_R3B9_gscp2 (PAMTRA)

ICON-DWD/ecomip011_R3B9_gscp2 EC orbit radar_reflectivity [dBZ]



IFS/50r1 4km

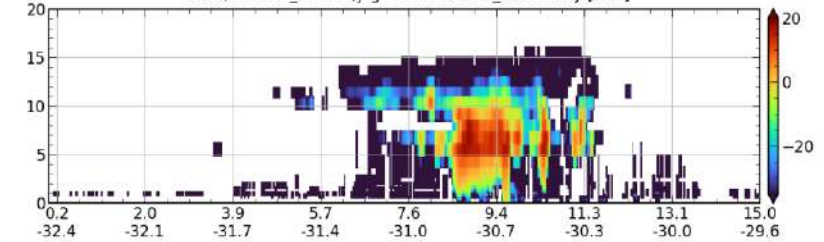
IFS/50r1/4km EC orbit radar_reflectivity [dBZ]



GRIST

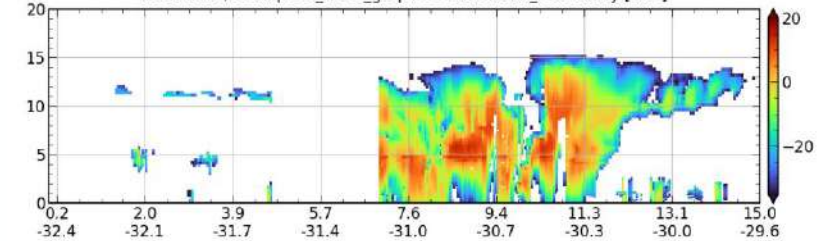
(Joint Simulator)

GRIST/ECOMP_Phase1/jsg EC orbit radar_reflectivity [dBZ]



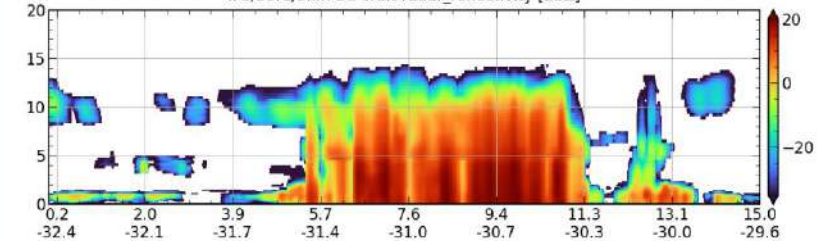
ICON-DWD/ecomip011_R3B9_gscp4 (PAMTRA)

ICON-DWD/ecomip011_R3B9_gscp4 EC orbit radar_reflectivity [dBZ]



IFS/50r1 9km

IFS/50r1/9km EC orbit radar_reflectivity [dBZ]

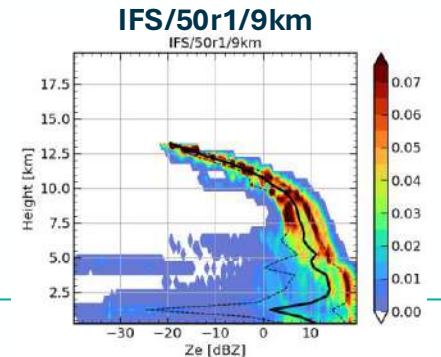
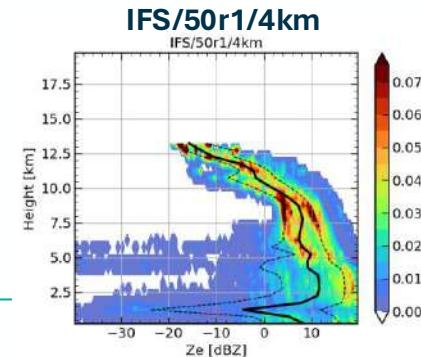
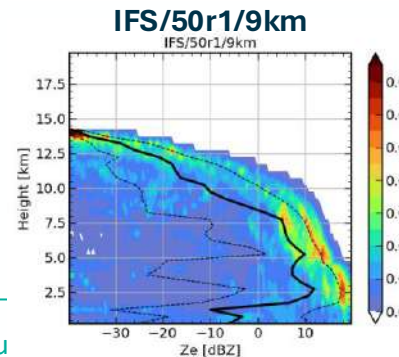
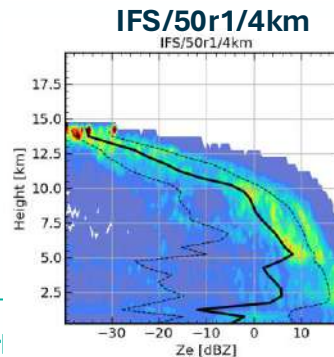
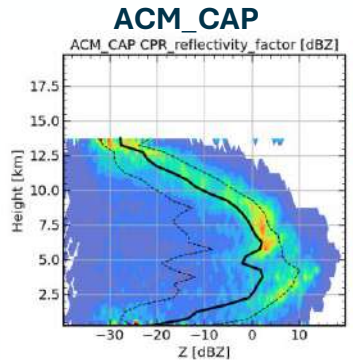
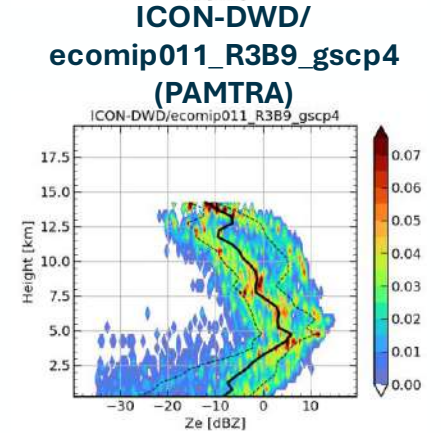
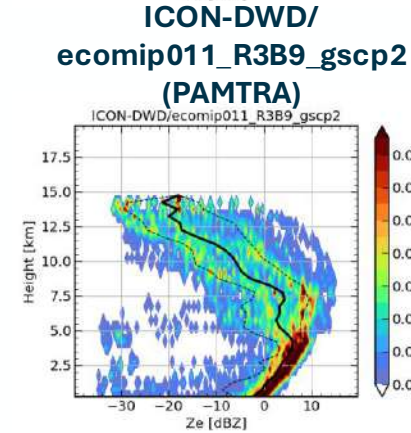
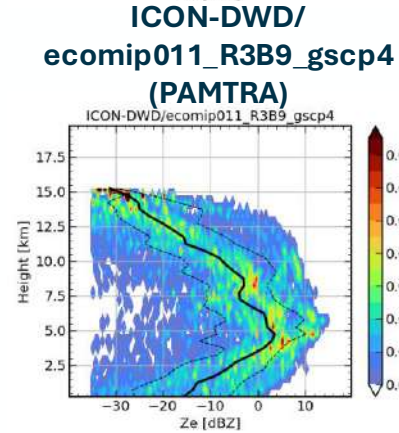
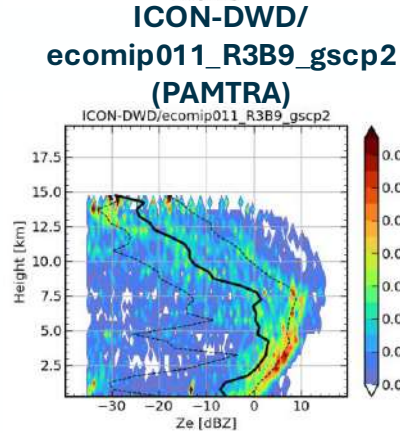
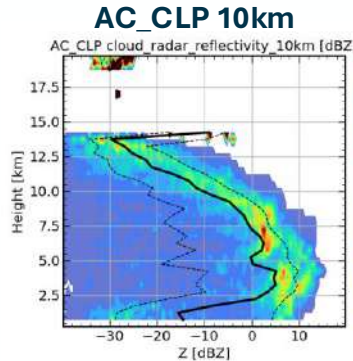
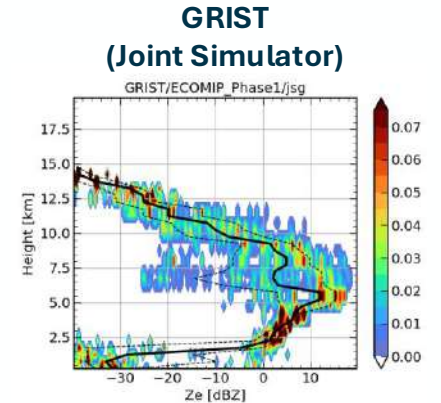
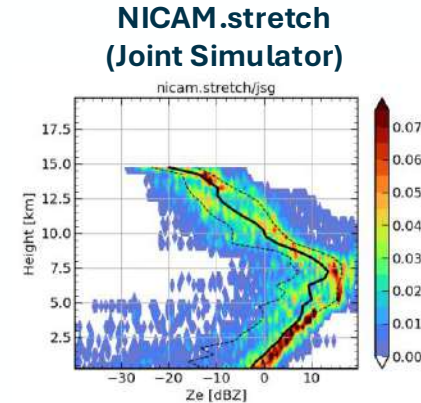
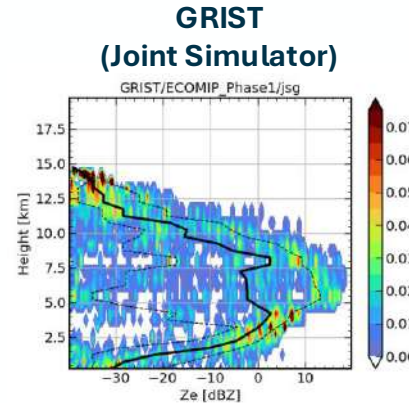
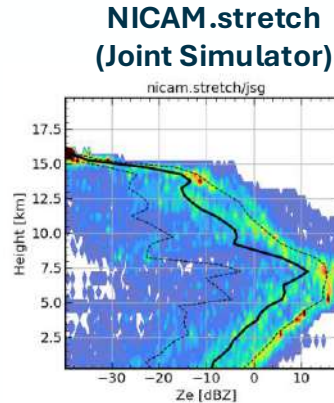
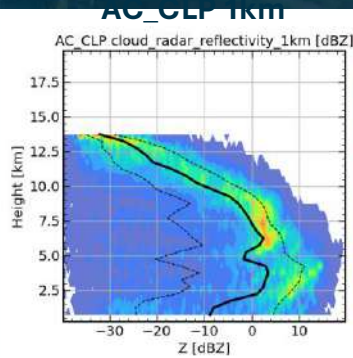


Z [dBZ] (CFADs 01520E, Only datasets with the satellite simulator applied)



All pixels

Pixels with IWC+LWC>0.01g/m³

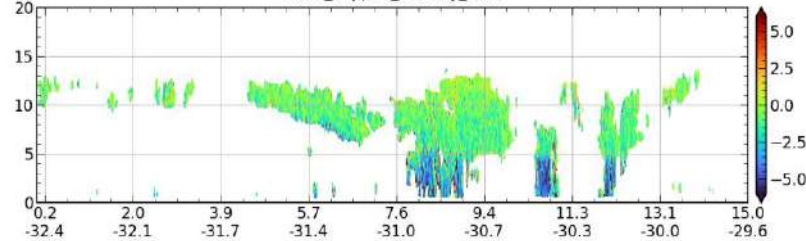


Vd [m/s] (EC overpass 01520E, Only datasets with the satellite simulator applied)

EarthCARE Observation

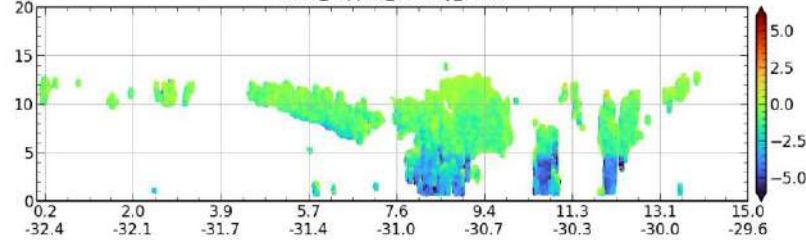
AC_CLP 1km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_doppler_velocity_1km



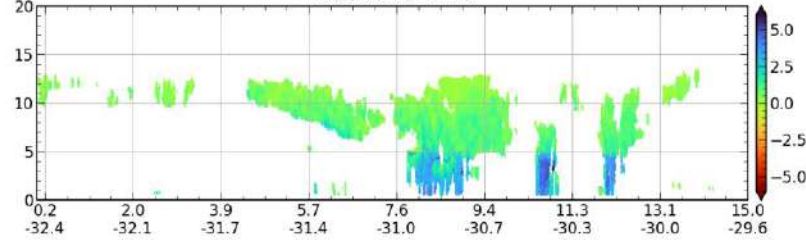
AC_CLP 10km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_doppler_velocity_10km



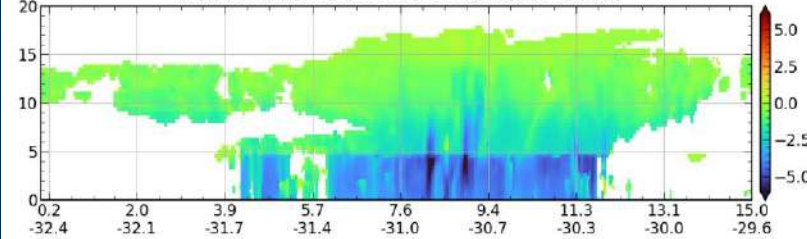
ACM_CAP

ECA_E_ACM_CAP_2BS_20240903T1605_20240903T1616_01520E_vBa.h5
CPR_doppler_velocity



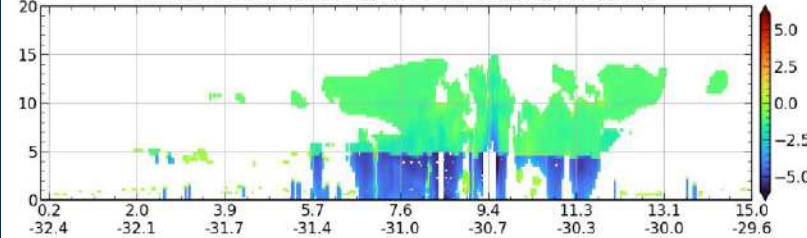
NICAM.stretch (Joint Simulator)

nicam.stretch/jsg 20240903 16:00 doppler_velocity [m/s]



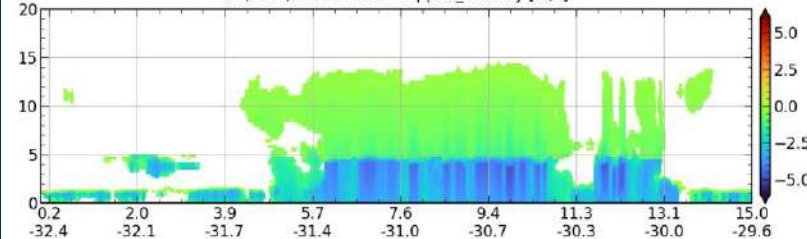
ICON-DWD/ecomip011_R3B9_gscp2 (PAMTRA)

ICON-DWD/ecomip011_R3B9_gscp2 EC orbit doppler_velocity [m/s]



IFS/50r1 4km

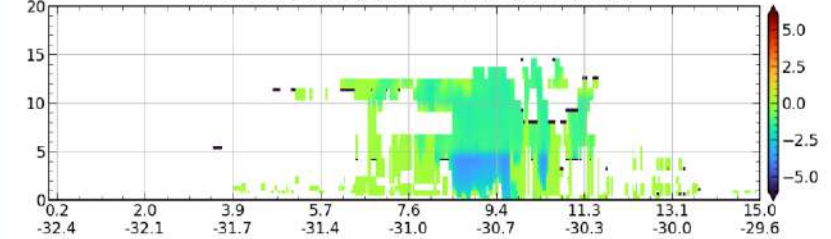
IFS/50r1/4km EC orbit doppler_velocity [m/s]



GRIST

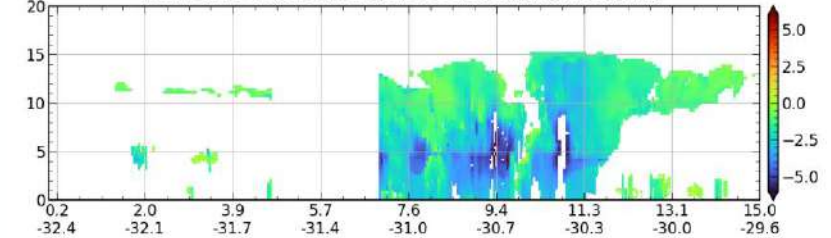
(Joint Simulator)

GRIST/ECOMIP_Phase1/jsg EC orbit doppler_velocity [m/s]



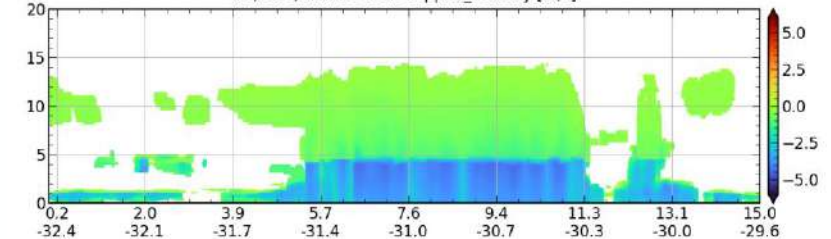
ICON-DWD/ecomip011_R3B9_gscp4 (PAMTRA)

ICON-DWD/ecomip011_R3B9_gscp4 EC orbit doppler_velocity [m/s]



IFS/50r1 9km

IFS/50r1/9km EC orbit doppler_velocity [m/s]

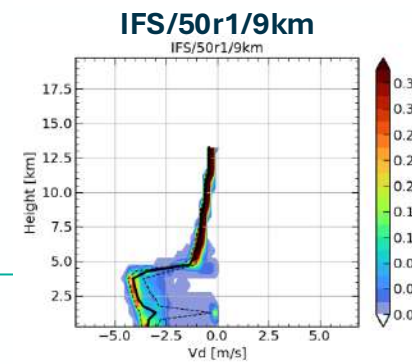
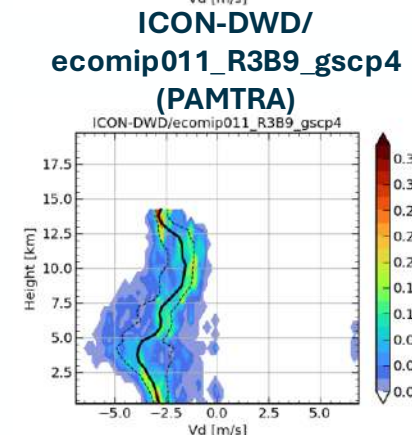
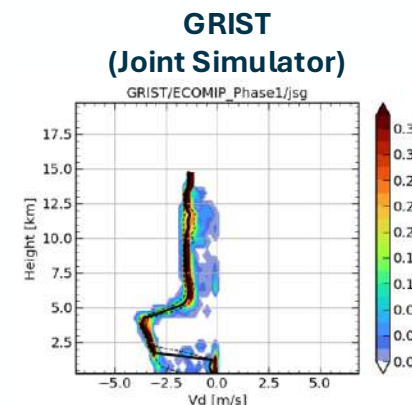
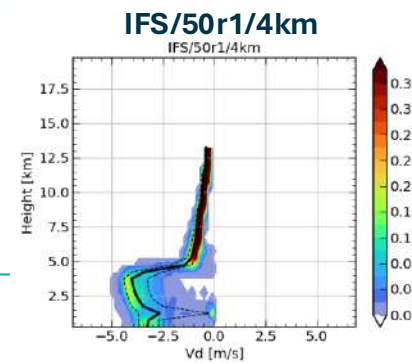
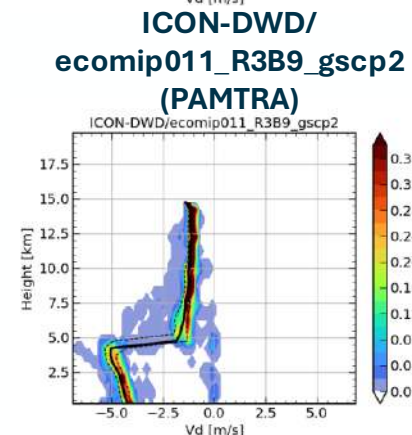
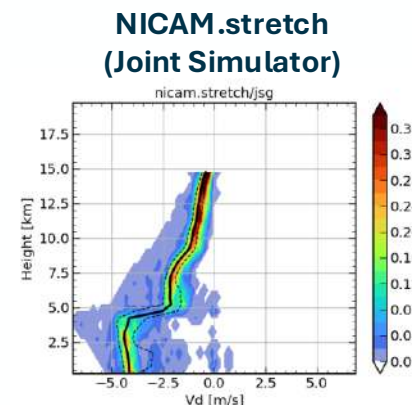
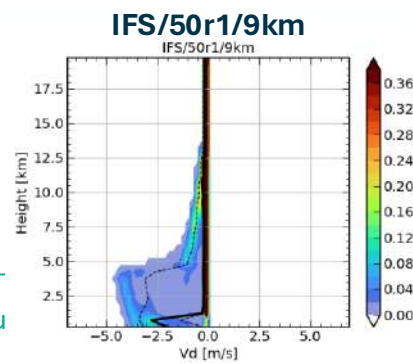
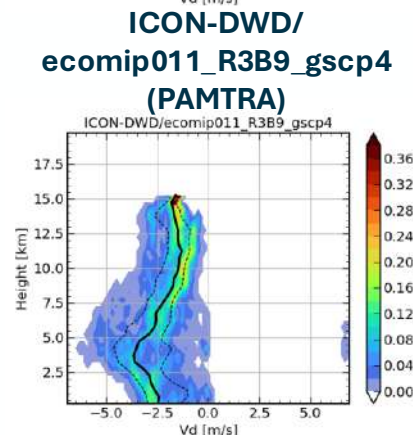
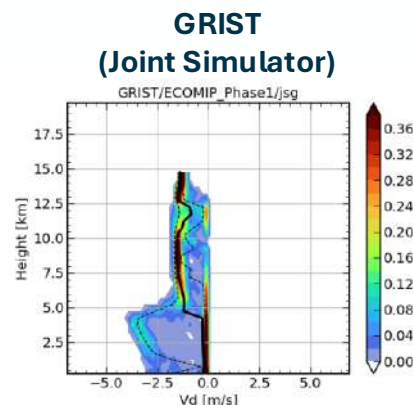
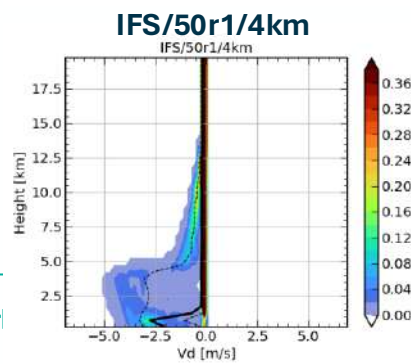
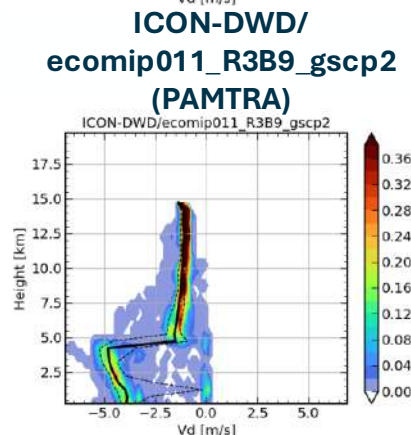
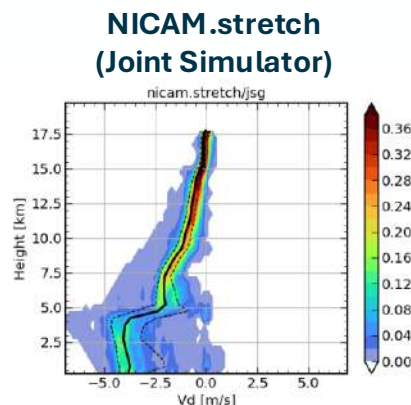
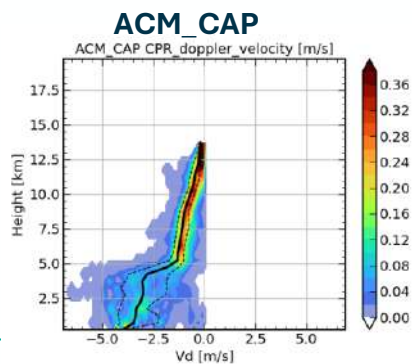
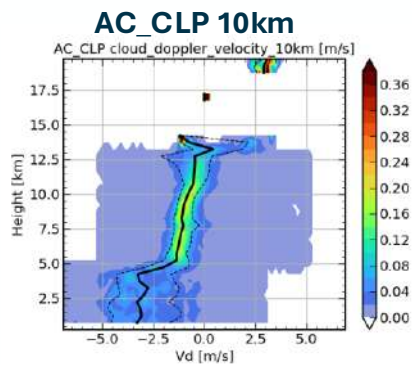
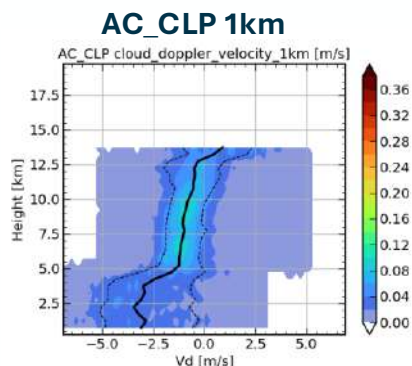


Vd [m/s](CFADs 01520E, Only datasets with the satellite simulator applied)

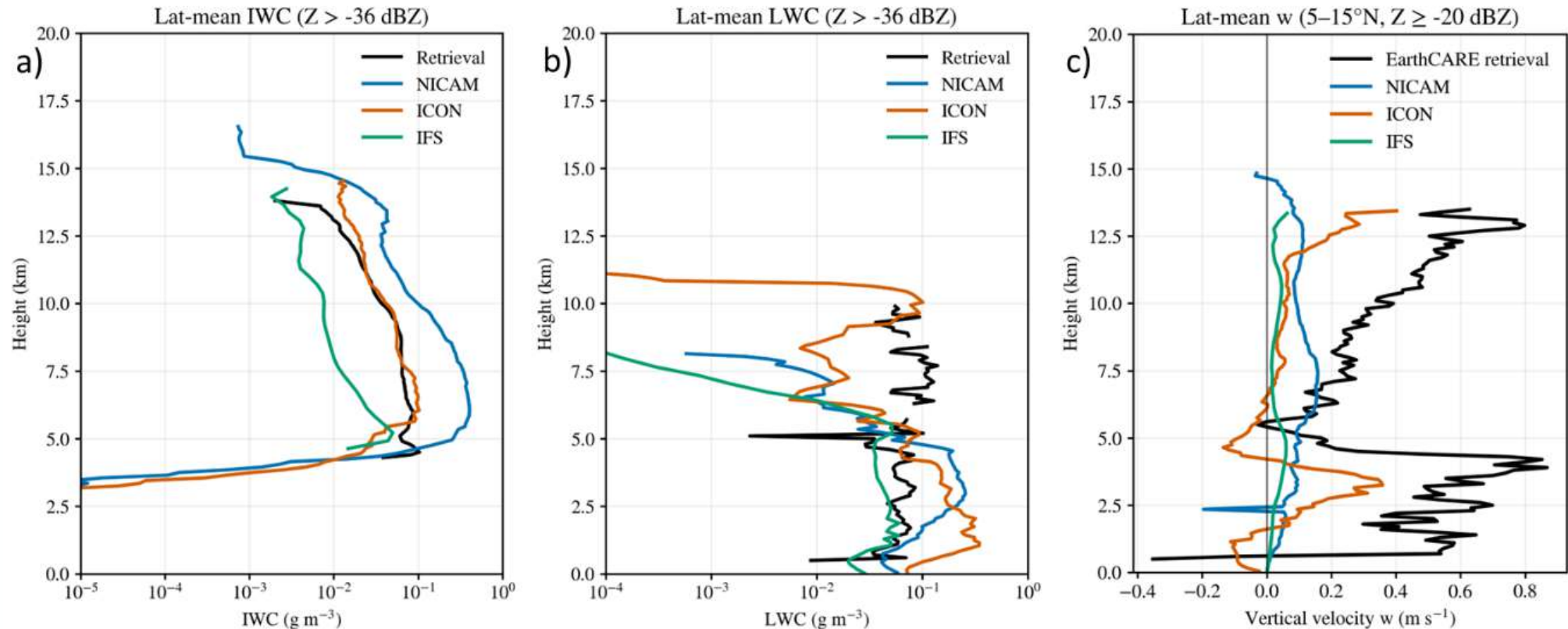


All pixels

Pixels with IWC+LWC>0.01g/m³



The vertical profiles of IWC, LWC, and vertical air velocity (w)



Roh et al. (2026, to be submitted)

Summary, implications, what's next



ECOMIP perspectives

- ECOMIP helps identify what aspects of cloud and precipitation systems are captured by current models, what are not captured, and what may be captured with future model improvements.
- Intercomparison of atmospheric models, satellite simulators, and retrieval products.
- Evaluation of vertical velocity profiles and convective mass fluxes within ITCZ.
- Assessment of cloud microphysical characteristics, such as the reflectivity–Doppler velocity (Z – V_d) relationship.

What's Next

- Sensitivity analyses of satellite simulators, including comparisons with J-Sim.
- Analysis of cloud macrostructure and convective organization.
- A paper on Phase I results will be submitted by September.
- Phase II: Continuous two-month simulations and statistical comparisons with EarthCARE observations.

Additional figures

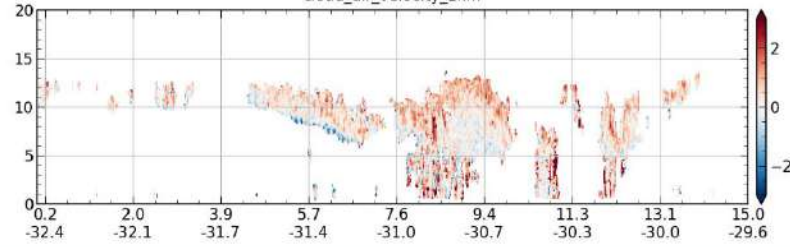
Vertical air motion [m/s] (EC overpass 01520E)



Without masking clouds

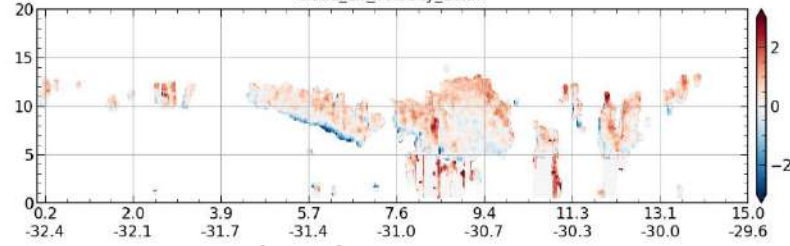
AC_CLP 1km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
cloud_air_velocity_1km



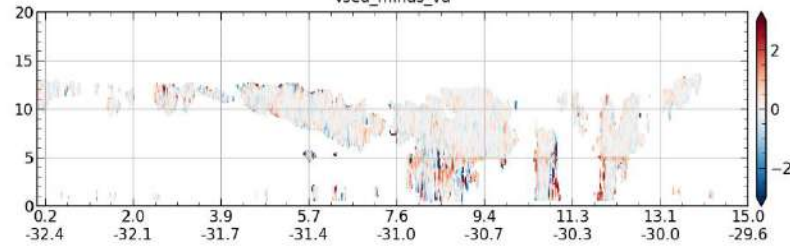
AC_CLP 10km

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cloud_air_velocity_10km



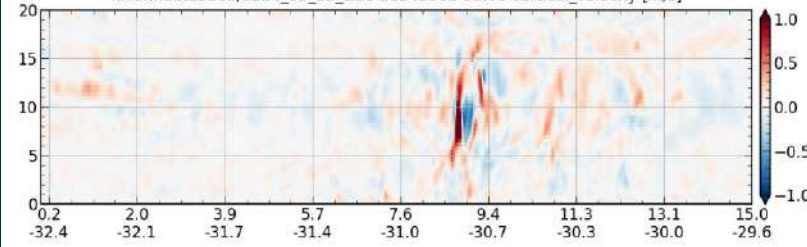
CPR_CD $-(V_d - V_{sed})$

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vsed_minus_vd



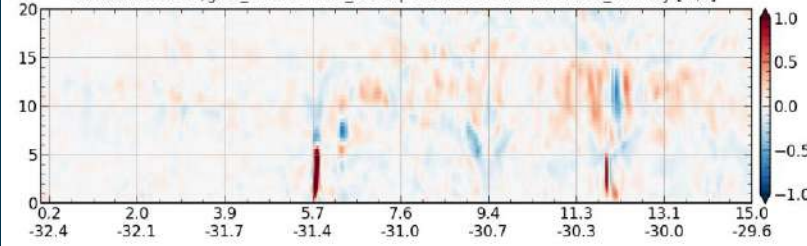
NICAM.data2025/2024_09_03_G11

nicam.data2505/2024_09_03_G11 20240903 16:00 vertical_velocity [m/s]



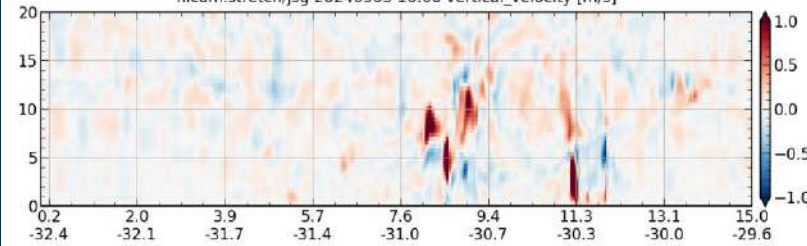
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nicam.data2505/gl11_2024090100_backup 20240903 18:00 vertical_velocity [m/s]



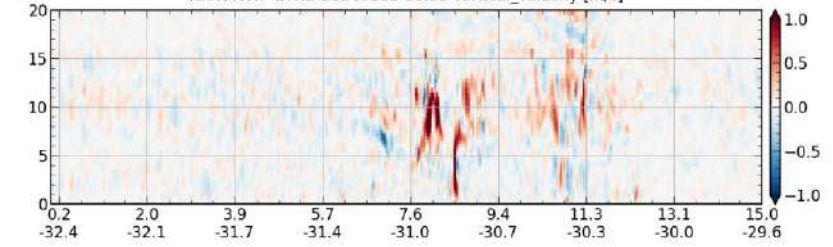
NICAM.stretch

nicam.stretch/jsg 20240903 16:00 vertical_velocity [m/s]



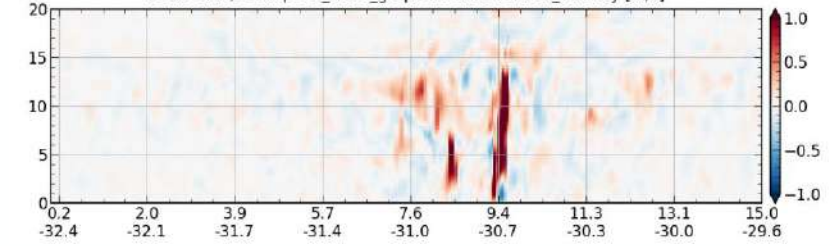
ICON-NWP-ETHZ

ICON-NWP-ETHZ 20240903 16:00 vertical_velocity [m/s]



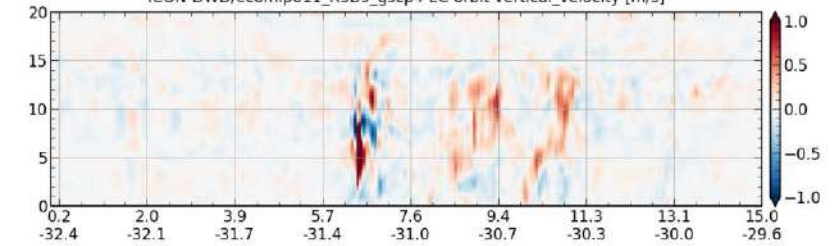
ICON-DWD/ecomp011_R3B9_gscp2

ICON-DWD/ecomp011_R3B9_gscp2 EC orbit vertical_velocity [m/s]



ICON-DWD/ecomp011_R3B9_gscp4

ICON-DWD/ecomp011_R3B9_gscp4 EC orbit vertical_velocity [m/s]



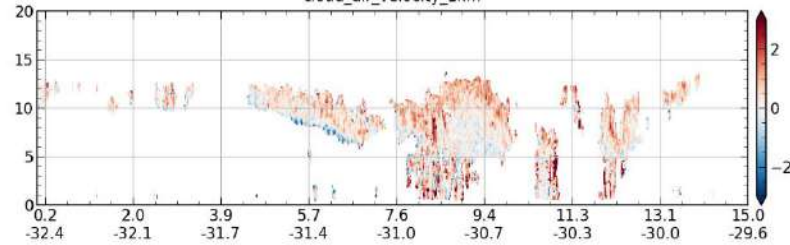
Vertical air motion [m/s] (EC overpass 01520E)



Without masking clouds

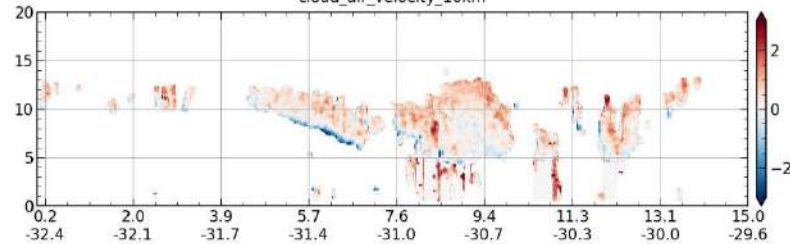
AC_CLP 1km

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cloud_air_velocity_1km



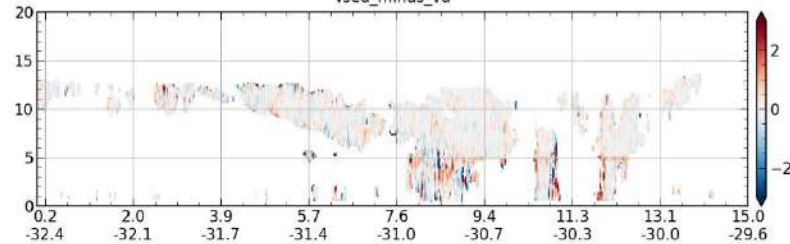
AC_CLP 10km

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cloud_air_velocity_10km



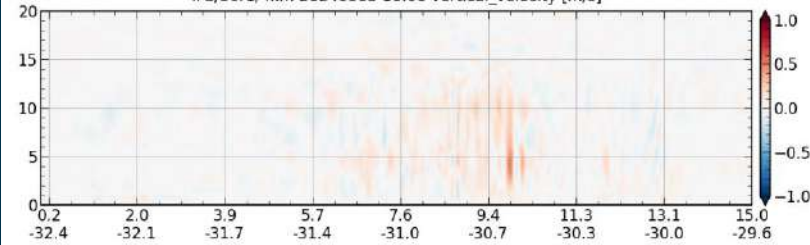
CPR_CD $-(V_d - V_{sed})$

ECA_MXZZ_CPR_CD_2A_20240903T160523Z_20260407T184709Z_01520E.h5
vsed_minus_vd



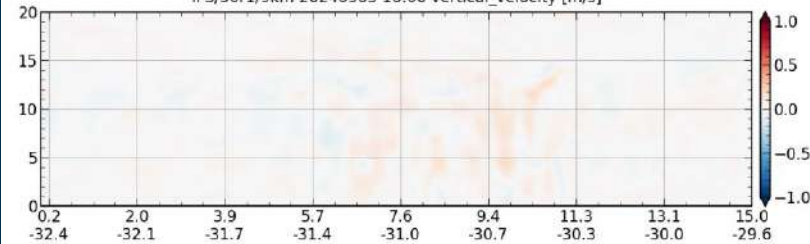
IFS/4km

IFS/50r1/4km 20240903 16:00 vertical_velocity [m/s]



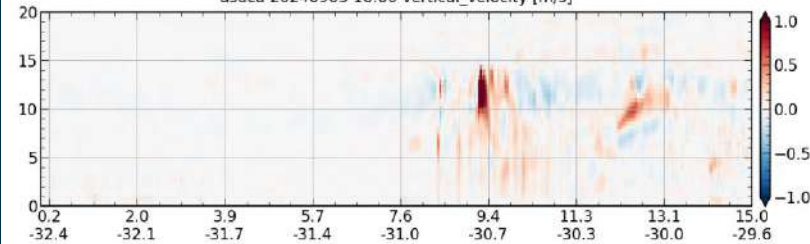
IFS/9km

IFS/50r1/9km 20240903 16:00 vertical_velocity [m/s]



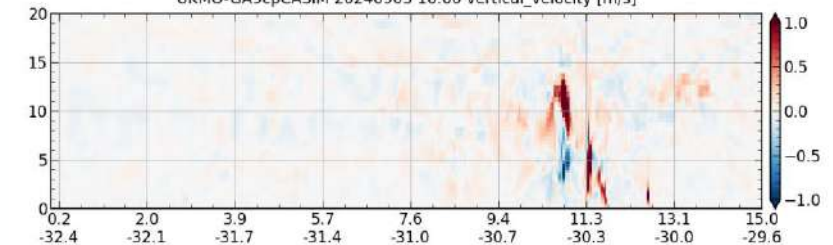
asuca

asuca 20240903 16:00 vertical_velocity [m/s]



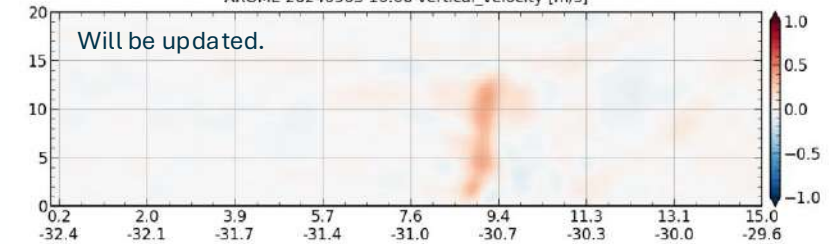
UKMO-GA9cpCASIM

UKMO-GA9cpCASIM 20240903 16:00 vertical_velocity [m/s]



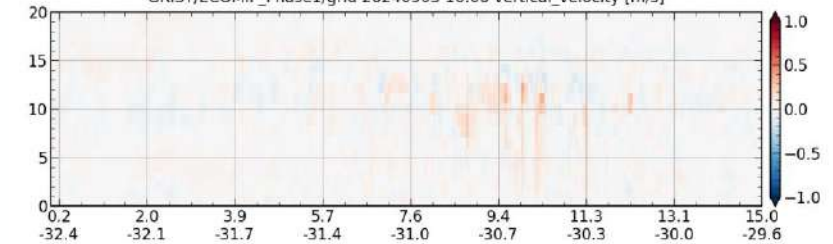
AROME

AROME 20240903 16:00 vertical_velocity [m/s]



GRIST

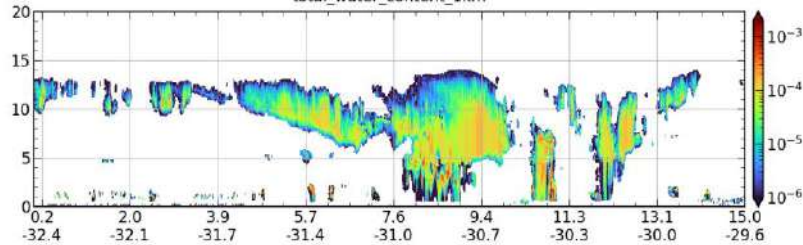
GRIST/ECOMIP_Phase1/grid 20240903 16:00 vertical_velocity [m/s]



IWC+LWC [kg/m³] (EC overpass 01520E)

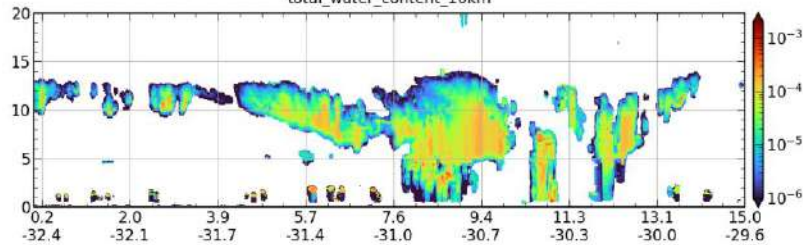
AC_CLP 1km

ECA_J_AC_CLP_2BS_20240903T1605_20240903T1616_01520E_vBb.h5
total_water_content_1km



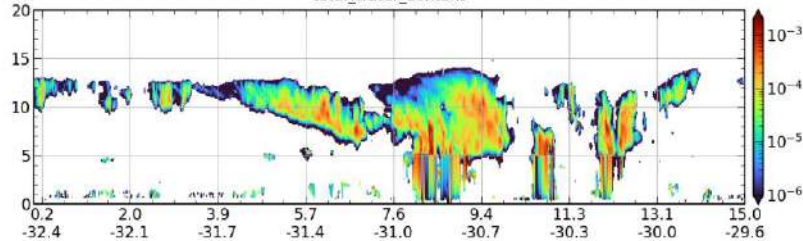
AC_CLP 10km

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total_water_content_10km



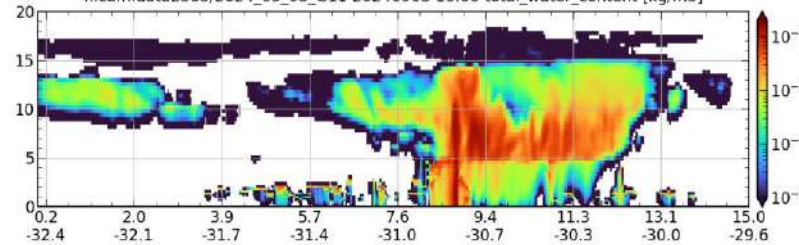
ACM_CAP

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total_water_content



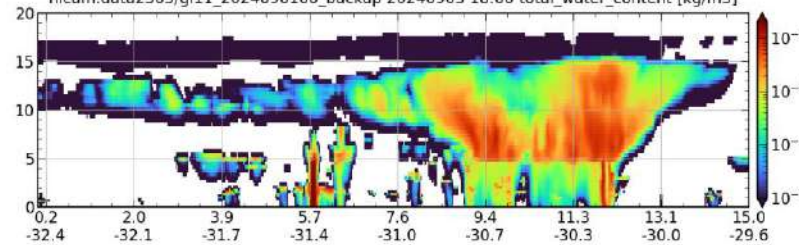
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nicam.data2505/2024_09_03_G11 20240903 16:00 total_water_content [kg/m³]



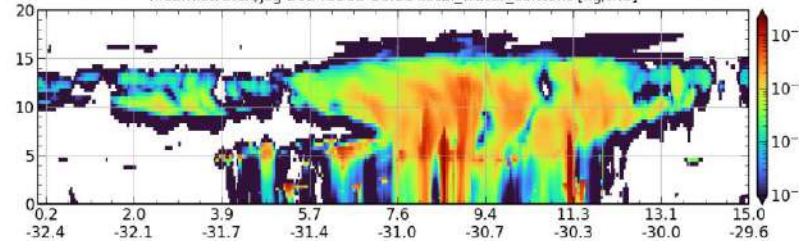
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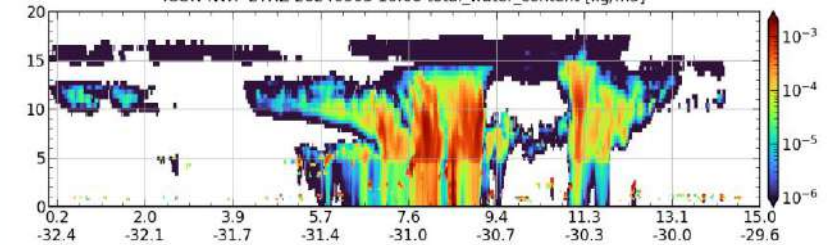
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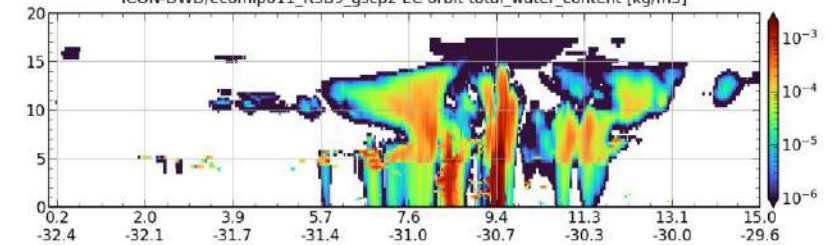
ICON-NWP-ETHZ

ICON-NWP-ETHZ 20240903 16:00 total_water_content [kg/m³]



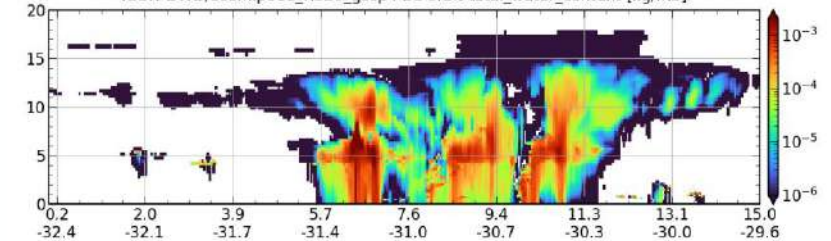
ICON-DWD/ecomip011_R3B9_gscp2

ICON-DWD/ecomip011_R3B9_gscp2 EC orbit total_water_content [kg/m³]



ICON-DWD/ecomip011_R3B9_gscp4

ICON-DWD/ecomip011_R3B9_gscp4 EC orbit total_water_content [kg/m³]

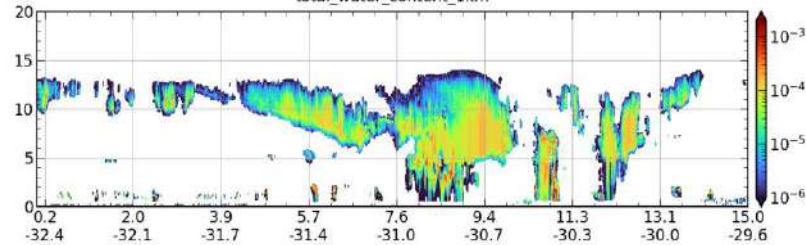


IWC+ LWC [kg/m³] (EC overpass 01520E)

AC_CLP 1km

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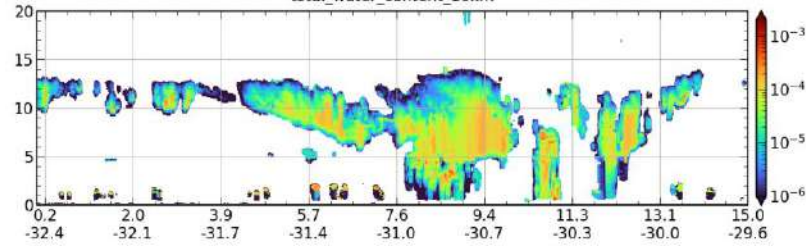
total_water_content_1km



AC_CLP 10km

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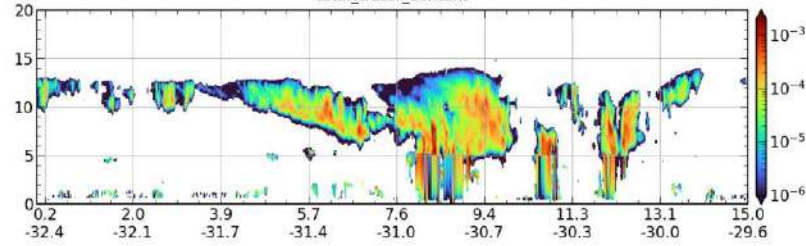
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ACM_CAP

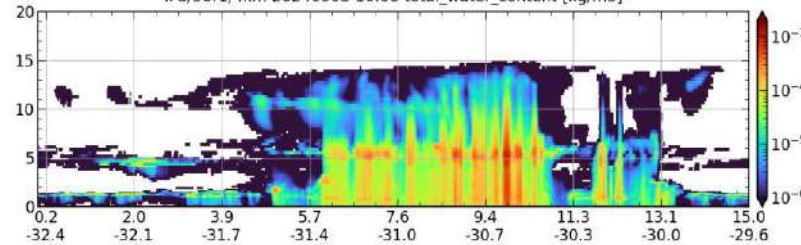
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total_water_content



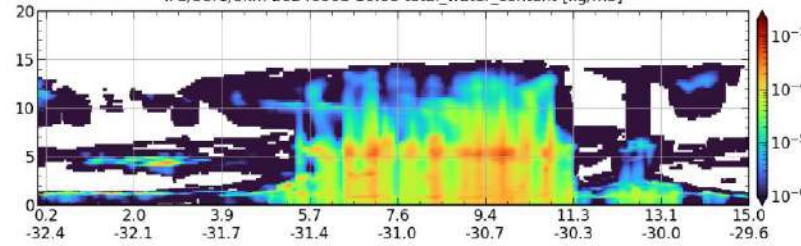
IFS/4km

IFS/50r1/4km 20240903 16:00 total_water_content [kg/m3]



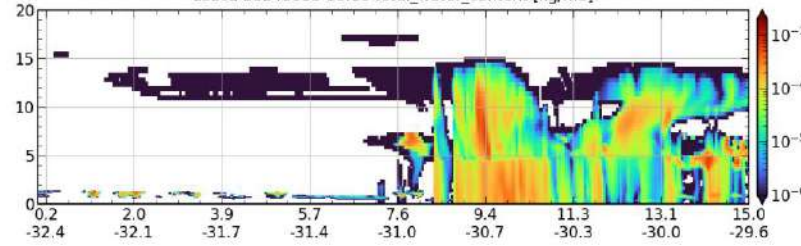
IFS/9km

IFS/50r1/9km 20240903 16:00 total_water_content [kg/m3]



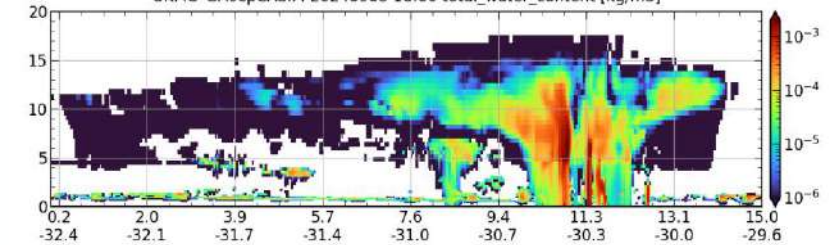
asuca

asuca 20240903 16:00 total_water_content [kg/m3]



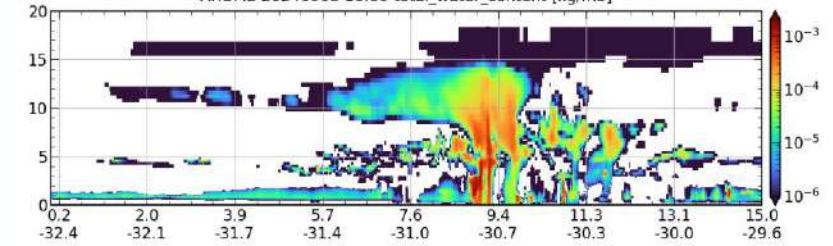
UKMO-GA9cpCASIM

UKMO-GA9cpCASIM 20240903 16:00 total_water_content [kg/m3]



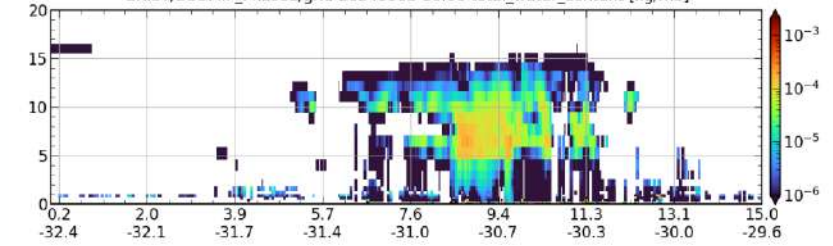
AROME

AROME 20240903 16:00 total_water_content [kg/m3]



GRIST

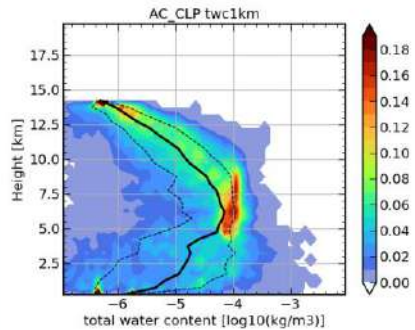
GRIST/ECOMIP_Phase1/grid 20240903 16:00 total_water_content [kg/m3]



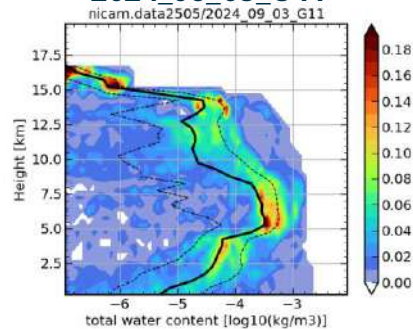
IWC+LWC [kg/m³] (CFADs 01520E)



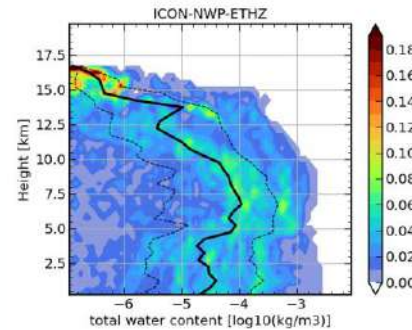
AC_CLP 1km



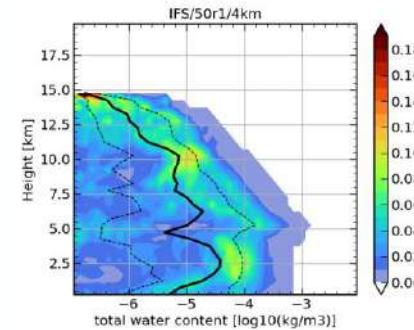
**NICAM.data2025/
2024 09 03 G11**



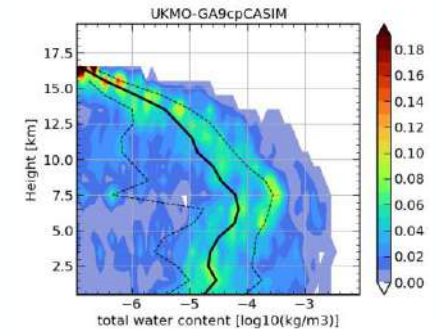
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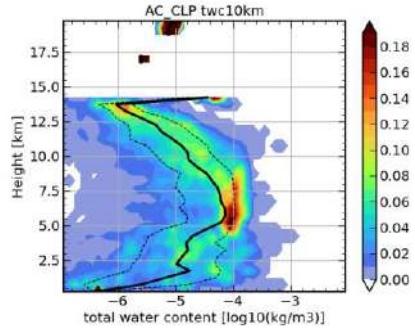
IFS/4km



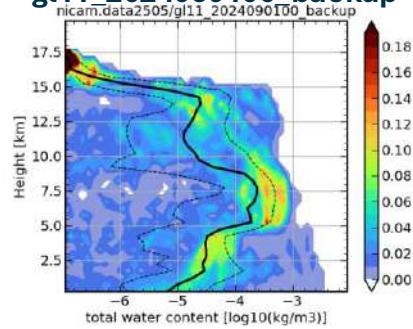
UKMO-GA9cpCASIM



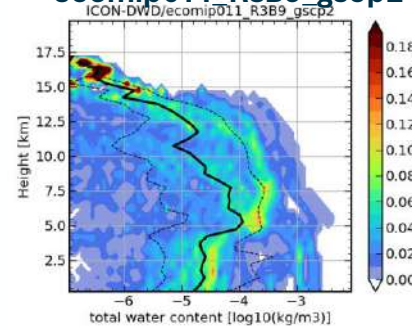
AC_CLP 10km



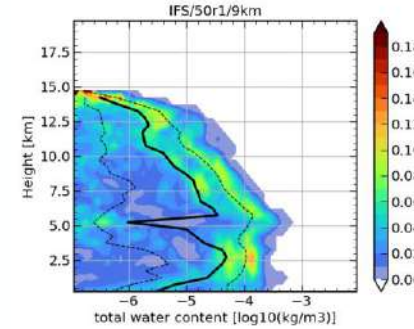
**NICAM.data2025/
gl11 2024090100 backup**



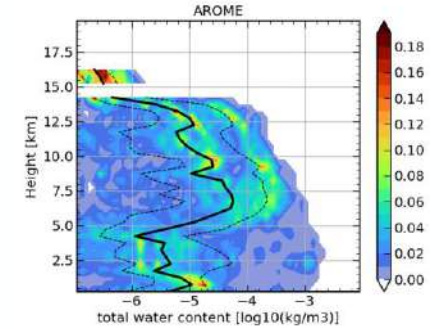
**ICON-DWD/
ecomip011 R3B9 gscp2**



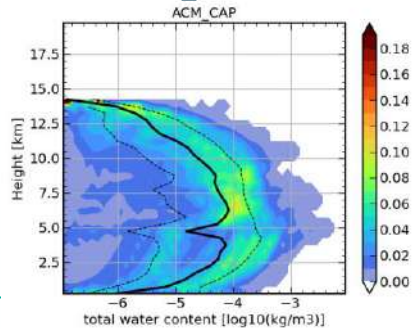
IFS/9km



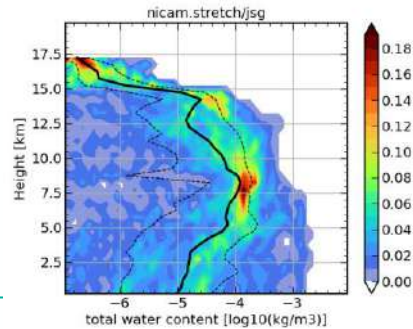
AROME



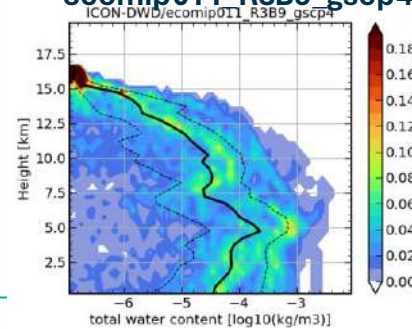
ACM_CAP



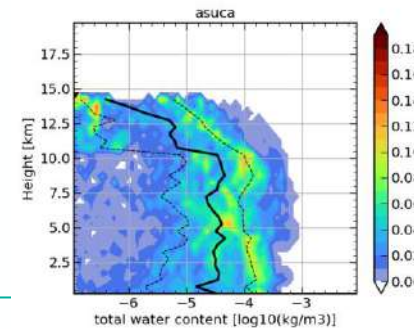
NICAM.stretch



**ICON-DWD/
ecomip011 R3B9 gscp4**



asuca



GRIST

