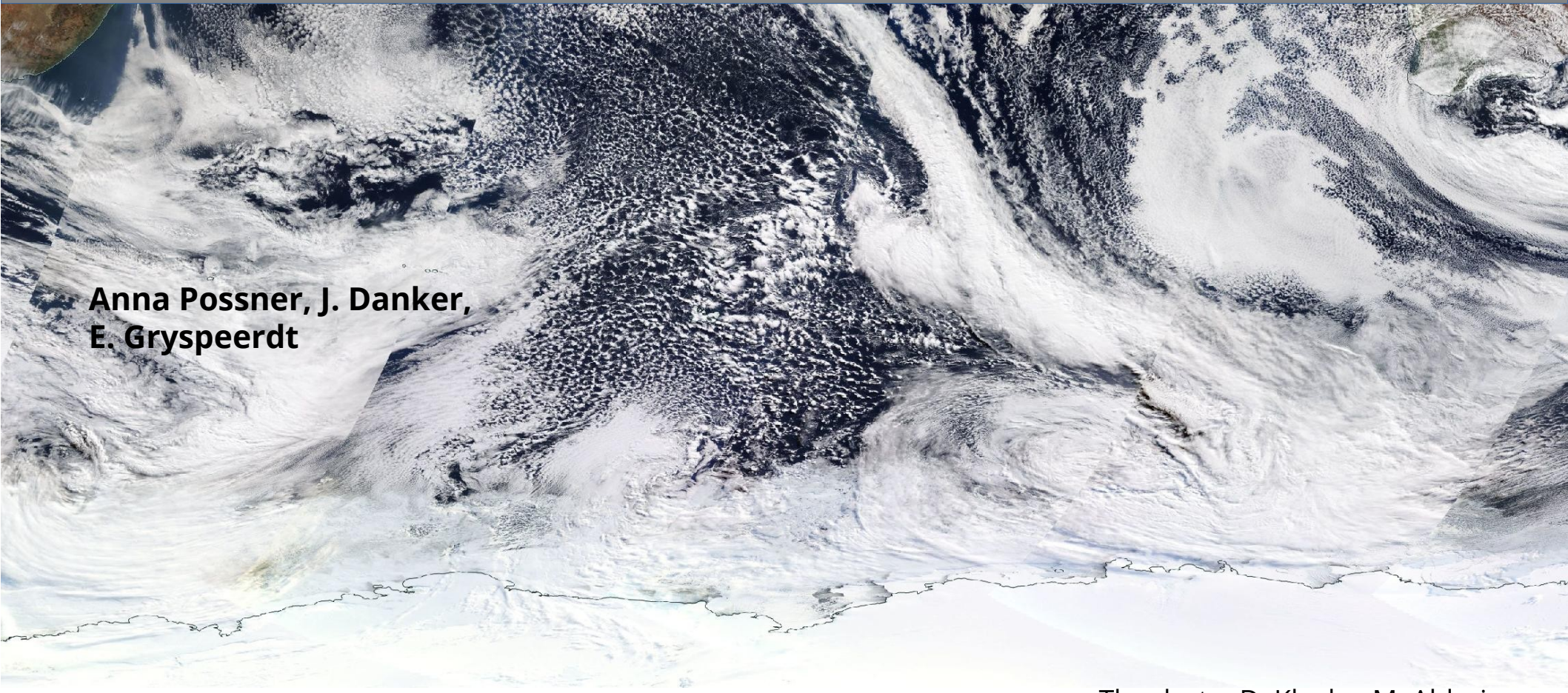
Resolution Dependence of Southern Ocean Mixed-Phase Clouds in ICON



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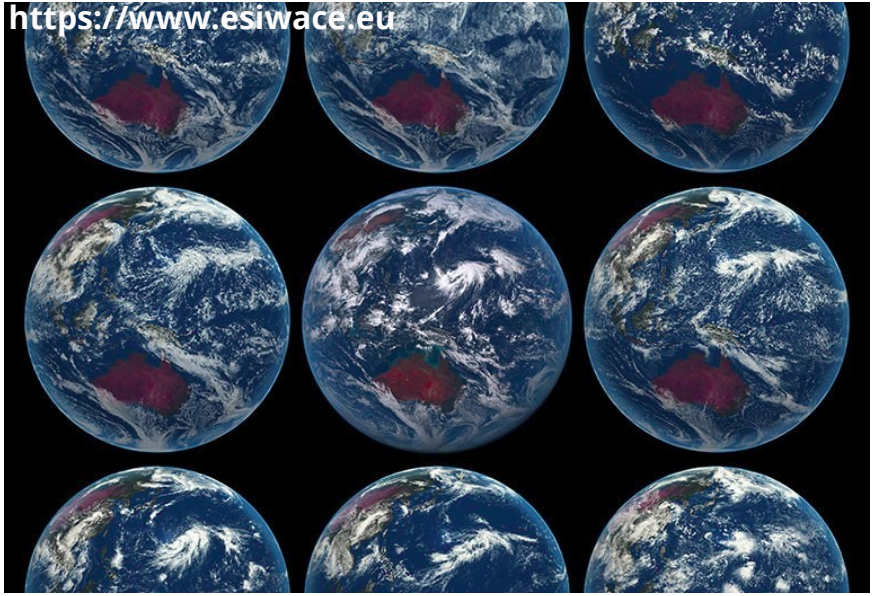
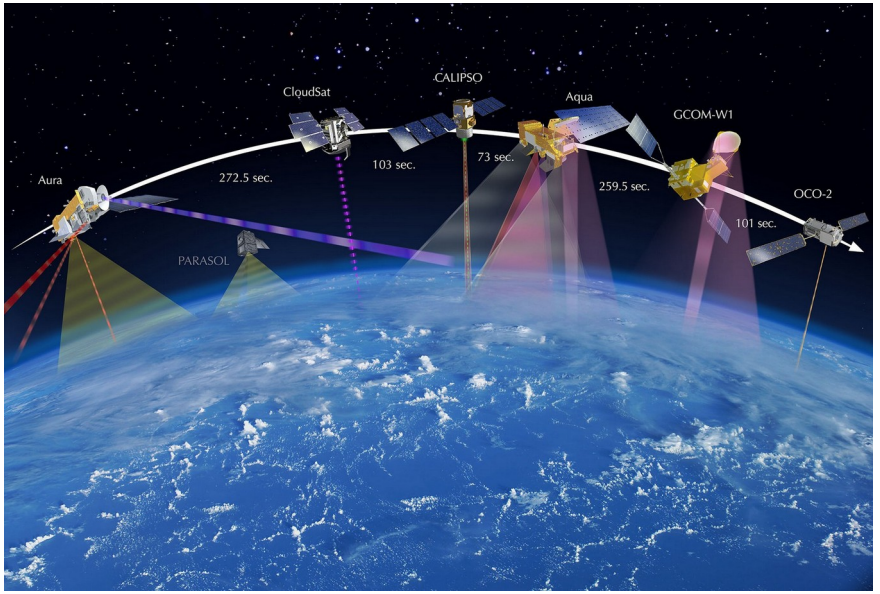
DYAMOND initiative

DYAMOND August 2016



+

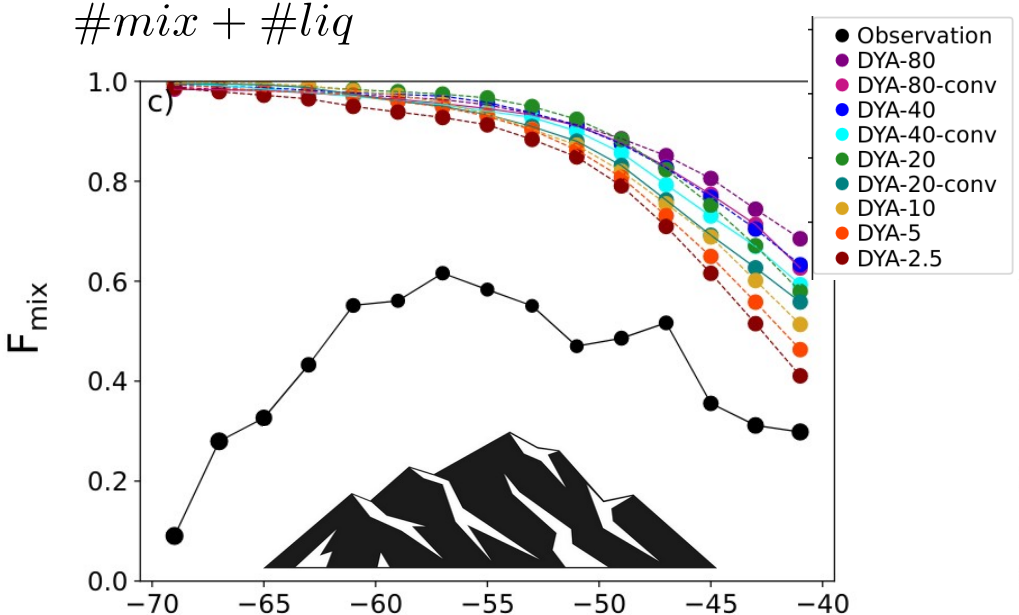
DARDAR-v2 Cloud Phase



-> formed vertically integrated classification of cloud phase **occurrence**

ICON: Cloud Phase Statistics

$$F_{mix} = \frac{\#mix}{\#mix + \#liq}$$



Ice occurrence in Southern Ocean supercooled boundary layer clouds is **overestimated**.

F_{mix}	
DARDAR-v2: **0.53**	ICON: **0.78 – 0.86**

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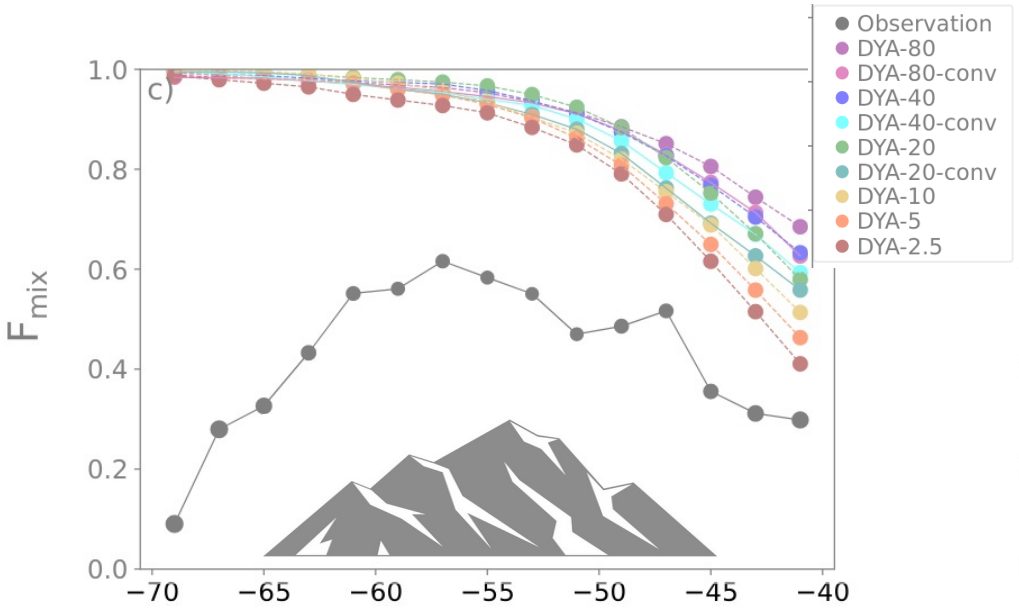
ICON: Radiative Bias



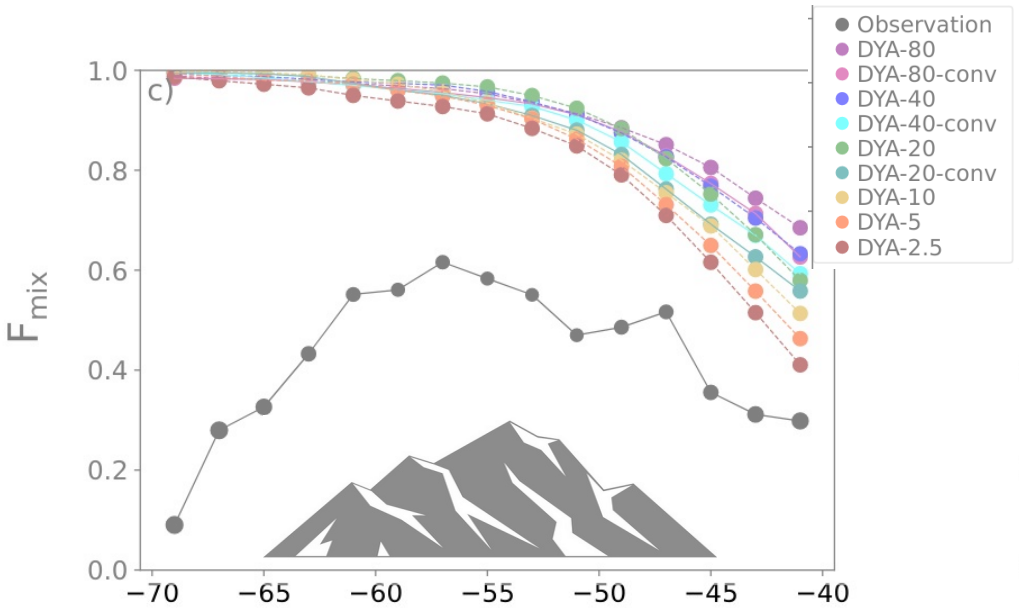
Δx

Simulation	$\Delta NetTOA_{sw}$ [Wm^{-2}]
DYA-80-conv	10.1
DYA-40-conv	7.0
DYA-20-conv	6.4
DYA-2.5	1.6

ΔSW

SW transmittance **overestimated** and radiation bias decreases with increasing resolution.

ICON: Radiative Bias



Δx

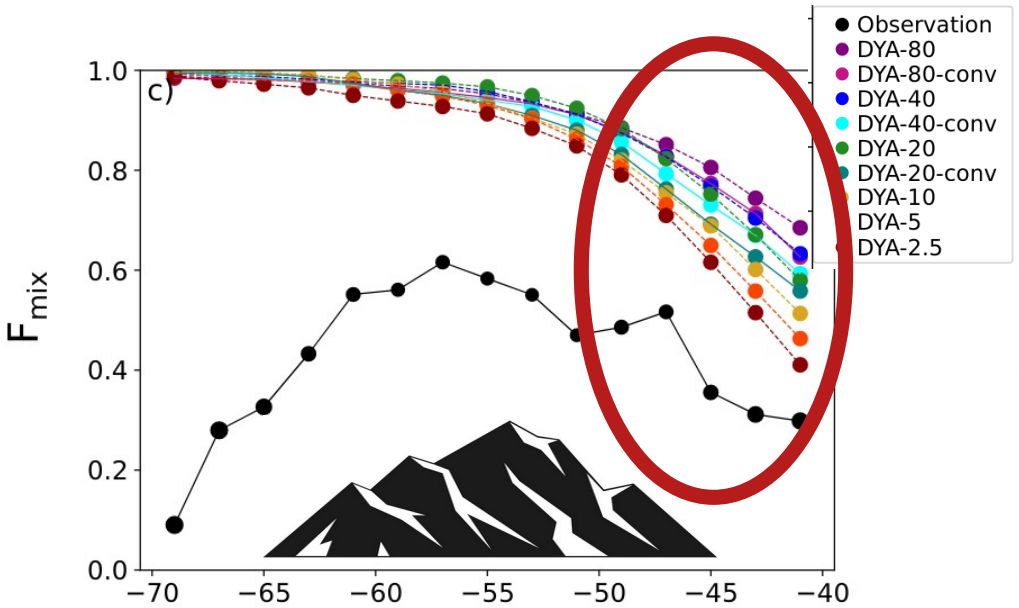
Simulation	$\Delta NetTOA_{sw}$ [Wm^{-2}]
DYA-80-conv	10.1
DYA-40-conv	7.0
DYA-20-conv	6.4
DYA-2.5	1.6

ΔSW

SW transmittance **overestimated** and radiation bias decreases with increasing resolution.

…but due to compensation of ±10 Wm^{-2} biases…

ICON: Seeding Impact on F_{mix}



Δx

Simulation	$\Delta NetTOA_{sw}$ [Wm^{-2}]
DYA-80-conv	10.1
DYA-40-conv	7.0
DYA-20-conv	6.4
DYA-2.5	1.6

ΔSW

Around **<u>20% of all clouds are seeded</u>** from above and seeding frequency is resolution dependent.

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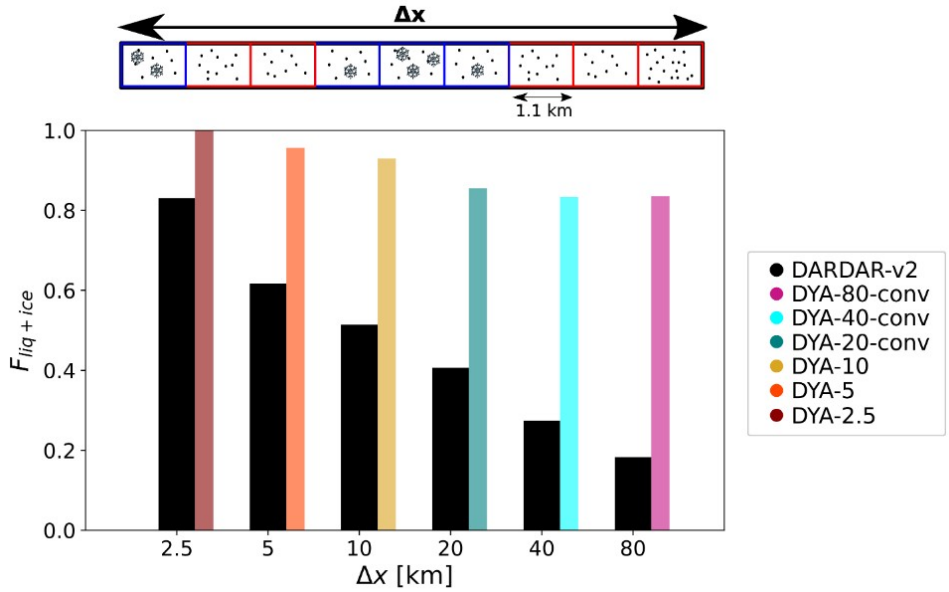
ICON: Growth Rates Resolution Dependent

	Δt	Δx	Δt + Δx
ΔLWP_{low} [%]	4.0	8.8	13.2
ΔIWP_{low} [%]	-13.4	12.3	-2.7



WBF growth is strongly **dependent on temporal resolution** and likely more so on horizontal resolution in models with correct cloud phase variability.

Outlook

SW biases in ICON are likely due to cloud cover treatment -> avenue of further research

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