

# Update on assimilation of microwave-radiometer observations at DWD

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## Microwave radiometer in Lindenberg







name	radio sonde	channels	obs. err.	localisation	comment
×6KV	on	14	2 $\epsilon_{Desroziers}$	dynamical	
×6K	on	7	2 $\epsilon_{Desroziers}$	dynamical	only K band
×6V	on	7	2 $\epsilon_{Desroziers}$	dynamical	only V band
×6nL	on	14	$2 \epsilon_{Desroziers}$	Iv=1	
×6L1	on	14	2 $\epsilon_{Desroziers}$	lv = 0.075	
×6сб	on	6	$\sigma_o$	dynamical	with clouds
×6c11	on	11	$2 \epsilon_{Desroziers}$	dynamical	without channel 8,9,10
x7c7	on	7	$2 \epsilon_{Desroziers}$	dynamical	every 2nd channel
x7c2	on	2	4 $\epsilon_{Desroziers}$	dynamical	channel 2, 13
x7c2	off	2	4 $\epsilon_{Desroziers}$	dynamical	channel 2, 13
×7c11	off	11	4 $\epsilon_{Desroziers}$	dynamical	without channel 8,9,10
×7c4	off	4	4 $\epsilon_{Desroziers}$	dynamical	channel 2, 7, 10, 13
x8c2	off	2	2 $\epsilon_{Desroziers}$	dynamical	channel 2, 13
x8L1	off	2	2 $\epsilon_{Desroziers}$	static	0.4 (880hPa), 0.15 (970hPa)



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хбnL	on	14	$2 \epsilon_{Desroziers}$	Iv=1	
×6L1	on	14	$2 \epsilon_{Desroziers}$	lv = 0.075	
хбсб	on	6	$\sigma_o$	dynamical	with clouds
×6c11	on	11	$2 \epsilon_{Desroziers}$	dynamical	without channel 8,9,10
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x7c4	off	4	4 <i>e</i> Desroziers	dynamical	channel 2, 7, 10, 13
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# Moving to a smaller domain





- improvement in disk space approx. 4 times
- improvement in computation time by > 2 times
- $\Rightarrow$  experiments for whole June possible

#### **Observation error**



• ignore cross-correlations  $\rightarrow$  only diagonals



error covariance matrix of brightness temperature channels

- Iterating errors using Desroziers
- Experiments indicate that error is too small
- $\Rightarrow$  inflate errors by factor of 2 (at least!) ...

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error covariance matrix of brightness temperature channels

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- Experiments indicate that error is too small
- $\Rightarrow$  inflate errors by factor of 2 (at least!) ...

 $\ldots$  or wait until off-diagonals of R can be taken to account by DACE  $\ldots$ 

... or use only very few channels



#### Vertical localisation – plevels and plevel widths





#### Vertical localisation – plevels and plevel widths



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# Vertical localisation – first experiments with 14 channels





- little impact on temperature
- ▶ for humidity, no localisation (nL) better than dynamical
- ▶ but sharp localisation (L1) partially better as well

# Vertical localisation – 2 channels, small domain



- without radio sonde and on smaller domain
- ▶ larger localisation (L1) improves RMSE of T on lower levels, but not QV
- ▶ L1 improved QV-bias compared to c2 but not compared to ref



#### Vertical localisation – 2 channels, small domain







## Vertical localisation – 2 channels, small domain



- ▶ wider localisation (L1) still not better than reference
- but some improvement compared to dynamical localisation

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- many experiments but still no proper setting found
- evolution from using all/most channels to only few (2/4)
- started computing experiments on smaller domain
  - $\Rightarrow$  More experiments with different vertical localisations
  - $\Rightarrow$  Potentially combine with Doppler-lidar observations when ready

#### More on vertical localisation





$$p_{\rm loc} = \frac{\sum_i w_i p_i}{\sum_i w_i}$$

p-level width:

$$dp_{\rm loc} = \frac{\sqrt{\frac{\sum wp^2}{\sum w} - \left(\frac{\sum wp}{\sum w}\right)^2}}{p_{\rm loc}}$$



#### More on vertical localisation



- Localise each channel vertically to limit increments
- ► p-level:

$$p_{\rm loc} = \frac{\sum_i w_i p_i}{\sum_i w_i}$$

 Combine Jacobians of *T*, *Q<sub>V</sub>*, *Q<sub>C</sub>* for weighting coefficients:

$$w = \left(\frac{\partial H}{\partial T}\sigma_{T} + \frac{\partial H}{\partial Q_{V}}\sigma_{Q_{V}} + \frac{\partial H}{\partial Q_{C}}\sigma_{Q_{C}}\right)$$

p-level width:

$$dp_{\rm loc} = \frac{\sqrt{\frac{\sum wp^2}{\sum w} - \left(\frac{\sum wp}{\sum w}\right)^2}}{p_{\rm loc}}$$

$$\sigma_{T} = 0.5$$
  

$$\sigma_{Q_{V}} = 0.1Q_{V}$$
  

$$\sigma_{Q_{C}} = 0.1Q_{C}$$

#### More on vertical localisation





Update on DA of MWR observations at DWD