A8.13 Remote-sensing of Ocean Winds and Stress

PARMIO: Passive Active Reference Microwave Infrared Ocean emissivity and backscatter model

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Many thanks to ISSI, whole ISSI team (in particular Catherine Prigent, Lise Kilic, Emmanuel Dinnat, Thomas Meissner, Magdalena Anguelova)

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Why?

- What was the problem in ocean emission and backscatter models?
  - Different physical assumptions in models -> problems in data assimilation
  - No maintained community open-source code
  - No assessment of model uncertainty
  - Model like Fastem in RTTOV not readily extendable to new missions e.g. ICI, CIMR

- Who identified this
  - GAIA-CLIM (H2020 project)
  - Science Working Groups of CGMS

- Science team proposed to the International Space Science Institute (Bern)

Who?

PMW: English S., Prigent C., Dinnat E., Anguelova M., Meissner T., Kilic L., Boutin J., Supply A., Lawrence H., Kazumori M., Weng F., Bettenhausen M., Yueh S., Hoyer J., Crewell S.

AMW: Stoffelen A., Bautista M., Abdalla S.

IR: Newman S., Nalli N.

General RT: Johnson B., Hocking J.

Space Agency: Accadia C., Donlon C.

EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS

When?

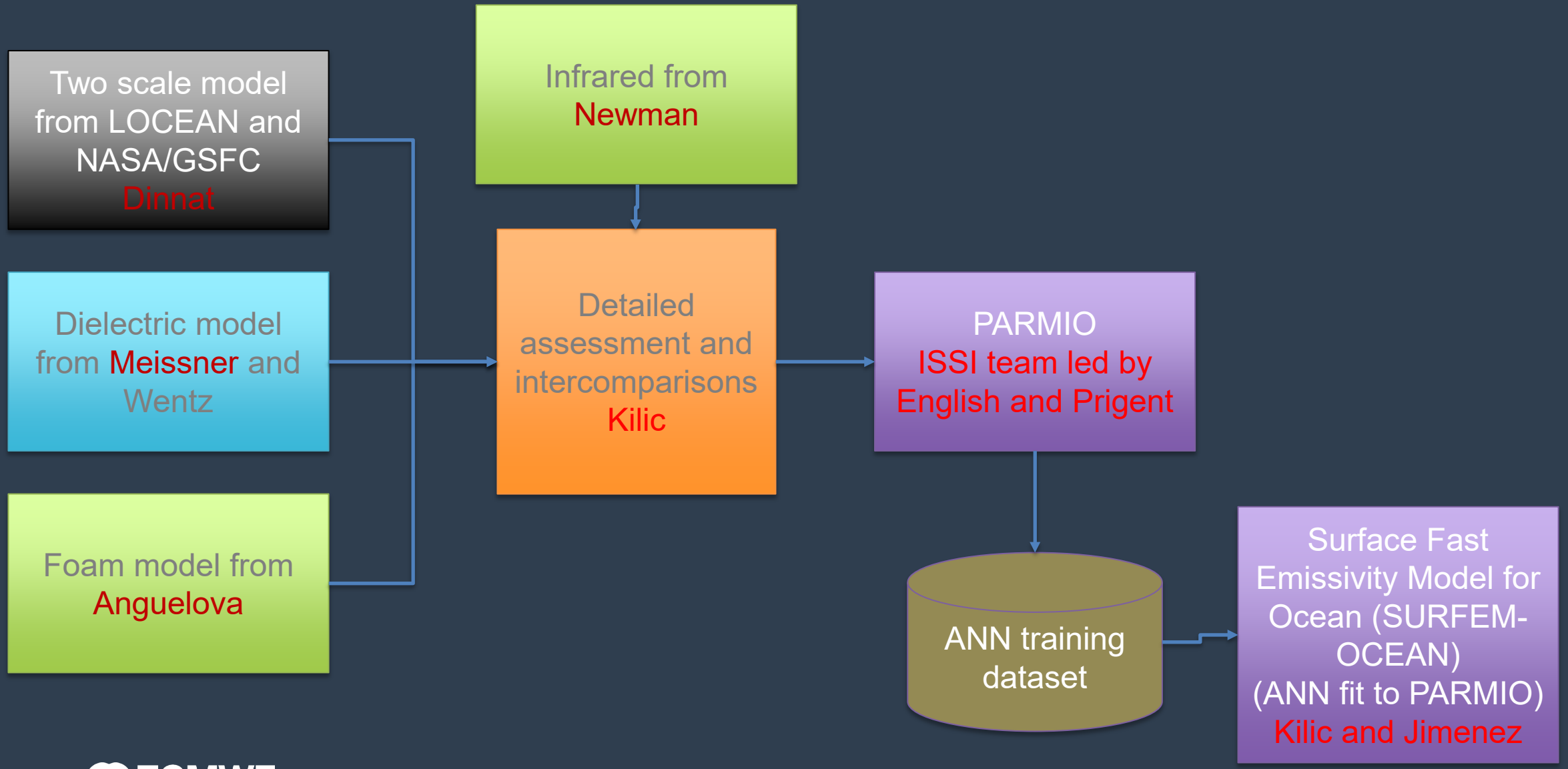
1st meeting 20-22 Nov 2019 10.1175/BAMS-D-20-0085.1 [1]	2nd meeting 30 April 2020	3rd meeting 7-8 Dec 2020	4th meeting 18 May 2021	5th meeting 9-10 June 2022	3Q 2022 Final report and public release of code

2019 2020 2021 2022 2023

Components evaluated	Integration and testing	Uncertainty assessment	Validation and extension
• Dielectric: MW12 [2] • Foam: AG13 [3] • Two scale solver model D03 [4] • Initial assessment [5]	• Build of PARMIO • Github version • Validation e.g. GMI, SMAP • Team and Beta-testers	• Somaraju-Trumpf [6] model • Comparison of closed form (LOCEAN) and general form (NRL) for foam model	• Extension to IR [7, 8] • Extension to Active • Integration • SURFEM-OCEAN

[1] English et. al.,2020, doi: 10.1175/BAMS-D-20-0085.1
[2] Meissner, T., and F. J. Wentz, 2012, doi:10.1109/TGRS.2011.2179662
[3] Anguelova, M. D. and P. W. Gaiser, 2013, doi: 10.1016/j.rse.2013.07.017
[4] Dinnat E. P., J. Boutin, G. Caudal, J. Etcheto, 2003, doi: 10.1029/2002RS002637
[5] Kilic L et al., 2019: doi: 10.1029/2019JC015493
[6] Somaraju R and J. Trumpf, 2006, doi: 10.1109/TAP.2006.884290
[7] Rowe P.M., M. Fergoda and S. Neshyba, 2020, doi: 10.1029/2020JD032624
[8] Newman S. et al., 2005, doi: 10.1256/qj.04.150

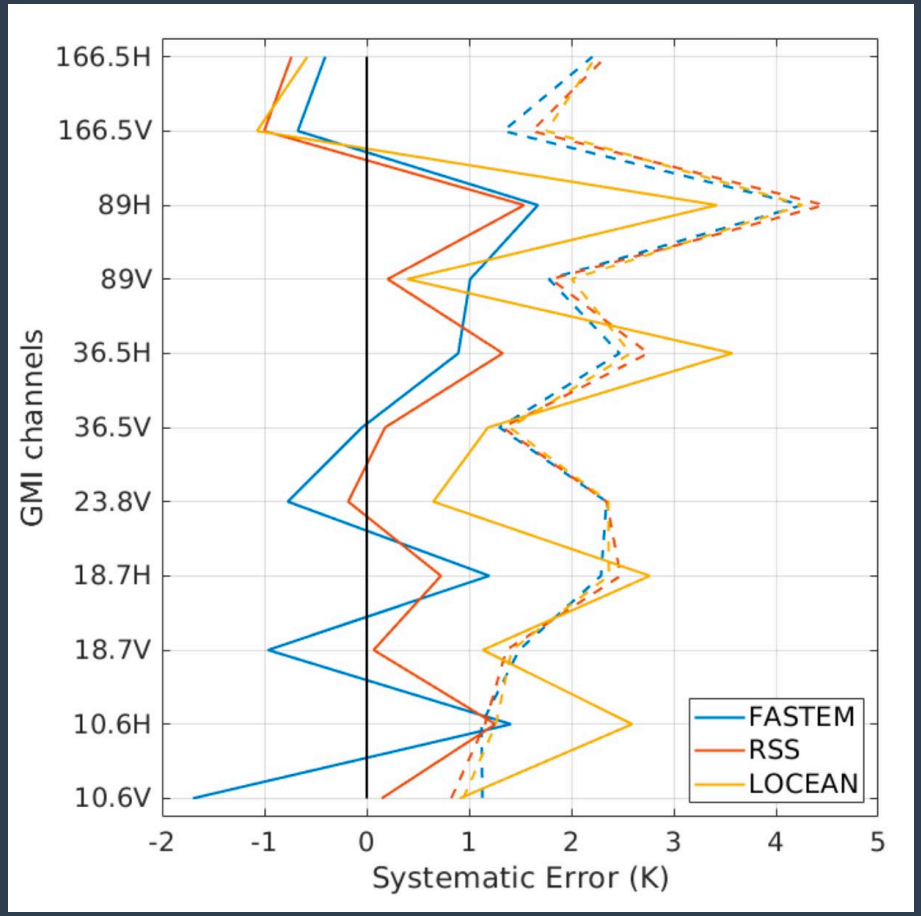
How were elements of PARMIO chosen?



PARMIO uncertainty assessment

Frequency [GHz]	Comparison	Bias (Kelvin)	Std.Dev (Kelvin)
1.41	GWU2020 - MW2012	-0.24	**0.09**
6.9	FASTEM5 - MW2012	0.18	**0.18**
10.7		0.07	**0.16**
18.7		-0.16	**0.14**
37.0		-0.33	**0.39**
85.5	Guillou1998 - MW2012	-0.56	**0.36**

From T Meissner



From L Kilic

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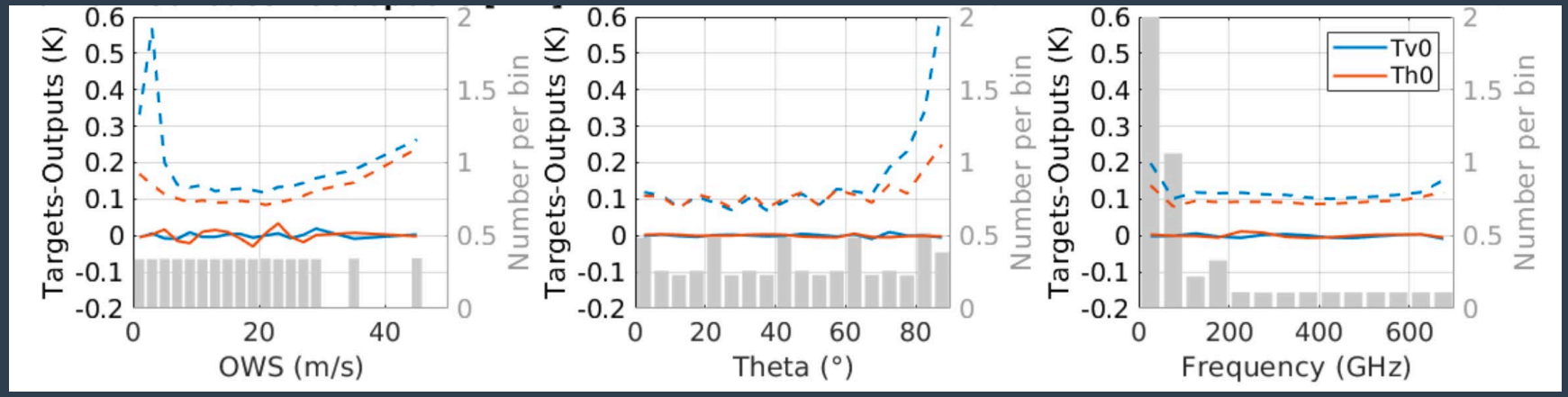
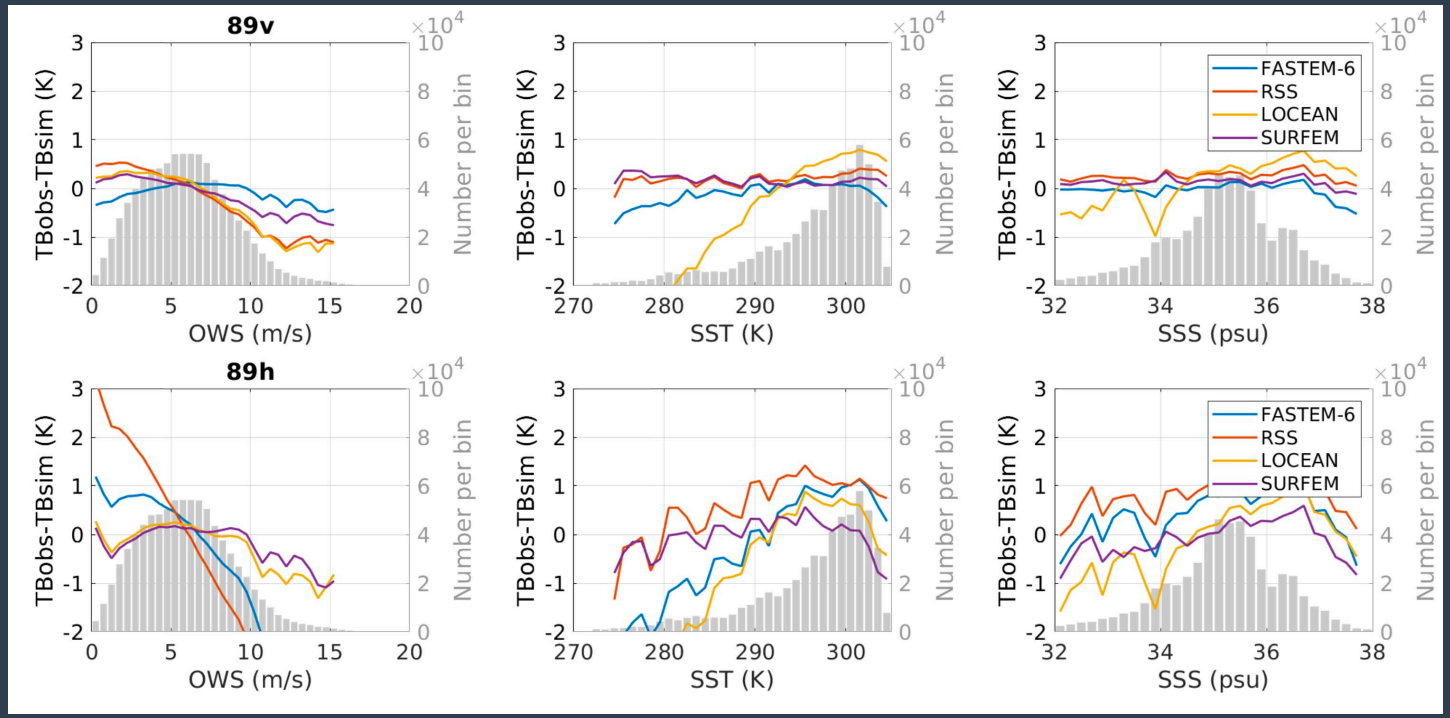
SURFEM—Ocean validation



Figures from Kilic, Prigent and Jimenez



Validation across wide range of frequencies – here 89 GHZ

Conclusions

- PARMIO: a new community ocean emissivity model for Microwave and Infrared
- PARMIO also supports active sensors e.g. SAR, scatterometer, radar
- SURFEM-Ocean: a new fast model aiming to replace Fastem-6 in RTTOV and CRTM
- Uncertainty ~0.1 K low frequency MW to ~0.4 K high frequency MW
- Well validated for passive microwave; preliminary testing for Infrared and Active

For detailed presentations and results visit:

https://www.issibern.ch/teams/oceansurfemiss/

PARMIO code and documentation is on Github and is available to beta-testers general release 3Q/2022 (contact Emmanuel Dinnat, Stephen English or Catherine Prigent)

SURFEM-Ocean code aims for inclusion in RTTOV v13.2, Sept 2022 release (contact Lise Kilic)

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