

Adaptation of turbulence parameterization of meso-scale models to the conditions in marine boundary layers



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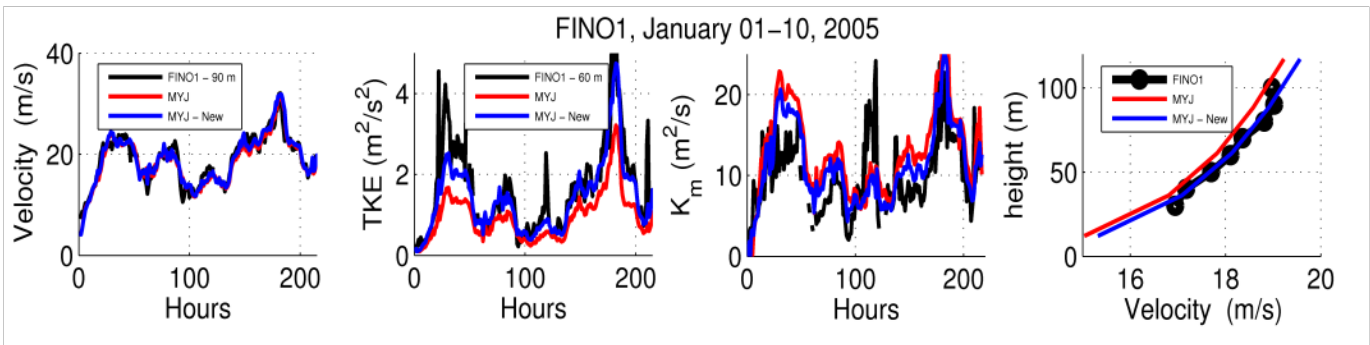
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Introduction

Marine atmospheric boundary layers (MABL) have special features such as a dynamic, wavy surface that is coupled with the turbulence of the air above. We are investigating whether updates to the Mellor-Yamada-Janjic (MYJ) planetary boundary layer scheme in the WRF model are necessary, with a focus on the Turbulent Kinetic Energy (TKE) in the MABL. Results here show improvements both over sea and land.

Results

Simulations with WRF at FINO1 (North Sea) yield too low TKE (red curve). Since experimental data show no clear difference between the levels of TKE over land and sea, the reason must be a general feature of the MYJ scheme. Updates of the model closure constants in MYJ based on recent higher Reynolds number boundary layer data (see Table) seem promising.



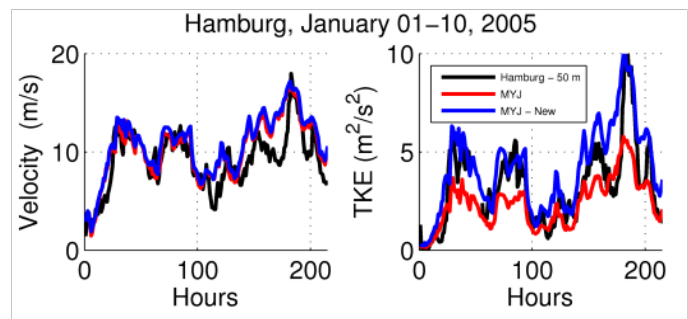
Turbulence parameterization

Model results show an improvement in the calculation of TKE when

- (a) Model constants are updated to be more in line with recent measurements (see Table).
- (b) The master length scale in the model is modified based on suggestions in Nakanishi (2001).
- (c) Mean wind speed is well predicted.

Conclusions & Outlook

These changes have been found to give up to a 40% and 20% (RMS) improvement in the calculation of TKE and the momentum exchange coefficient, respectively. Further work investigating updated parameters under a range of conditions is ongoing.



Acknowledgments

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References

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Author	Re ($\times 10^4$)	$\frac{u'_r}{u_*}$	$\frac{v'_r}{u_*}$	$\frac{w'_r}{u_*}$	$\frac{q}{u_*}$	$B_1 = \left(\frac{q}{u_*}\right)^3$
Österland (1999)	2.25	2.3	1.55	1.05	2.97	26.2
Carlier & Stanislas (2005)	2.06	2.31	1.52	1.06	2.96	25.9
<u>Mellor-Yamada Models:</u>						
Mellor & Yamada (1982)	-	1.9	1.2	1.2	2.55	16.6
Current WRF	-	1.70	1.07	1.07	2.28	11.9
Updated here	-	1.97	1.57	1.57	2.96	26.0