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Modelling the Diurnal Variability of Sea Surface Temperatures

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For y ni ersity of Re ding no t Dep rt ent of E rth ciences, i on Fr ser ni ersity, B rn y, British Co i , A , C n d
s pi en

he st dy i so se the c ssi tion of s th t t es into cco nt the ertic te per t re str ct re of the pper oce n s introd ced y Don on et nd sed y the G o Oce n D t Assi i tion E peri ent GODAE igh Reso tion e rf ce e per t re Pi ot Pro ect G R PP

he p per proceeds s fo o s A c gro nd to di rn cyc e ode ing nd the ode set p sed in this or is gi en in ection Res ts fro so e initi e peri ents perfor ed t pper oce n ooring sites re presented in ection his or is then e tended to the se of oper tion d t sets in ection n ection di rn ri i ity ps in the At ntic re prod ced nd co p red to s te ite deri ed e s re ents Fin y conc sions re gi en in ection

2 Modelling

2.1 Background

One di ension ode ing of the oce nic i ed yer h s een ide y sed in the de e op ent of t r ence nd ir se p r eteris tions ch ode s re so s it e for ode ing di rn ri i ity of s they c n h e ch gre ter ne r s rf ce ertic reso tion th n c n e chie ed in f oce n GCM Mi ed yer ode ing c n gener y e c tegorised into t o ro d ppro ches nd di sion B in ode s tte pt to ode the i ed yer in n integr sense e g nd co p re s d dr et sed grid yer of c , incre sing e ponenti y ith depth to c , hen co p ring ode o tp t to AA R o ser tions

he penetr tion of so r r di tion is so critic for di rn ode ing A sing e spectr nd p r eteris tion is sti ide y sed e g nd despite its cr de str ct re orroc s et i p e ented 9 nd p r eteris tion hi e s orth e peri ented ith se er p r eteris tions inc ding deco posing the f so r spectr into inter s n recent ye rs ore ttention h s een gi en to the io ogic i p ct on so r sorption

o tt in the te por reso tion for di rn ode ing st dies d t fro the OGA COARE sites re often sed, here high freq ency eteoro ogy e ery in tes is i e 9 , , nd Bernie et perfor ed e peri ents sing di erent freq encies nd conc ded th t to c pt re 9 of the di rn ri ity of , ho r y forcing s req ired o er, orroc s et sed ho r y s rf ce es fro MO N P n yses nd then gener ted on y

freq ent the 9 ho e ing de R R

3.1 Data

rf ce Meteoro ogic nd oce n te per t re o ser tions re o t ined fro the oods o e Oce nogr phic nstit tion O pper oce n ooring d t rchi e e se ti e series fro three dep oy ents COARE . Ar i n e . nd the d ction site Det i s of e ch ti e series is gi en in e dep o ho r y periods, the nor o tp t for t nd freq ency fro N P ode s his o s s to ssess the degr d tion fro di rn ode ing th t o d e e pected fro sing the N P prod cts o er ch ider re s

Di rn y rying so r R forcing is the essenti dri er of the di rn cyc e rf ce inso tion nder c e r s ies, I , s c c ted, t e ery ti e step sing the ppro ch of Ros ti nd Miy od he Reed for

I I C_n n : 9 ;

is then sed to deri e the tot s rf ce so r r di tion, here n is the fr ction c o d co er, c_n, the c o d co er coe cient is set to , is the so r noon ng e, nd the edo his for is on y sed for higher c o d o nts : n , C d c o d

A di rn r ing sign of zero is gi en if the t the st rt is so respecti e y his co p res ith the corresponding e n o ser ed di rn r ing sign s of : C, : C, nd : C h s the di rn ode is cc r te on er ge to ithin tenth of degree for e ch ti e series, ith the Ar i n e site eing ost c ose y rep ic ted his s ggests th t the di rn cyc e c n e e ecti e y ode ed ith ho r y forcing d t , tho gh it is possi e th t there re oc tions here the occ rrence of sh rp ind rsts ro nd idd y re ore pre ent, th s h pering the ode ing e ort Nonethe ess the st nd rd o tp t fro oper tion e ther forec sting centres is ho r y nd the res ts in e sho th t ode ing the di rn cyc e of s er the g o oce n sho d e possi i ity his topic is ddressed in the ne t section

	RM Errors			
ite	C	Di rn r ing C	MLD	tr ti tion C
COARE	9		9	
Ar i n e	9		99	
d ction				

e **Statistics from comparisons derived from observations and model simulations forced with 6 hourly data and initialised daily at the mooring sites.**

4 NWP Forcing Experiments

n this section the GO M ode is set p to se N P forcing d t on rger sp ti do in he se of N P d t in di rn ri i ity ode ing is f r fro ide , p rtic r y ith reg rds to the se of ho r y ind stress es, s the di rn cyc e c n e e tre e y sensiti e to the sc e ind str ct re o er the st section sho ed th t hen GO M is forced ith ho r y e n d t t the ooring sites it c n re son y c pt re the or

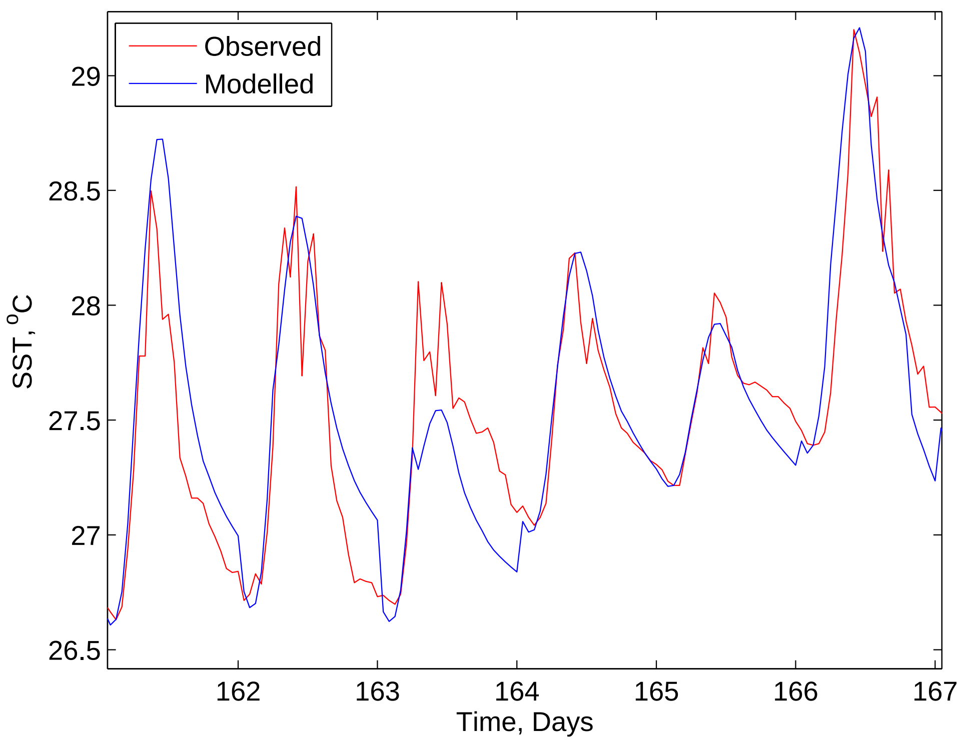


Fig re **Example of the modelled and observed diurnal warming signal at the Arabian Sea site.**

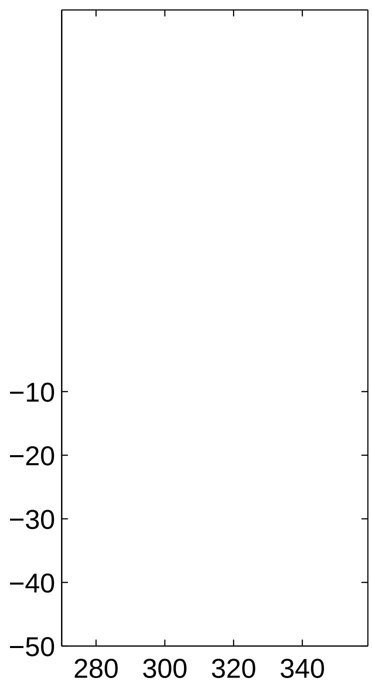
MO Forec sting Oce n Assi i tion Mode FOAM g o ode pro ides n yses of oce n te per t re nd s inity t depths , , , , 9 , nd 9 etres t GM

te ite o ser tions inc de co in tion of infr red E R nd feed c et een the ode ed nd the es, nd pre i in ry e peri ents fo nd this to e etter th n sing the prescri ed es fro ECM F

he ch nge in so r ith depth into the oce n is p r eterised s s of e ponenti s

$$\mathbf{f} \; \mathbf{z} \quad \sum_{i}^{n} \mathbf{A}_i \, e \;\; p \quad \mathbf{K}_i \mathbf{z} \; :$$

n the pre io s section this s deter ined sing 9 nd p r eteris tion A tho gh the 9 nd p r eteris tion co di erences i e ch r cteristic of ny initi o set r ther th n di erences de e oping thro gh the d y he GO M initi pro es re o t ined fro the MO oper tion oce n prediction syste , FOAM ,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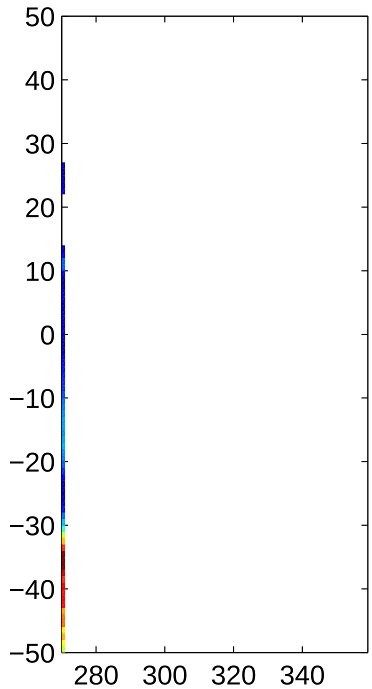
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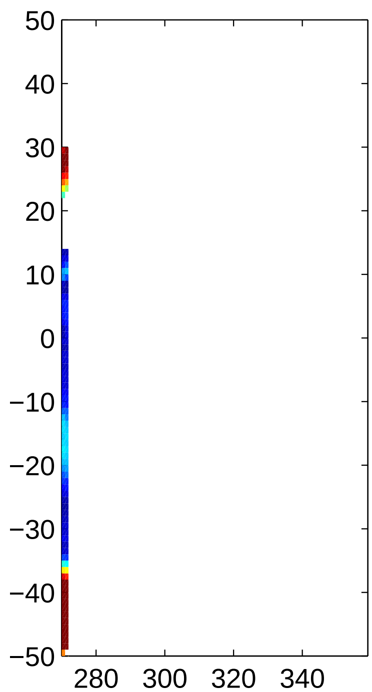
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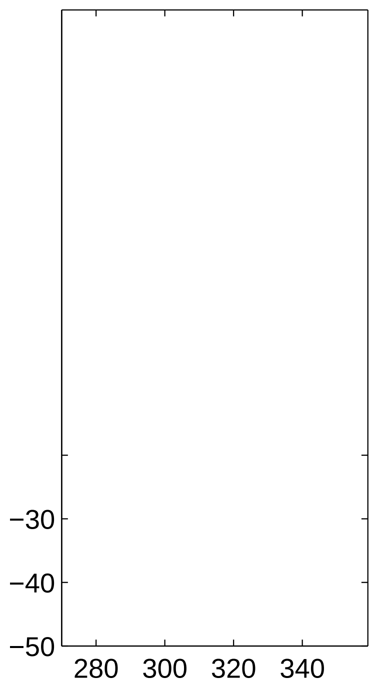
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5.2 Satellite Validation

o ssess the cc r cy of the ode ed di rn r ing esti tes, G R , L P o ser tions fro E R , AM R E, nd M re co p red to ho r y ode o tp t he res ts presented in e on er ge his sho d e e pected s O A represents night ti e or fo nd tion te per t re, i e the ini te per t re to e e pected d ring the d y, here s the tch ps here co p re o ser tions, inc ding those th t cont in di rn sign hen co p red to the GO M o ser tion co p risons in e e see th t

O A

6 Discussion and Conclusions

Progress h s een de in nderst nding nd ncing the i ity to n eric y ode di rn ri i ity t the ne r s rf ce oce n A ide y sed one di ension i ed yer ode , GO M, is opti ised for the p rposes of di rn cyc e ode ing sing st te of the rt p r eteris tions for ir se nd oce n r di nt he ting t is t ned g inst high freq ency hese de e op ents in di rn ode ing re i t on in co p nion p per th t descri es no e d t ssi i tion ethod hich ti ises di rn

P F ent, Firing, M yer, nd C refois A p it de nd horizont str ct re of rge se s rf ce r ing ent d ring the Co st Oce n Dyn ics E peri ent **J. Phys. Oceanogr.**, 9 99

C Gi n nd C G rrett e t p r eteriz tion for the Mediterr ne n e he ro e of t ospheric eroso s nd constr ints fro the ter dget **J. Geophys. Res.** 99 9 99

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L A orroc s, A R rris, nd R nders Mode ing the di rn ther oc ine for d yti e fro AA R echnic Report FR , Met O ce,

N G er **Marine Optics** E ier, 9

L nth nd C A C yson An i ed i ed yer ode for geophysic pp ic tions **J. Geophys. Res.** 99 99

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ri i ity in the estern eq tori