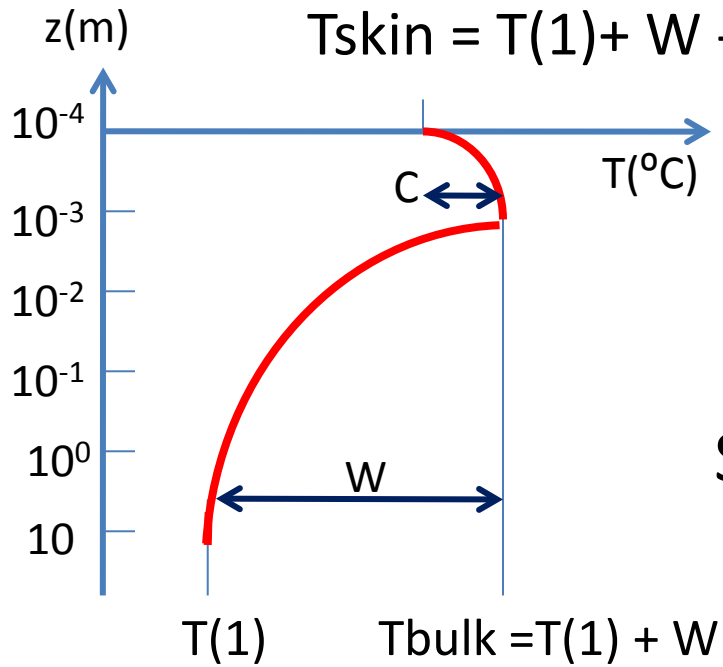
Diurnal cycling in coupled Ocean GCMs

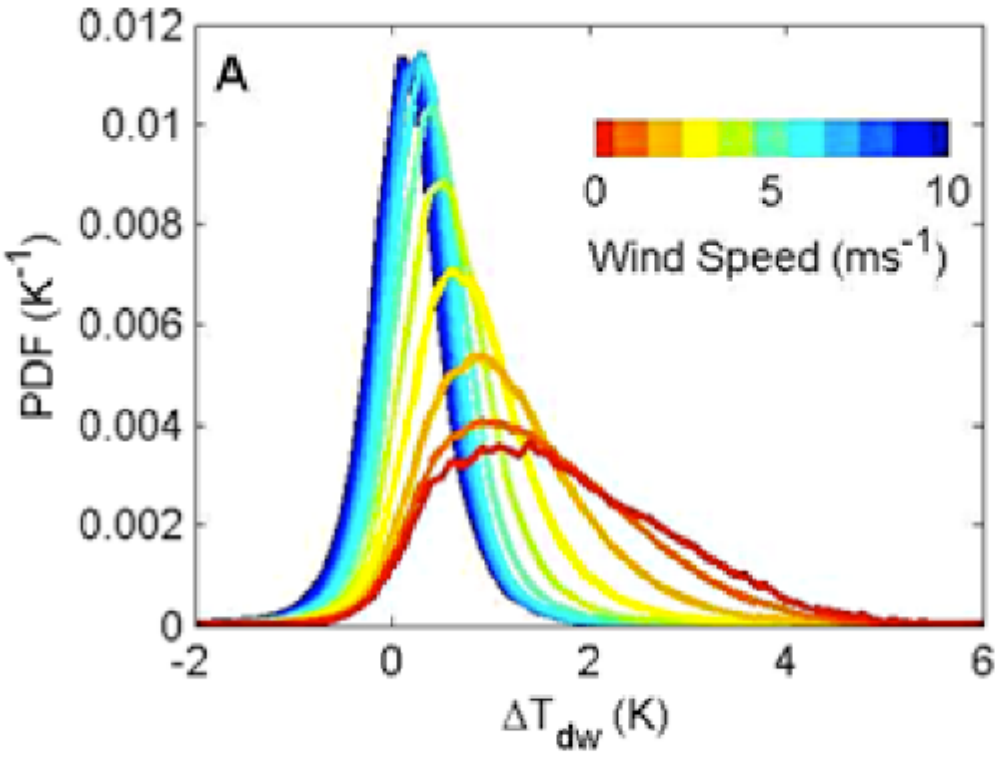


$$LW\uparrow = \sigma\,(Tskin)^4$$

$$Evap \;\; \alpha \;\; (qair - qsat[Tbulk])$$

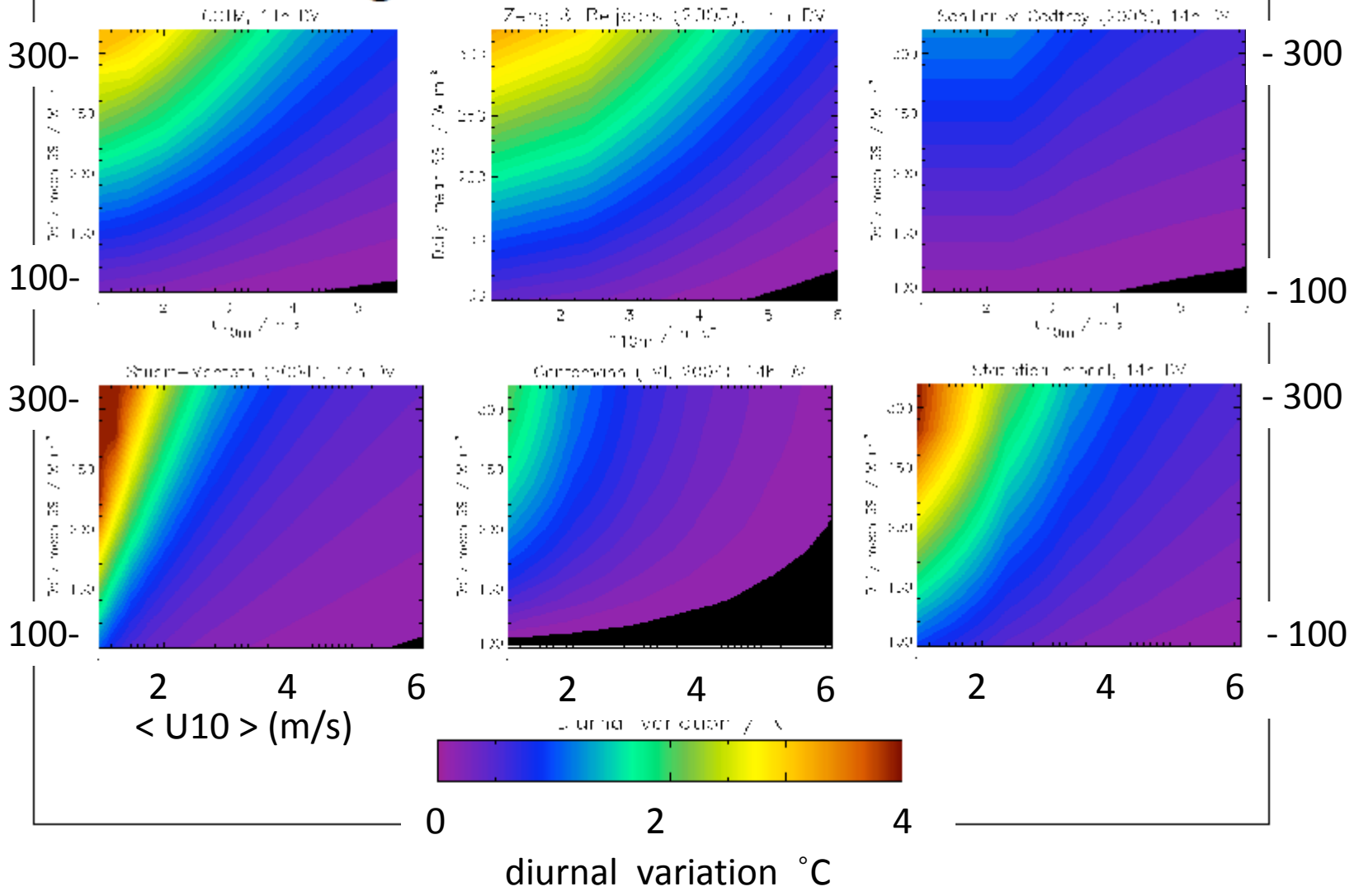
$$Sen.\ Heat\ \alpha \;\; (Tair - Tbulk)$$

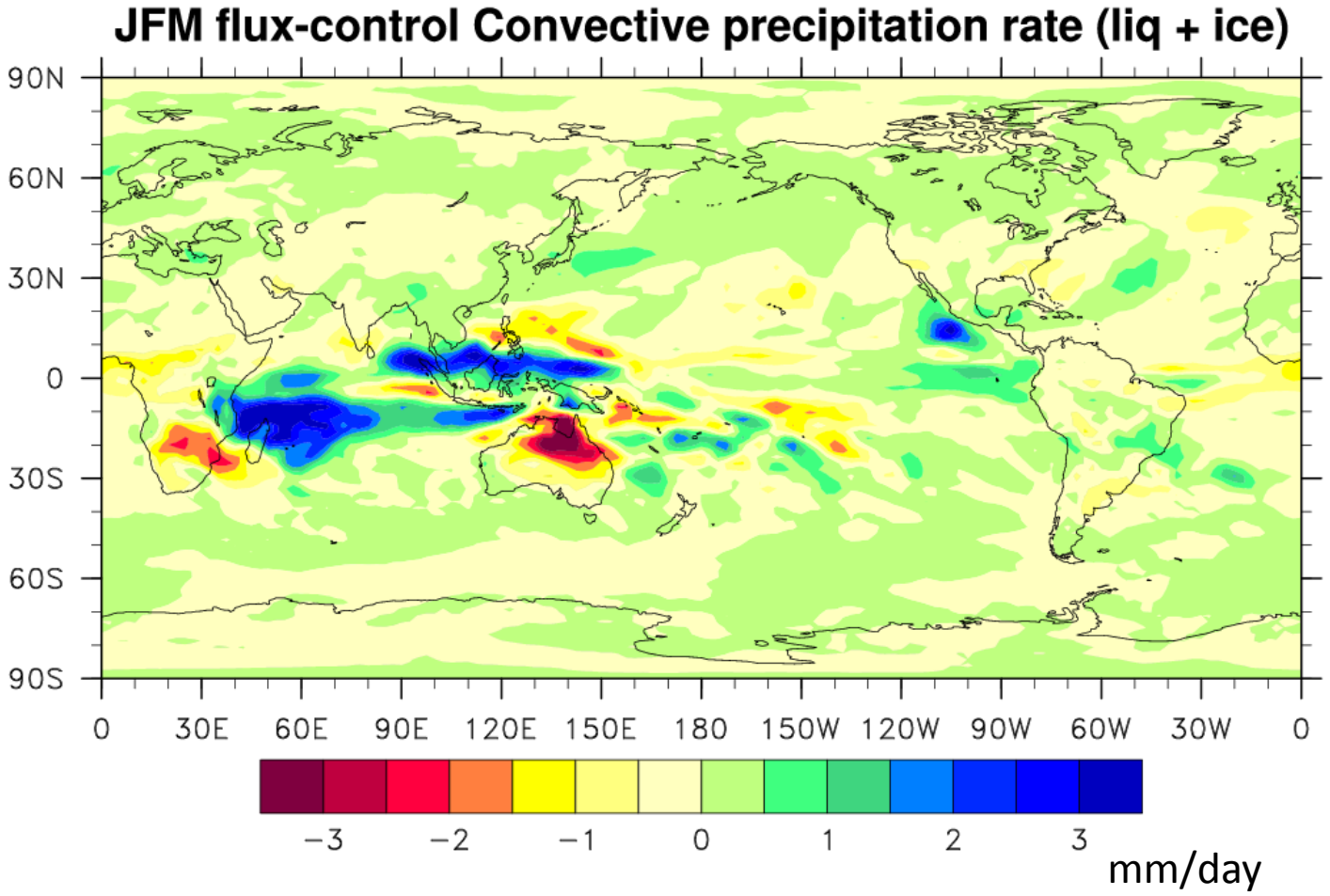
For models whose numerics preclude either order cm resolution OR frequent coupling :

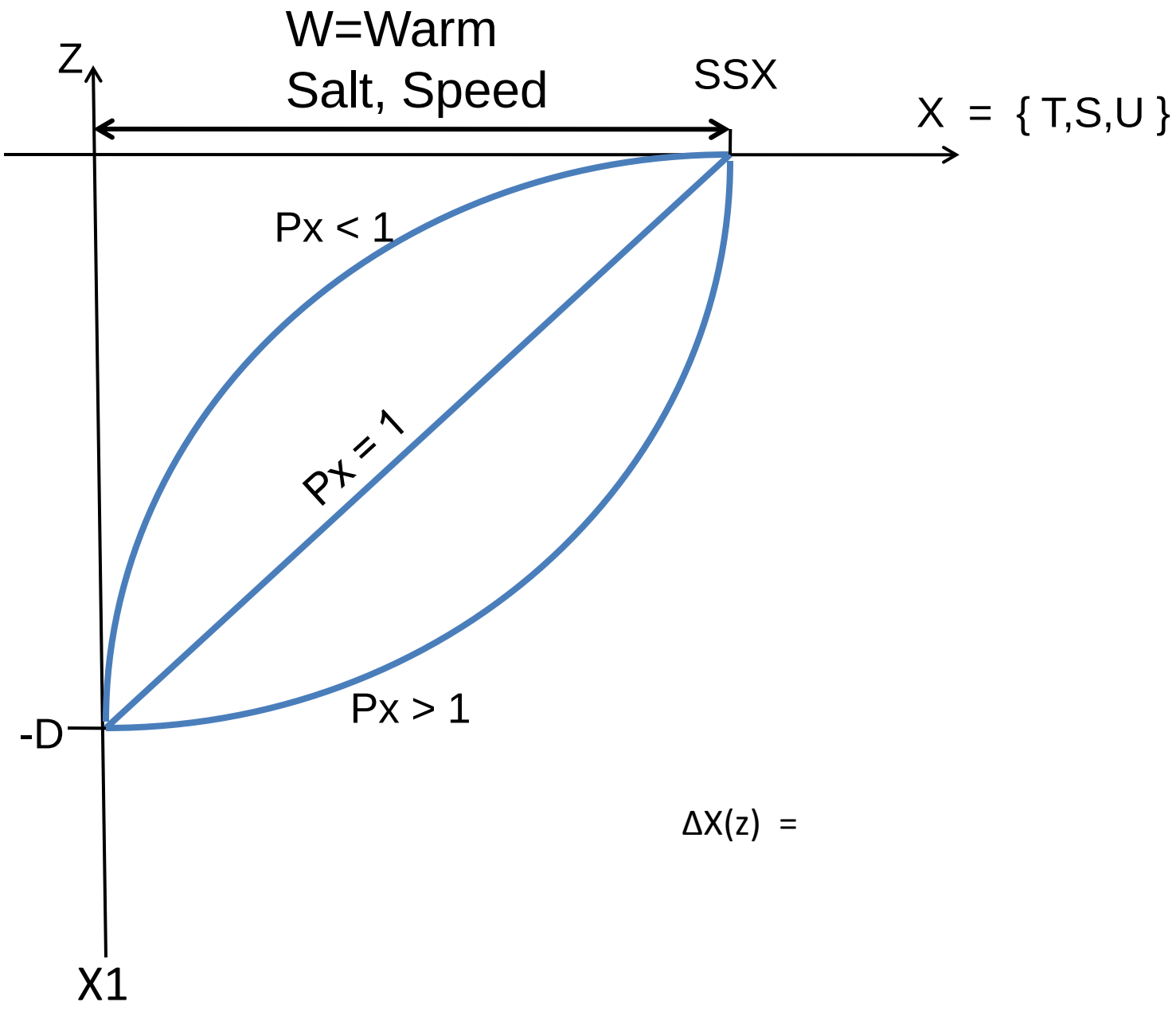


- Distribution of dSST observed by SEVIRI at 2 pm LT
- Stratified by AMSRE (~1.30 pm) wind speed
- Amplitude determined by SSI(t), Qnon-solar(t) and U(t)

Range of model behaviours



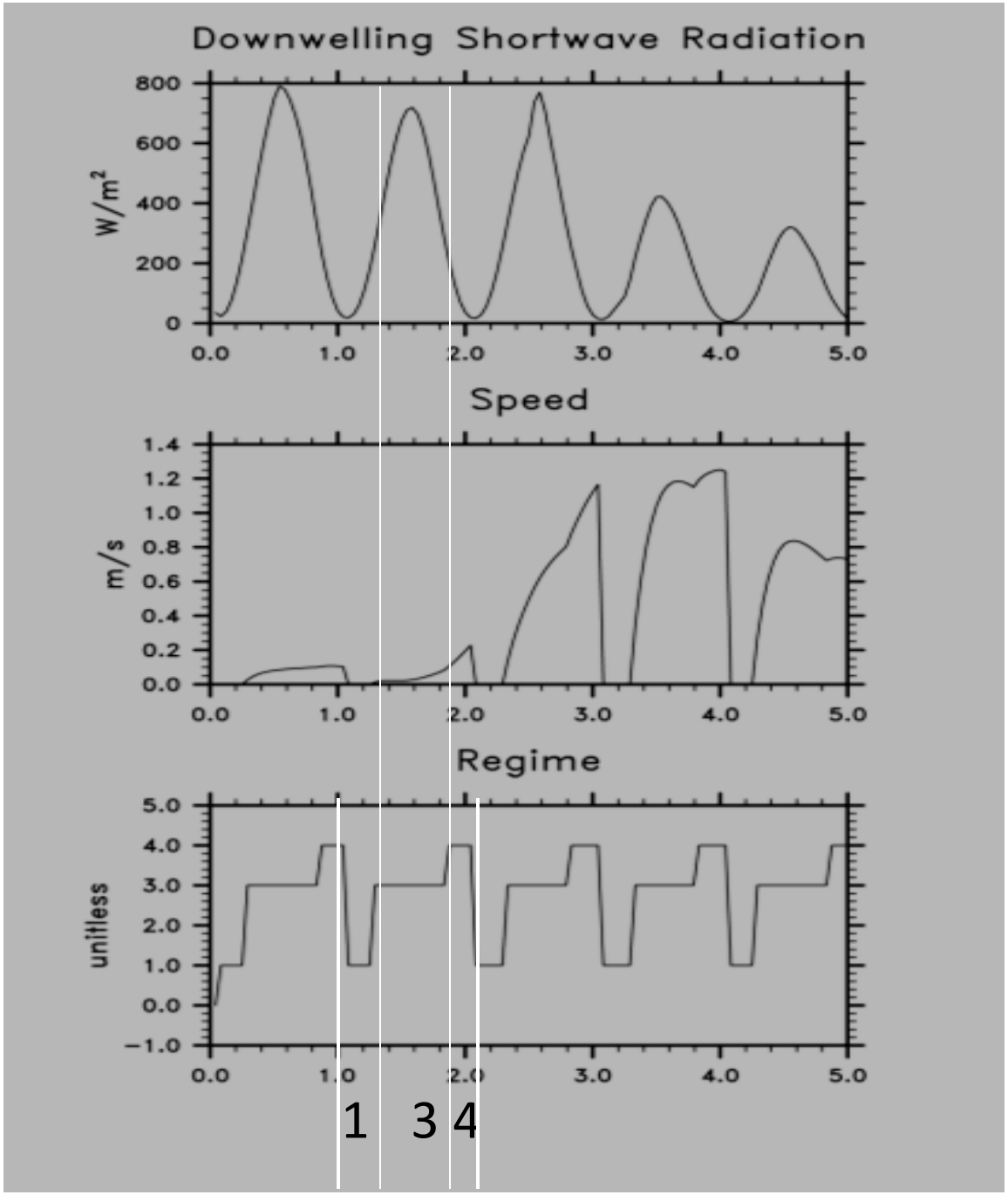

JFM flux-control Convective precipitation rate (liq + ice)
90N
60N
30N
0
30S
60S
90S
0
30E
60E
90E
120E
150E
180
150W
120W
90W
60W
30W
0
−3
−2
−1
0
1
2
3
mm/day

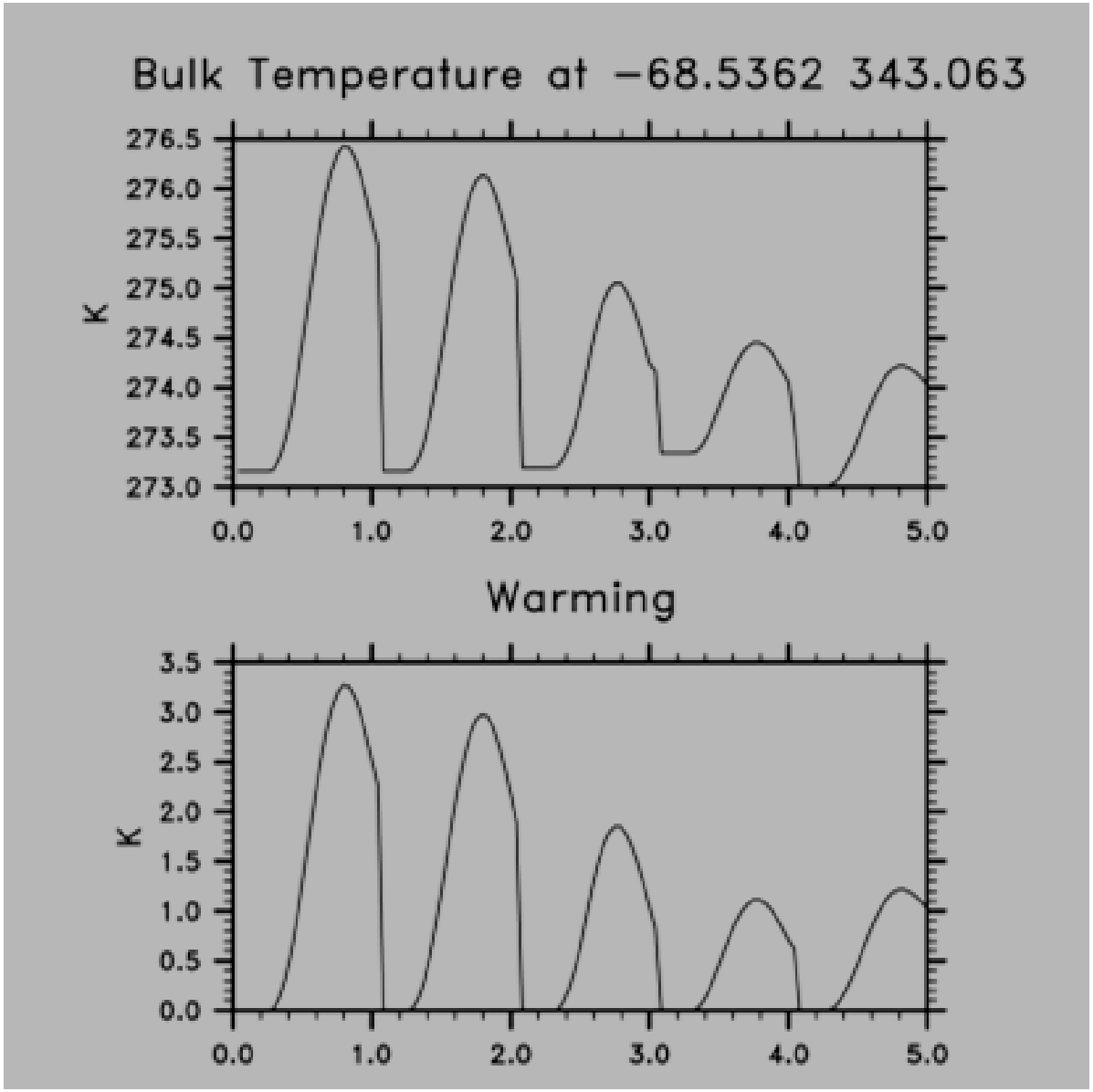


$\Delta X(z) =$

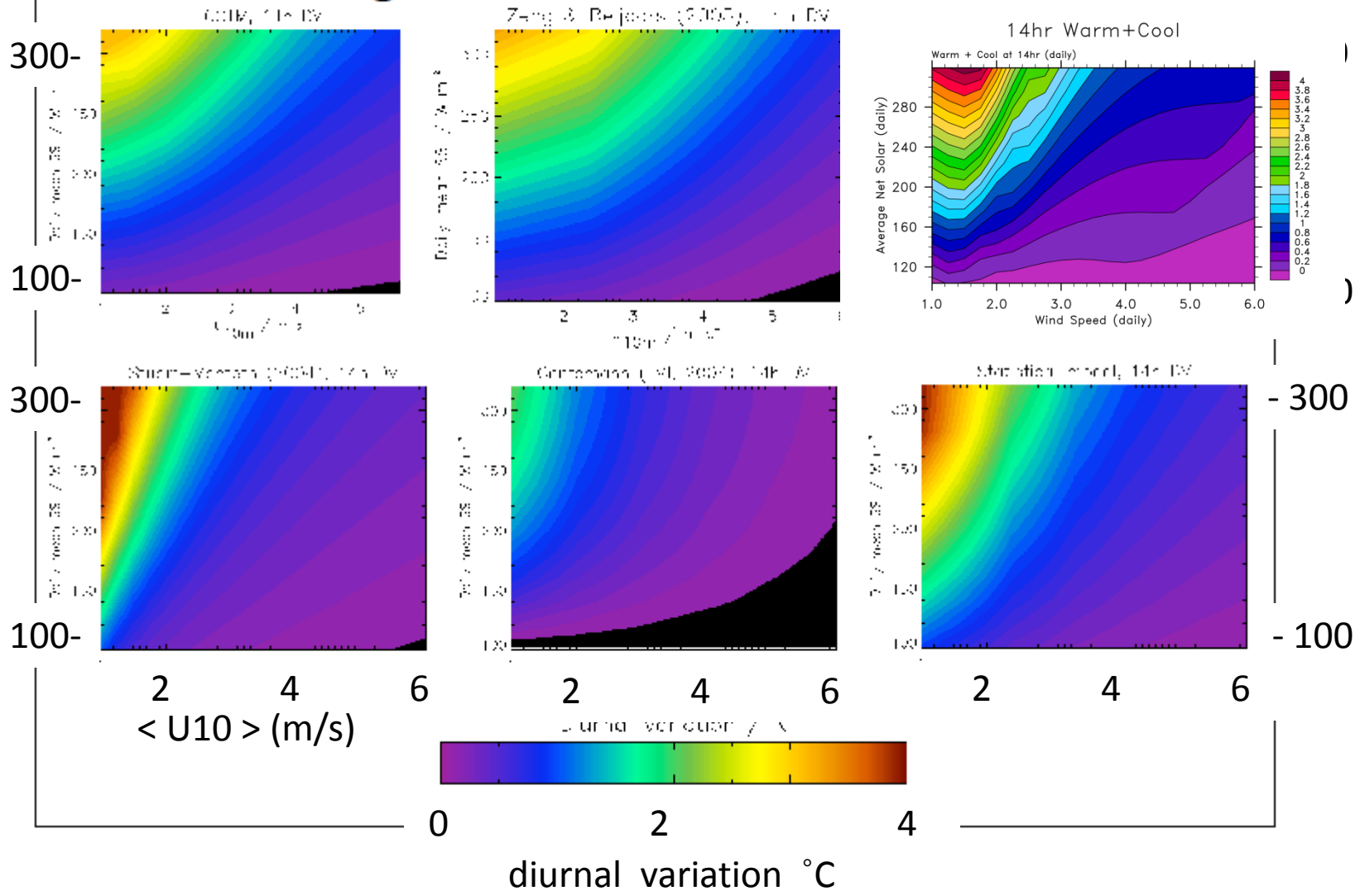
REGIMES

	Buoyancy Forcing	L
0	Positive at midnight	>0
1	convective at midnight	<0
2	Positive	L > D
3	Positive	L < D
4	convective	<0 W>0

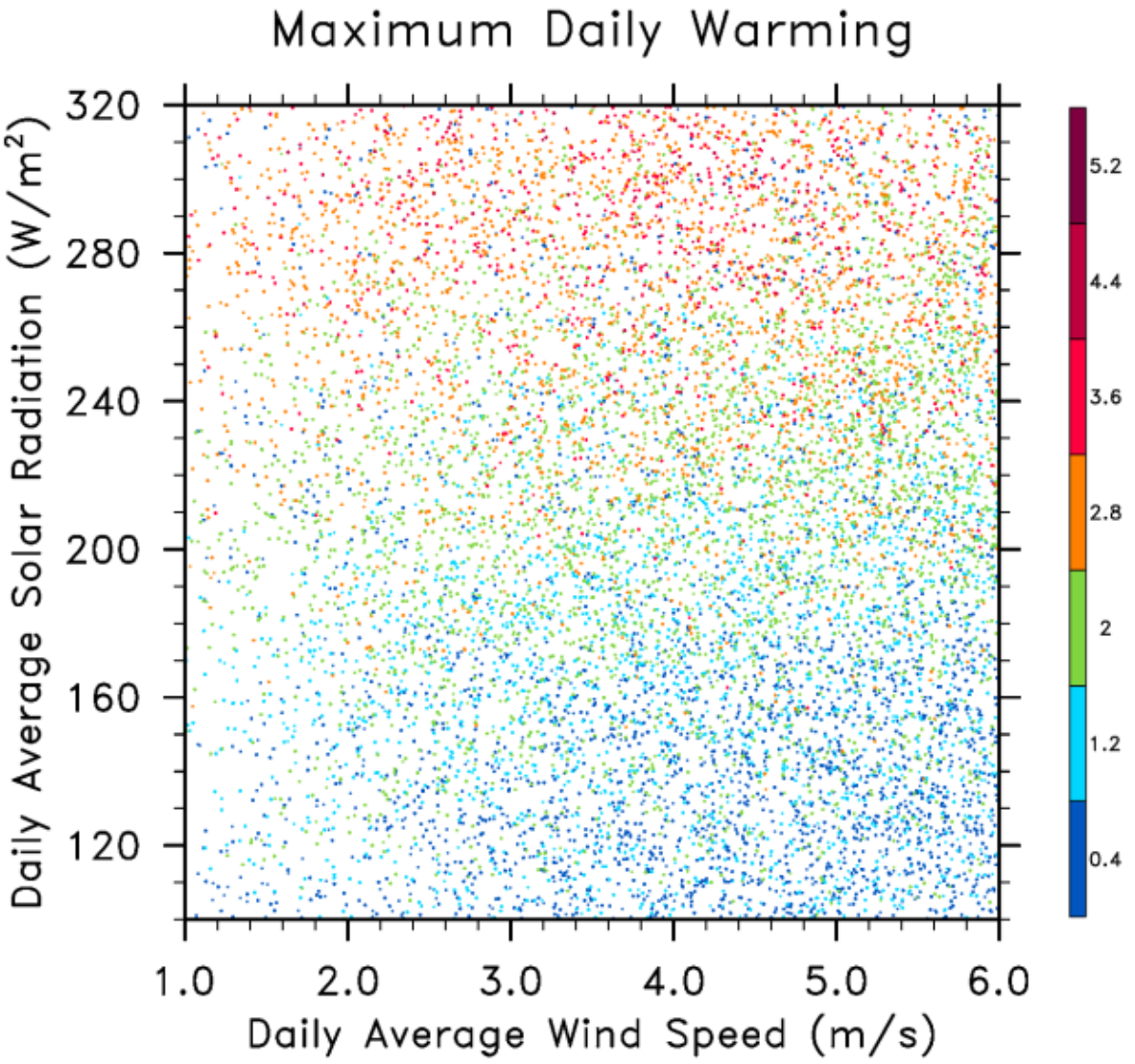



Bulk Temperature at −68.5362 343.063
K
276.5
276.0
275.5
275.0
274.5
274.0
273.5
273.0
0.0
1.0
2.0
3.0
4.0
5.0
Warming
K
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
1.0
2.0
3.0
4.0
5.0

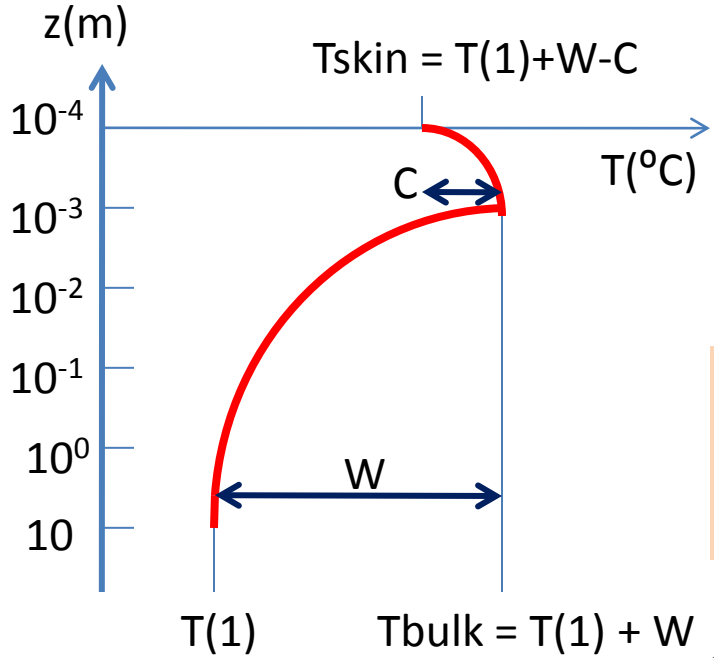
Range of model behaviours



Subtropical Atlantic



Diurnal cycling in coupled Ocean GCMs



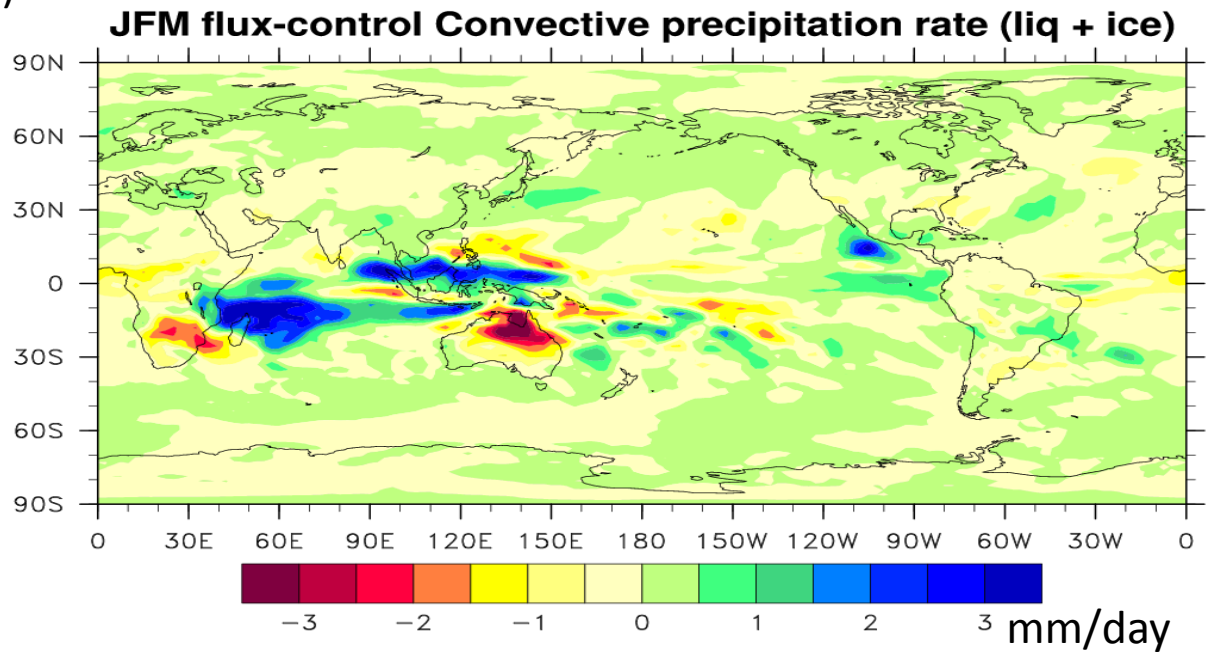
For models whose numerics preclude either order cm resolution or frequent coupling :

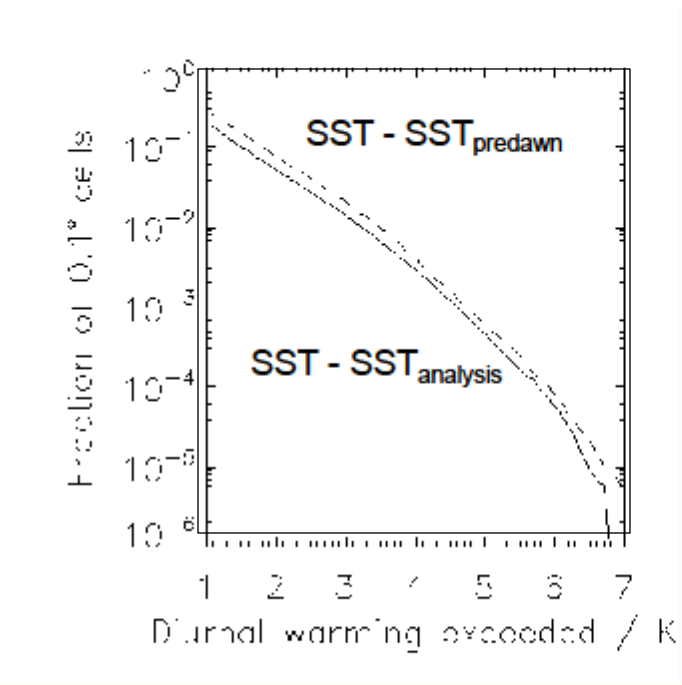
Compute for every atmosphere time step n ---

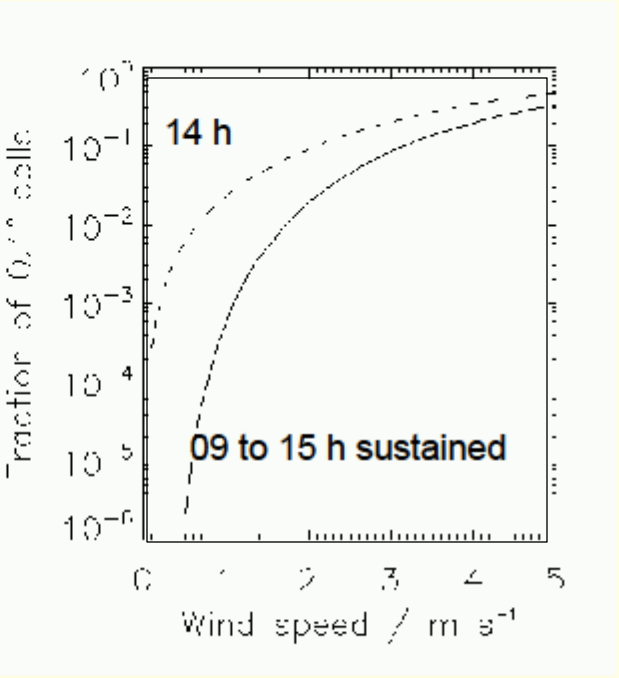
$W_{n+1} = W_n + Fw\ (Qsol, Qnsol, P\text{-}E, \mathbf{U})_n$

$C = Fc\ (Qsol, Qnsol, P\text{-}E, \mathbf{U})$

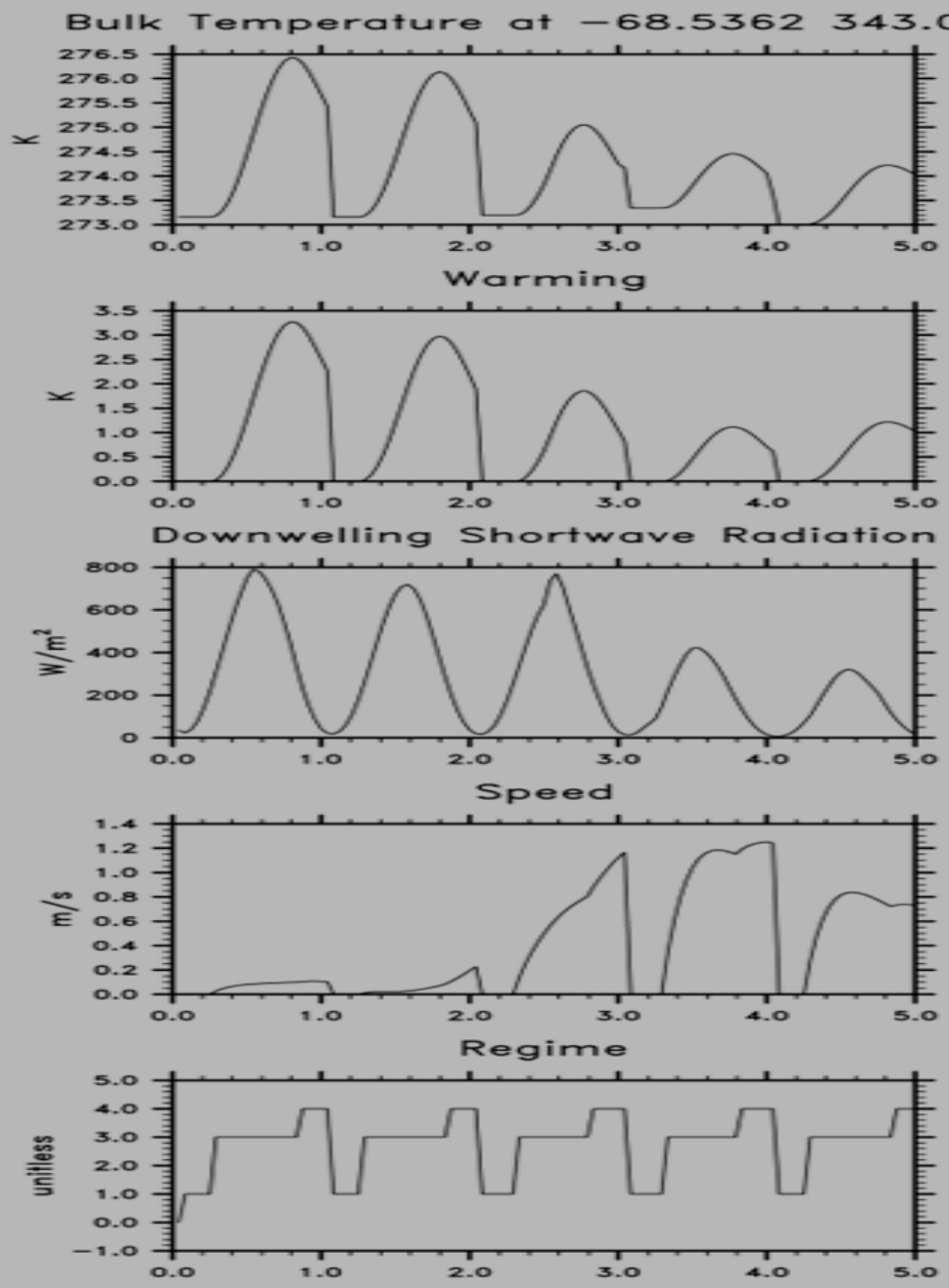
Significant impacts of ad hoc scheme say build defensible model, and verify against (satellite) observations !!!

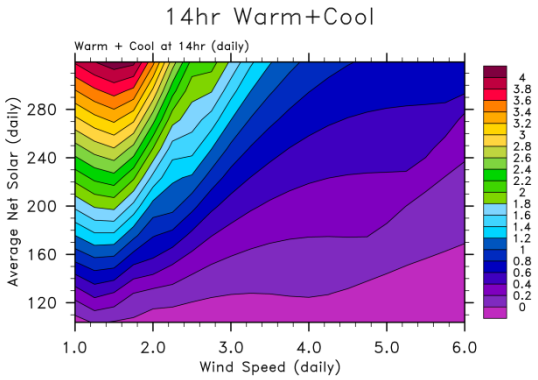






Instantaneous low winds are too frequent to “explain” the full range of dSST


Bulk Temperature at −68.5362 343.063
K
276.5
276.0
275.5
275.0
274.5
274.0
273.5
273.0
0.0
1.0
2.0
3.0
4.0
5.0
Warming
K
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Downwelling Shortwave Radiation
W/m²
800
600
400
200
0
Speed
m/s
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Regime
unitless
5.0
4.0
3.0
2.0
1.0
0.0
−1.0


14hr Warm+Cool
Warm + Cool at 14hr (daily)
Average Net Solar (daily)
280
240
200
160
120
1.0
2.0
3.0
4.0
5.0
6.0
Wind Speed (daily)
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0