Evaluation of TRMM Latent Heating Algorithms in Different Global Convective Regimes

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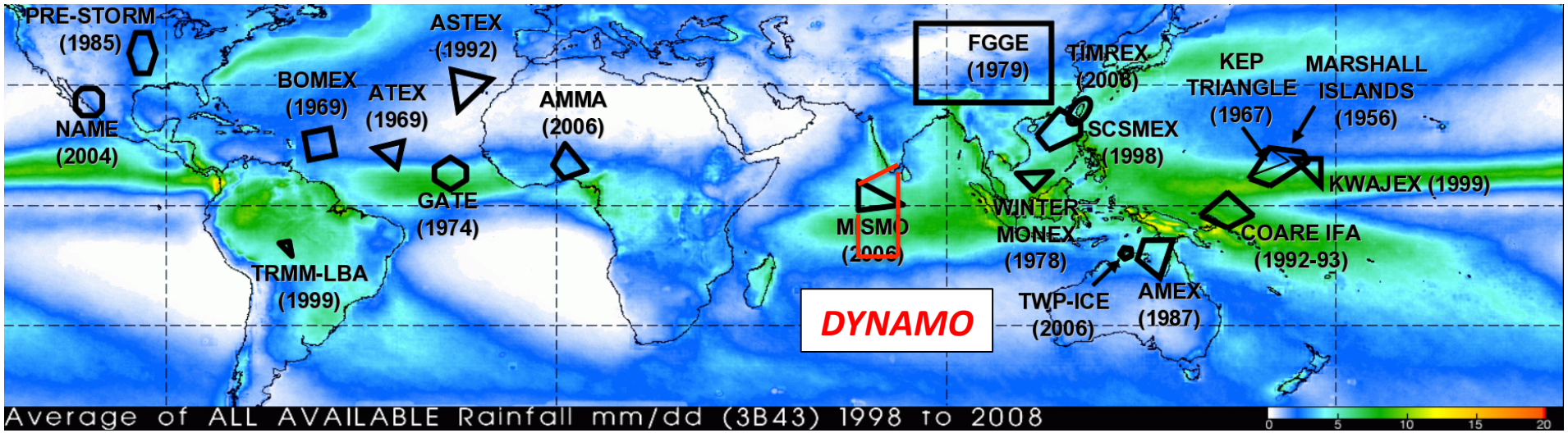
PMM Science Team Meeting, 8 November 2011

Locations of Tropical/Midlatitude Sounding Network Field Campaigns in Relation to TRMM-mean Precipitation



- *Majority of networks in tropics have been over oceans*
- *Some in coastal environments with strong land/sea breeze effects*
- *A few in trade wind regimes*

Validation of TRMM LH Algorithms

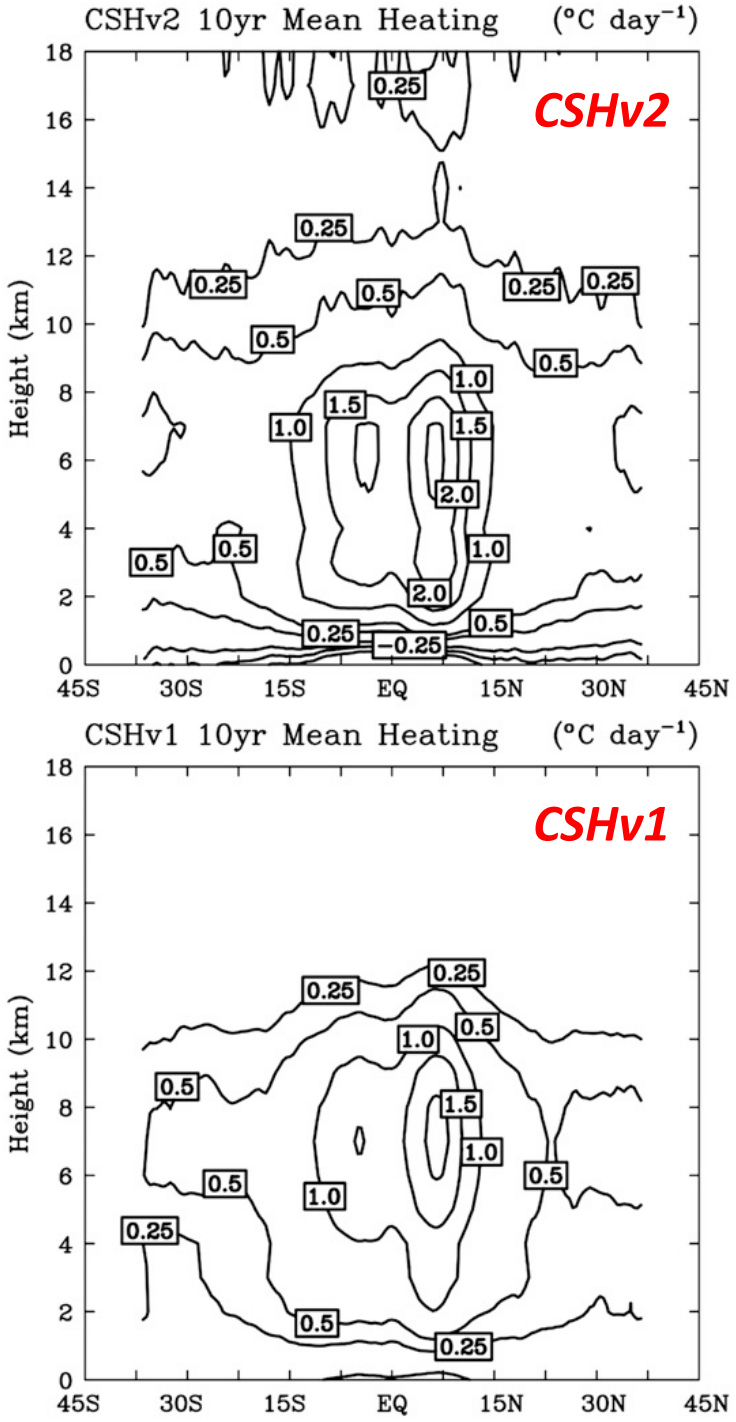
- Direct observations of latent heating not possible; estimates inferred from sounding networks, Doppler radars
- Comparisons of early versions with reanalyses: differences in TRMM estimates (especially for shallow heating) greater than among reanalyses
- Recent comparisons of CSH, SLH, TRAIN with reanalyses in context of MJO (e.g., Jiang et al. 2011; Ling and Zhang 2011) do not find westward tilt of heating as seen in reanalyses; Q_R does show westward tilt
- Version 7 LH algorithms to be released soon

New CSH Algorithm (CSHv2)

Tao et al. (2010, *J. Clim.*)

Differences between v1 and v2:

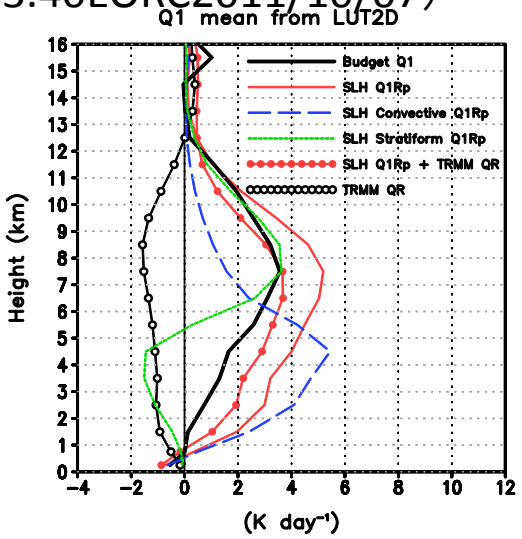
- *Increase in low- and midlevel heating*
- *Lower level of peak heating by 1 km*
- *Larger differences between land and ocean*



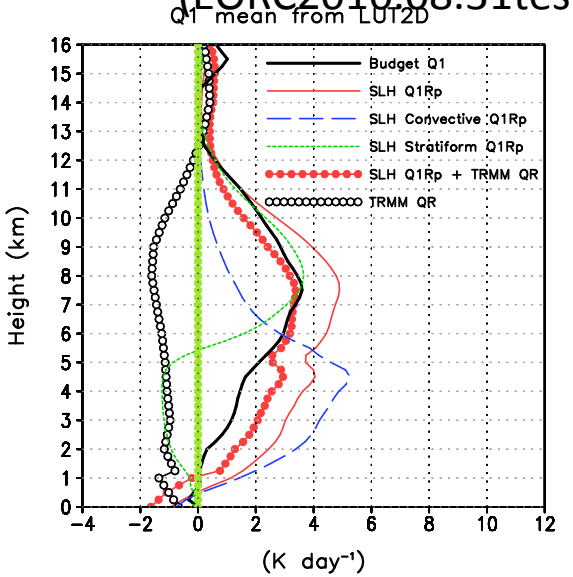
SLH v7 Algorithm (Takayabu talk yesterday)

SCSMEX

SLH for PR2A25 V7
(V3.40EORC2011/10/07)



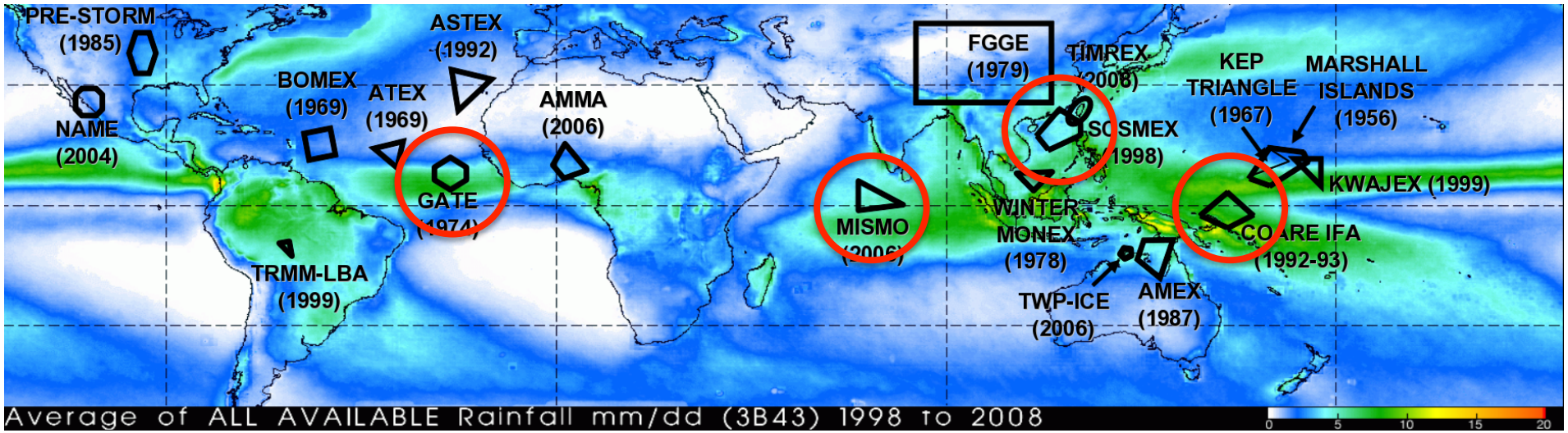
SLH for PR2A25 V6 but with GANAL
(EORC2010.08.31testv30a4)



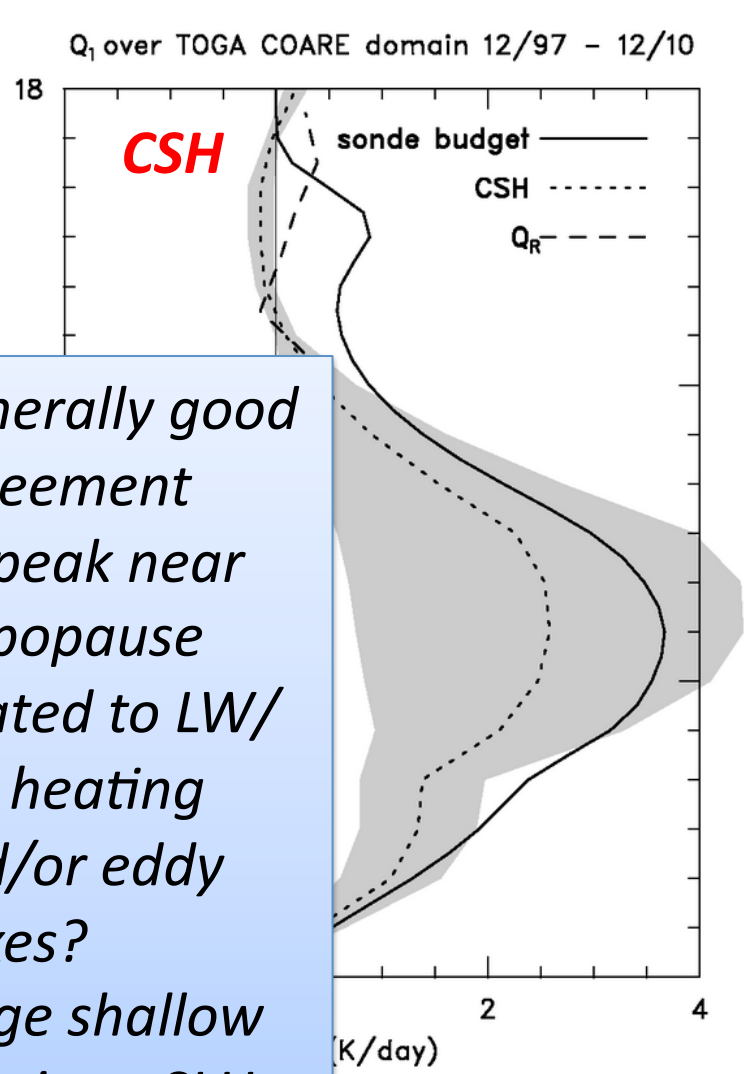
Comparison with Field Campaign Data

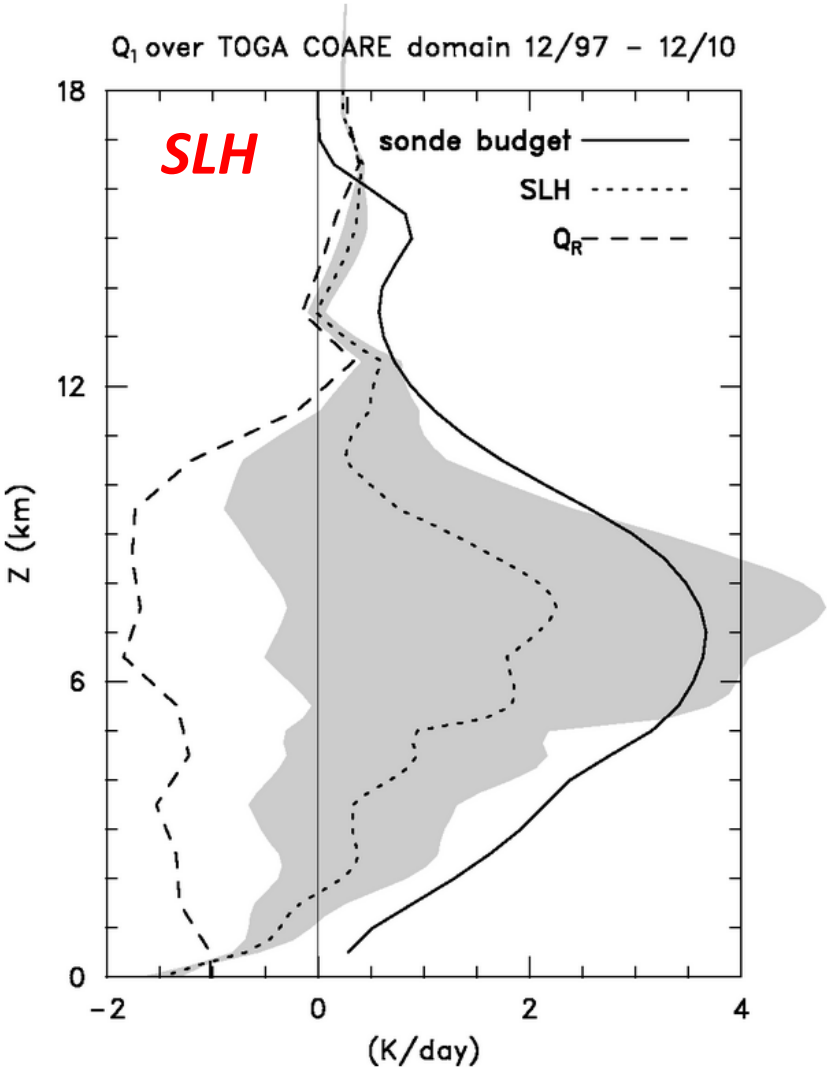
- CSH (Tao et al.) and SLH (Shige et al.) v6 used
- SLH $Q_1 - Q_R$ converted to Q_1 using L'Ecuyer and Stephens (2003) Q_R; Q_R preliminarily based on 2001 (ENSO-neutral year)
- CSH and SLH estimates based on monthly averaged data for period 1998-2010 for corresponding months of experiments
- Horizontal resolution of Q_R, CSH, SLH = 0.5 deg
- Vertical resolution of Q_R, CSH = 1 km
- Vertical resolution of SLH = 0.25 km

Oceanic ITCZ/Monsoon Regimes



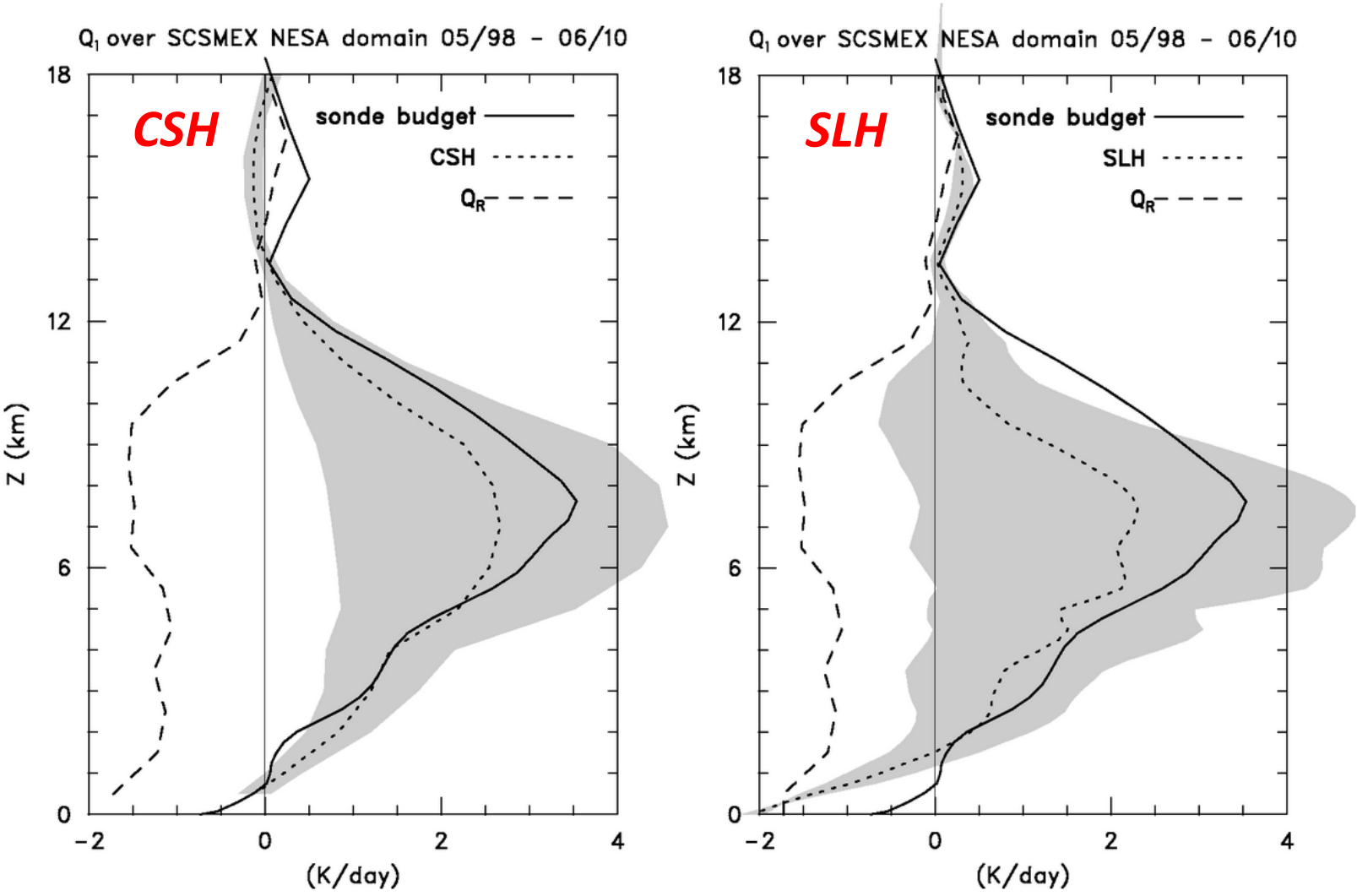
TOGA COARE





- *Generally good agreement*
- *Q_R peak near tropopause related to LW/ SW heating and/or eddy fluxes?*
- *Large shallow fraction - SLH*

SCSMEX-N


Q1 over SCSMEX NESA domain 05/98 - 06/10
CSH
sonde budget
CSH
QR
Z (km)
18
12
6
0
-2
0
2
4
(K/day)
Q1 over SCSMEX NESA domain 05/98 - 06/10
SLH
sonde budget
SLH
QR
Z (km)
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12
6
0
-2
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2
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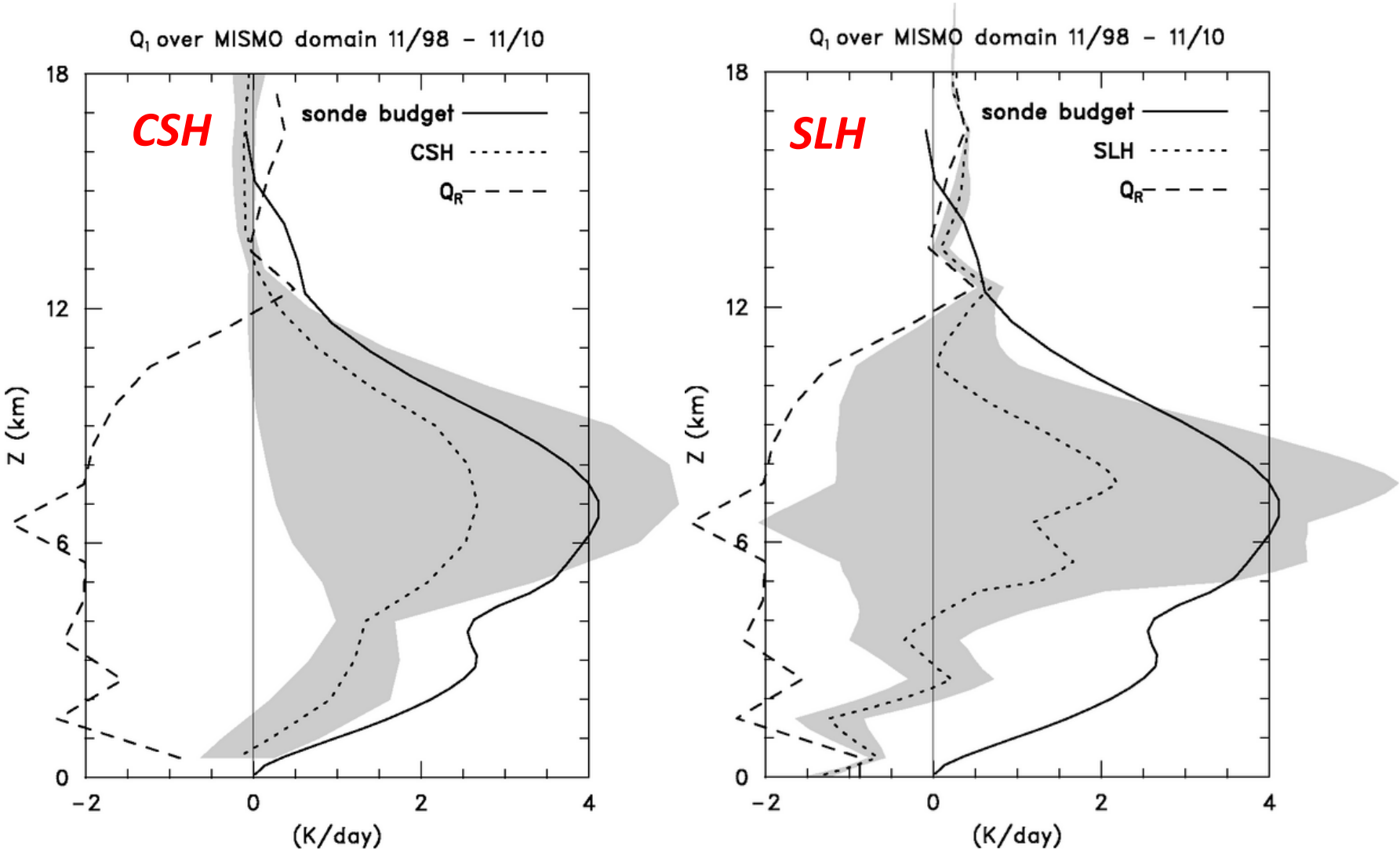
(K/day)

MISMO


Q1 over MISMO domain 11/98 – 11/10
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sonde budget
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(K/day)
Q1 over MISMO domain 11/98 – 11/10
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sonde budget
SLH
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Z (km)
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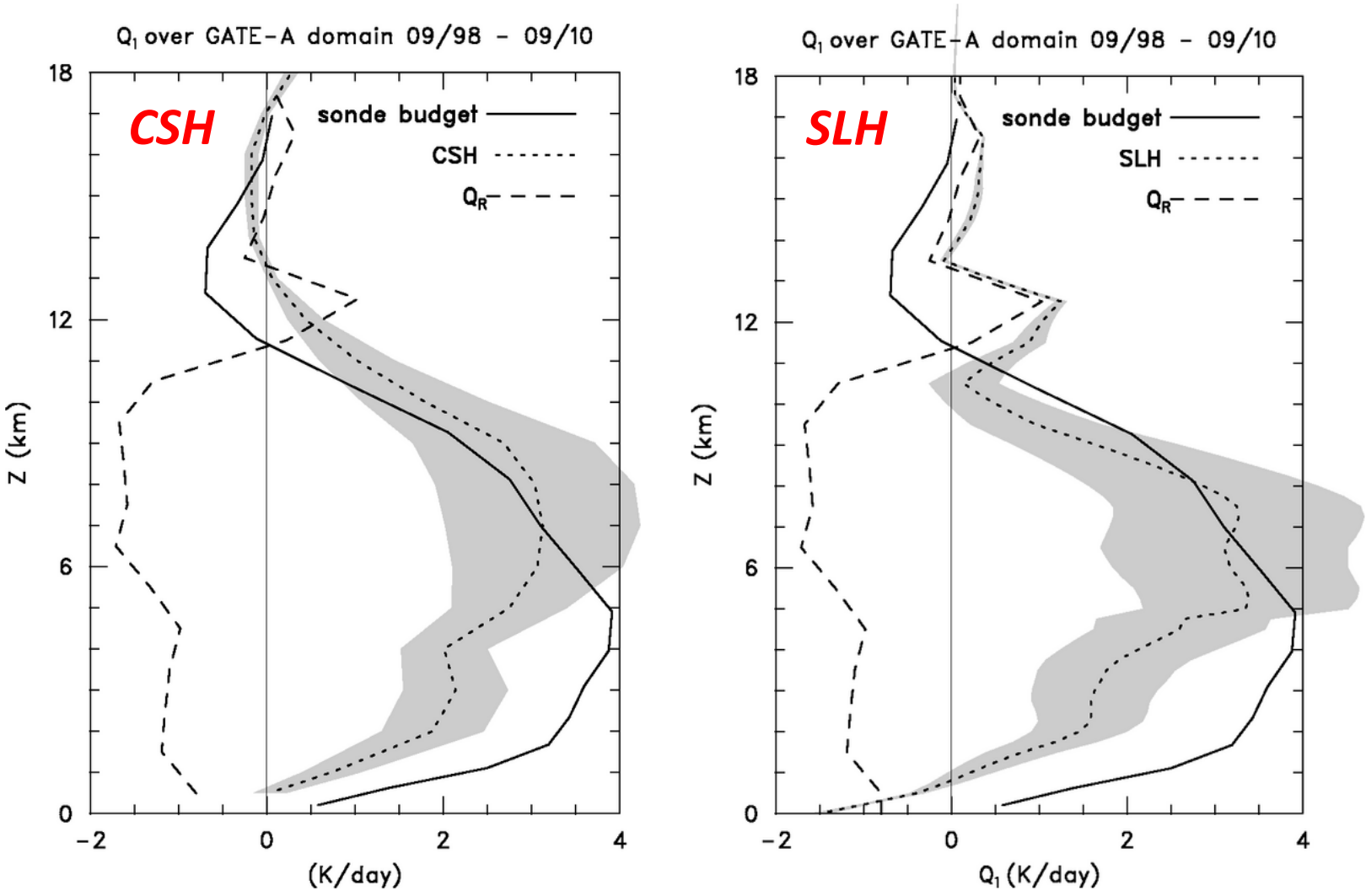
(K/day)

GATE


Q1 over GATE-A domain 09/98 - 09/10
CSH
sonde budget
CSH
QR
Z (km)
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(K/day)
Q1 over GATE-A domain 09/98 - 09/10
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sonde budget
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Z (km)
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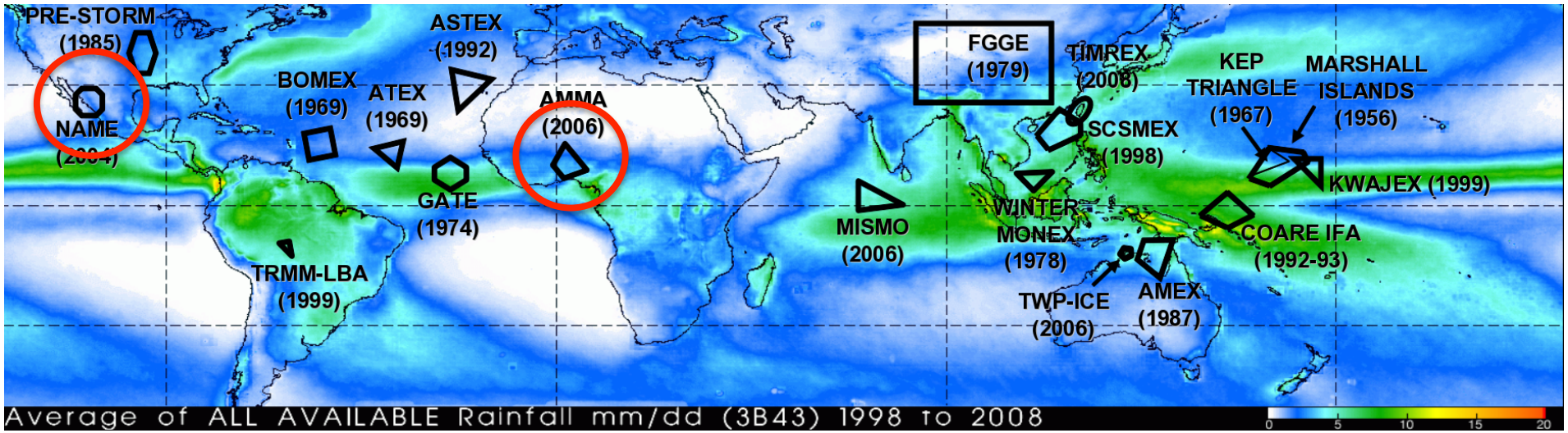
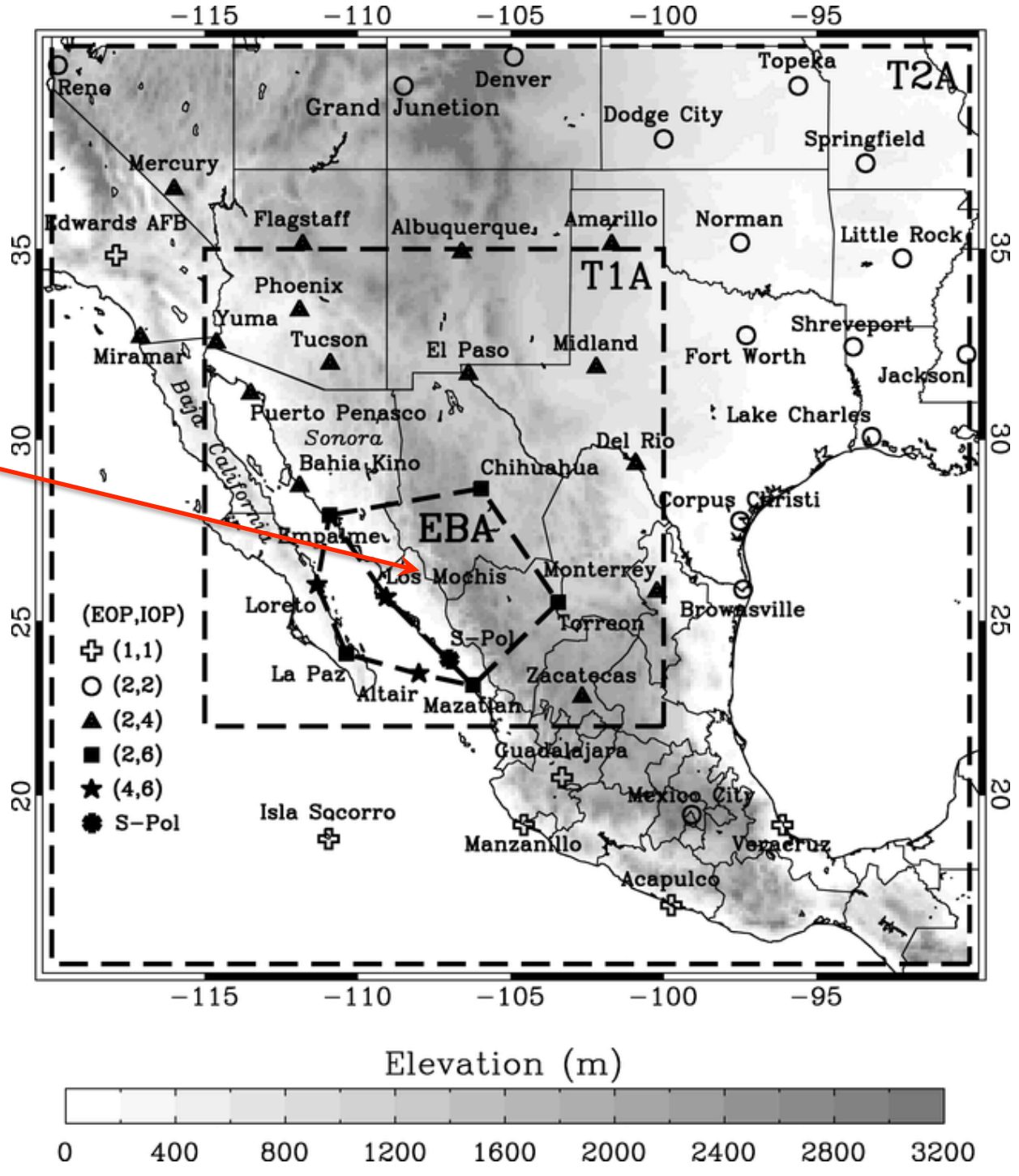
Q1 (K/day)

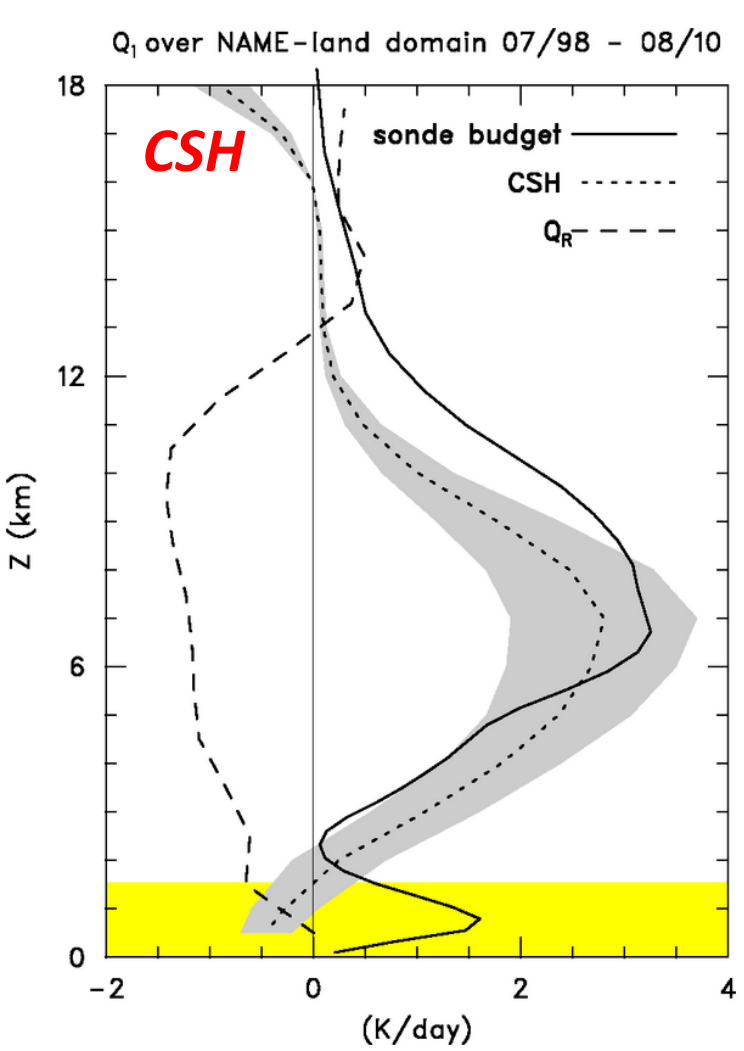
Continental Regimes



Land Portion of Enhanced Budget Array (EBA)



NAME


Q1 over NAME-land domain 07/98 - 08/10
CSH
sonde budget
CSH
QR
Z (km)
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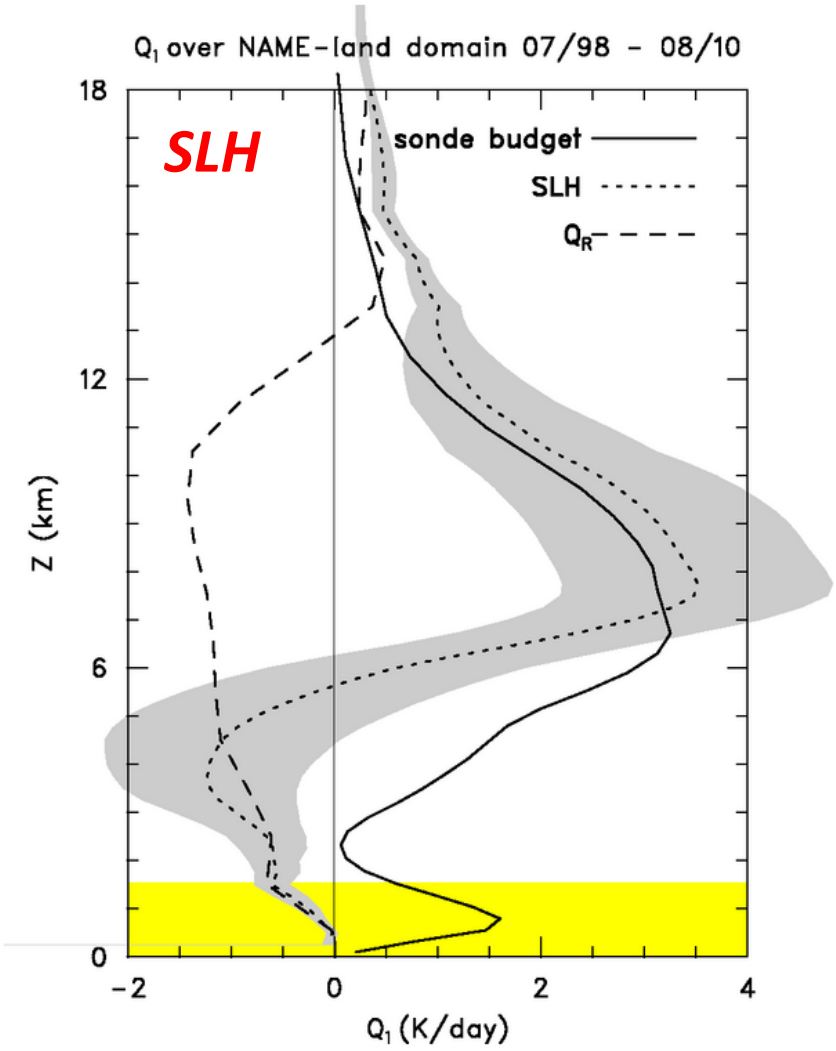
(K/day)


Q1 over NAME-land domain 07/98 - 08/10
SLH
sonde budget
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Z (km)
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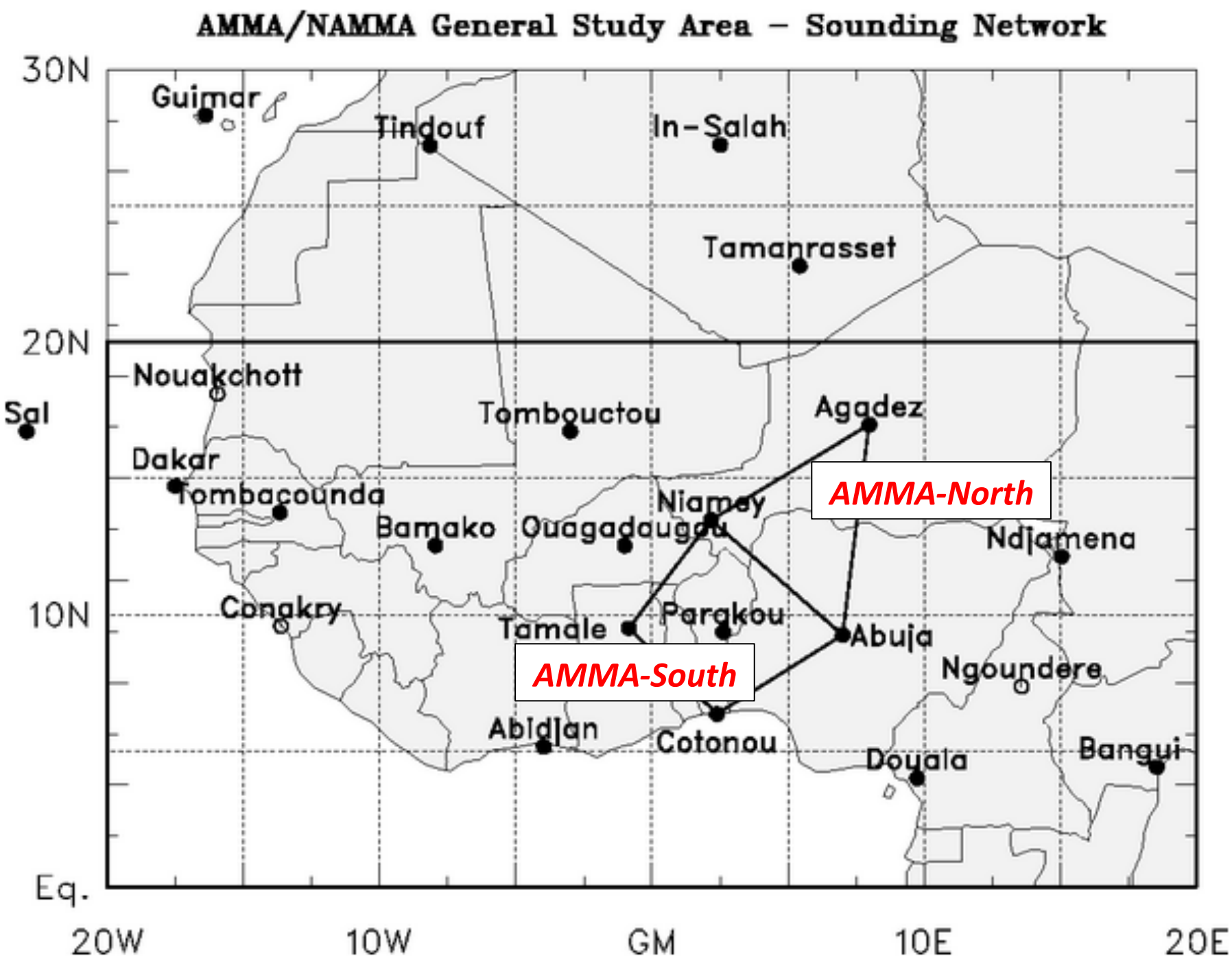
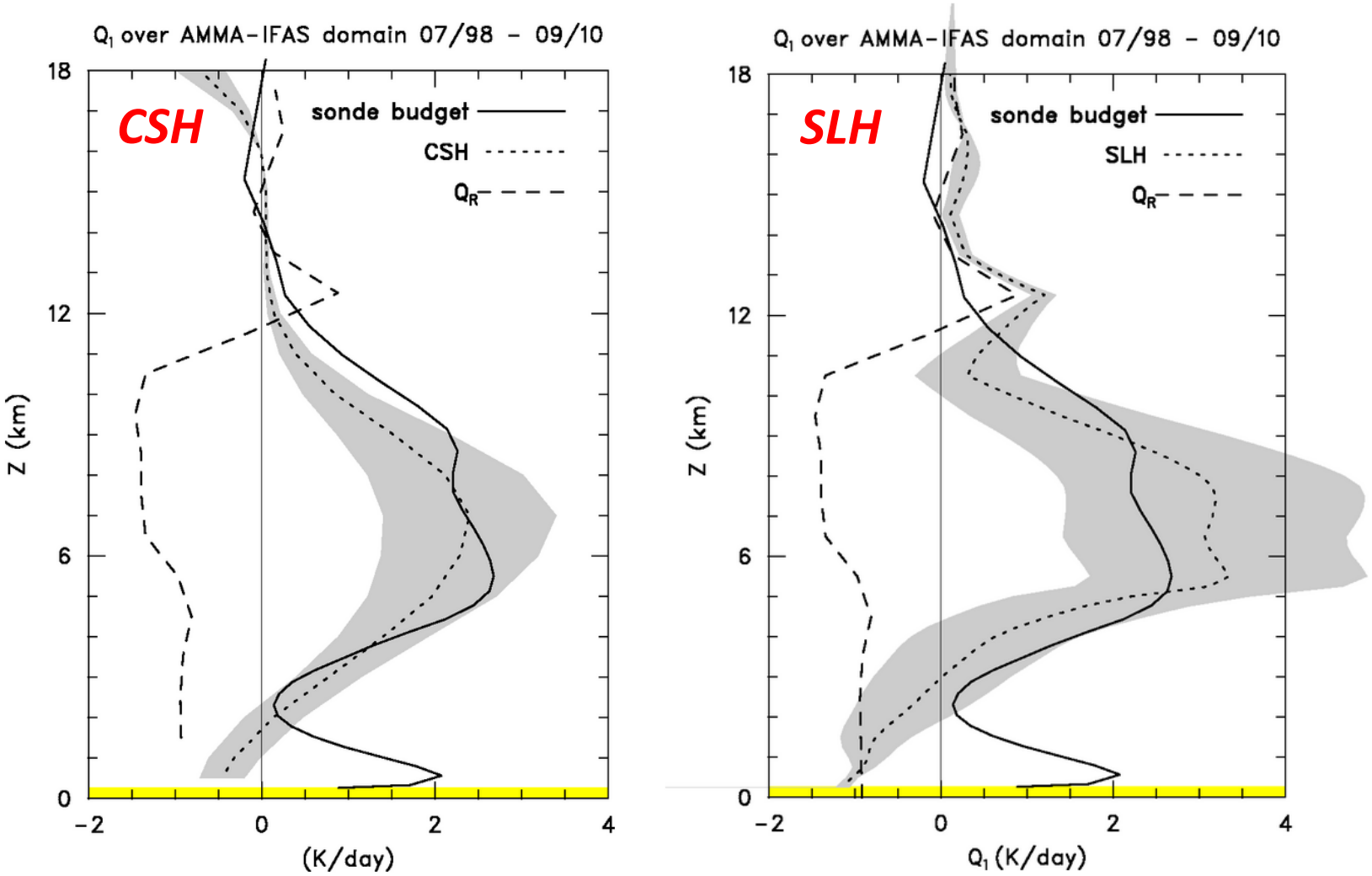
Q1 (K/day)


AMMA/NAMMA General Study Area – Sounding Network
30N
20N
10N
Eq.
20W
10W
GM
10E
20E
Guimar
Tindouf
In-Salah
Tamanrasset
Nouakchott
Sal
Tombouctou
Agadez
Dakar
Tombacounda
Niamey
Bamako
Ouagadougou
Ndjamena
Conakry
Parakou
Tamale
Abuja
Ngoundere
Abidjan
Cotonou
Douala
Bangui
AMMA-North
AMMA-South

AMMA-South


Q1 over AMMA-IFAS domain 07/98 - 09/10
CSH
sonde budget
CSH
QR
Z (km)
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(K/day)
Q1 over AMMA-IFAS domain 07/98 - 09/10
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sonde budget
SLH
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Z (km)
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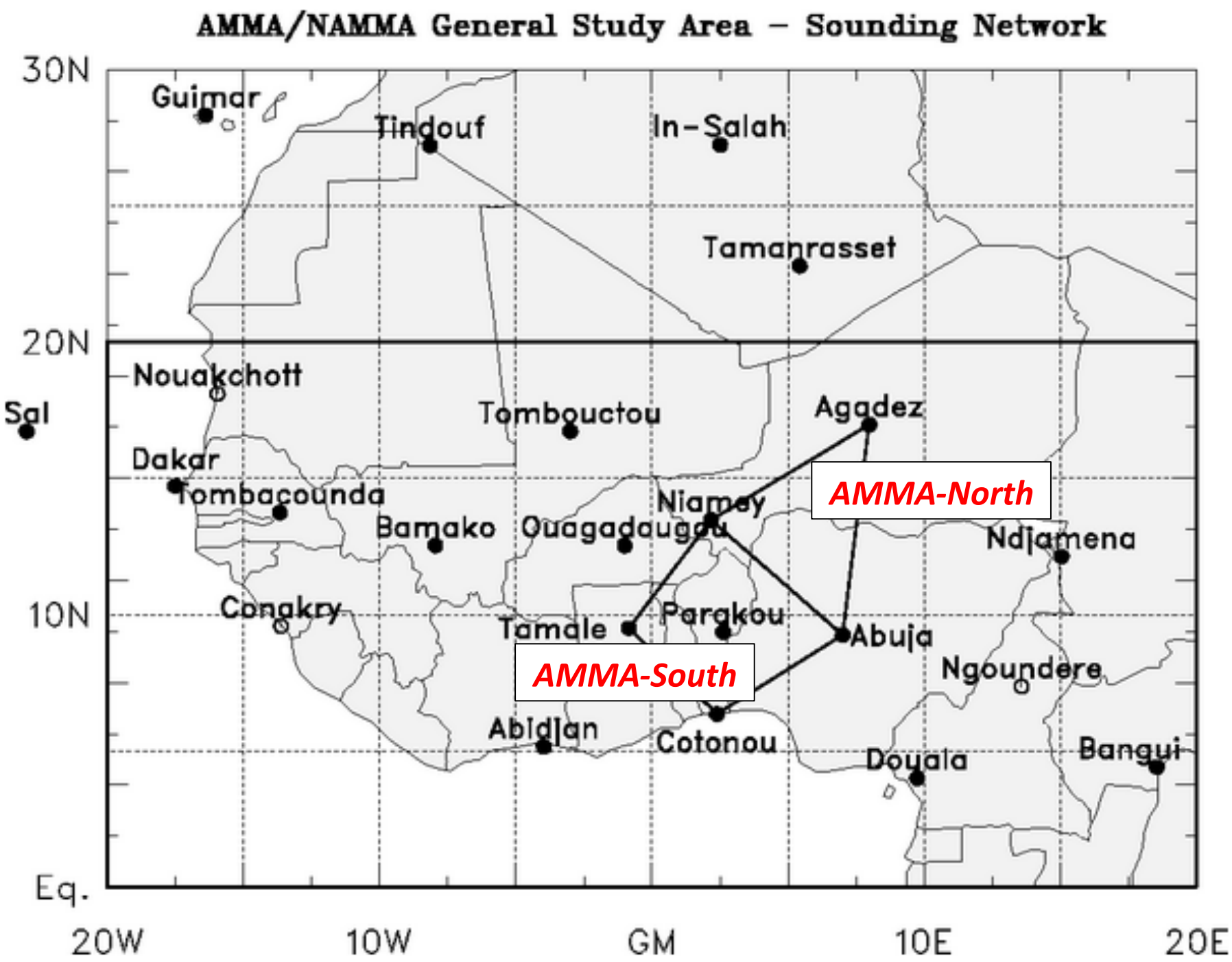
Q1 (K/day)


AMMA/NAMMA General Study Area – Sounding Network
30N
20N
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Tindouf
In-Salah
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Nouakchott
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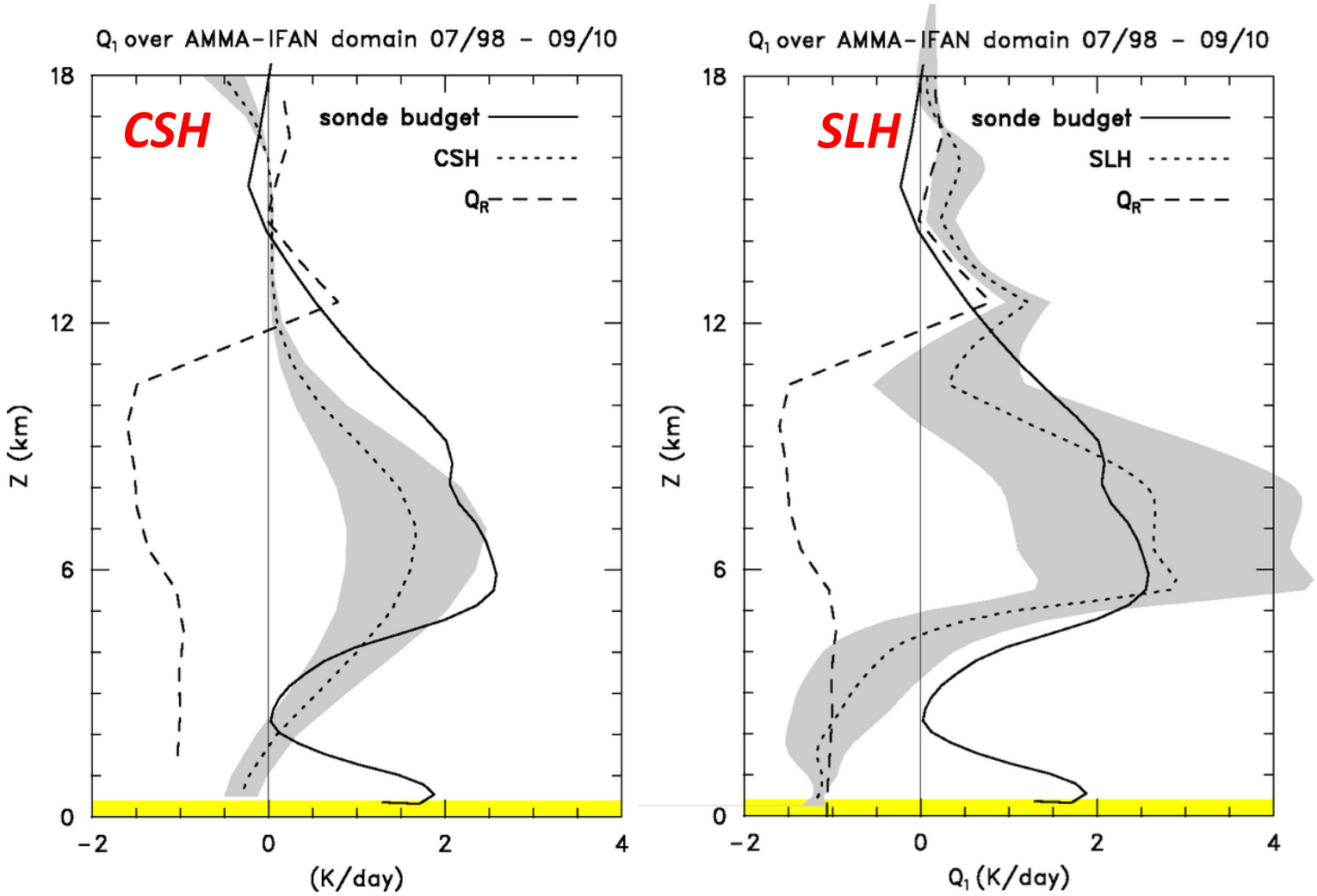
Agadez
Dakar
Tombacounda
Niamey
Bamako
Ouagadougou
Ndjamena
Conakry
Parakou
Tamale
Abuja
Ngoundere
Abidjan
Cotonou
Douala
Bangui
AMMA-North
AMMA-South

AMMA-North


Q1 over AMMA-IFAN domain 07/98 - 09/10
CSH
sonde budget
CSH
QR
Z (km)
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(K/day)
Q1 over AMMA-IFAN domain 07/98 - 09/10
SLH
sonde budget
SLH
QR
Z (km)
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-2
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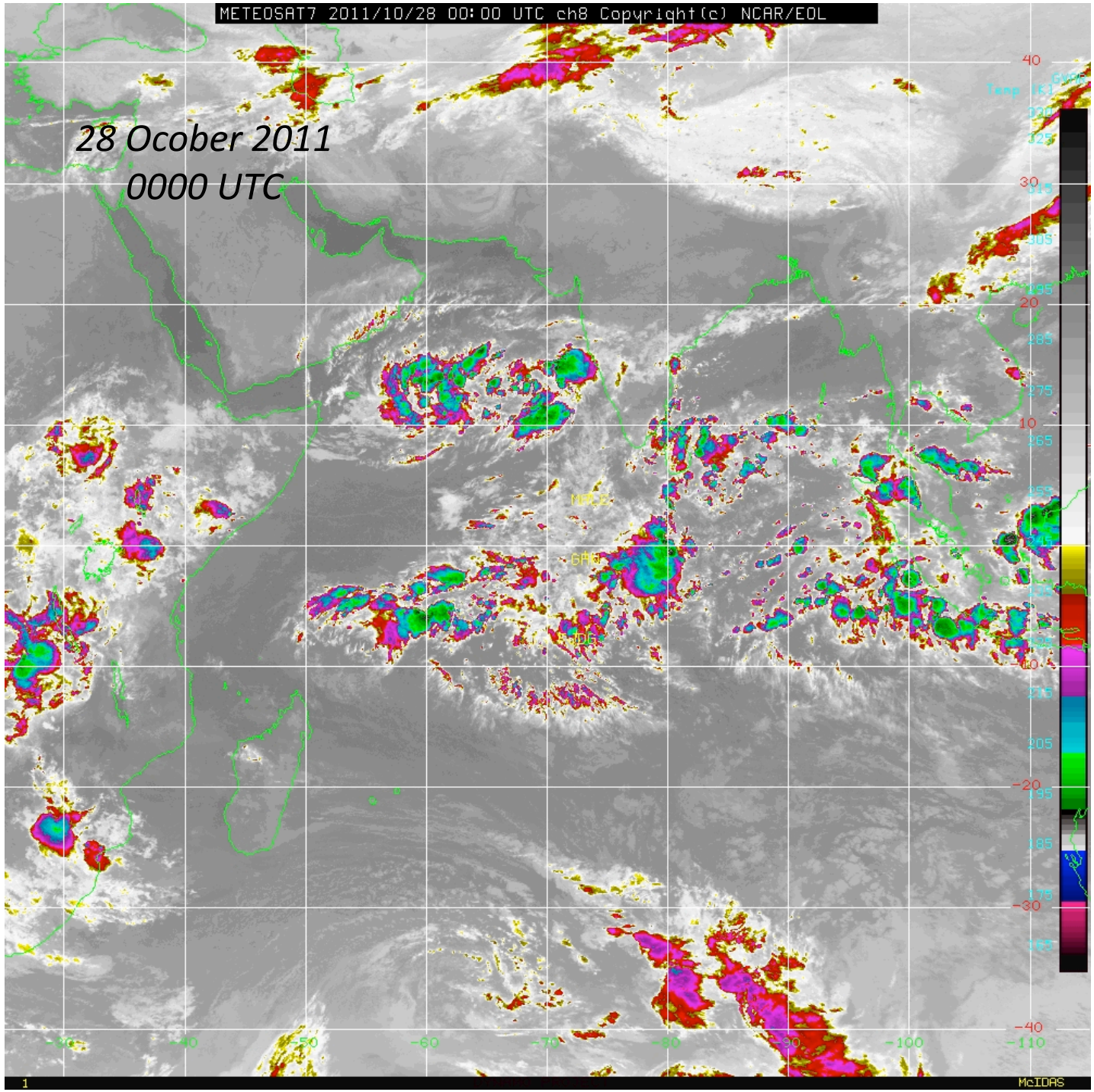
Q1 (K/day)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28 Ocober 2011
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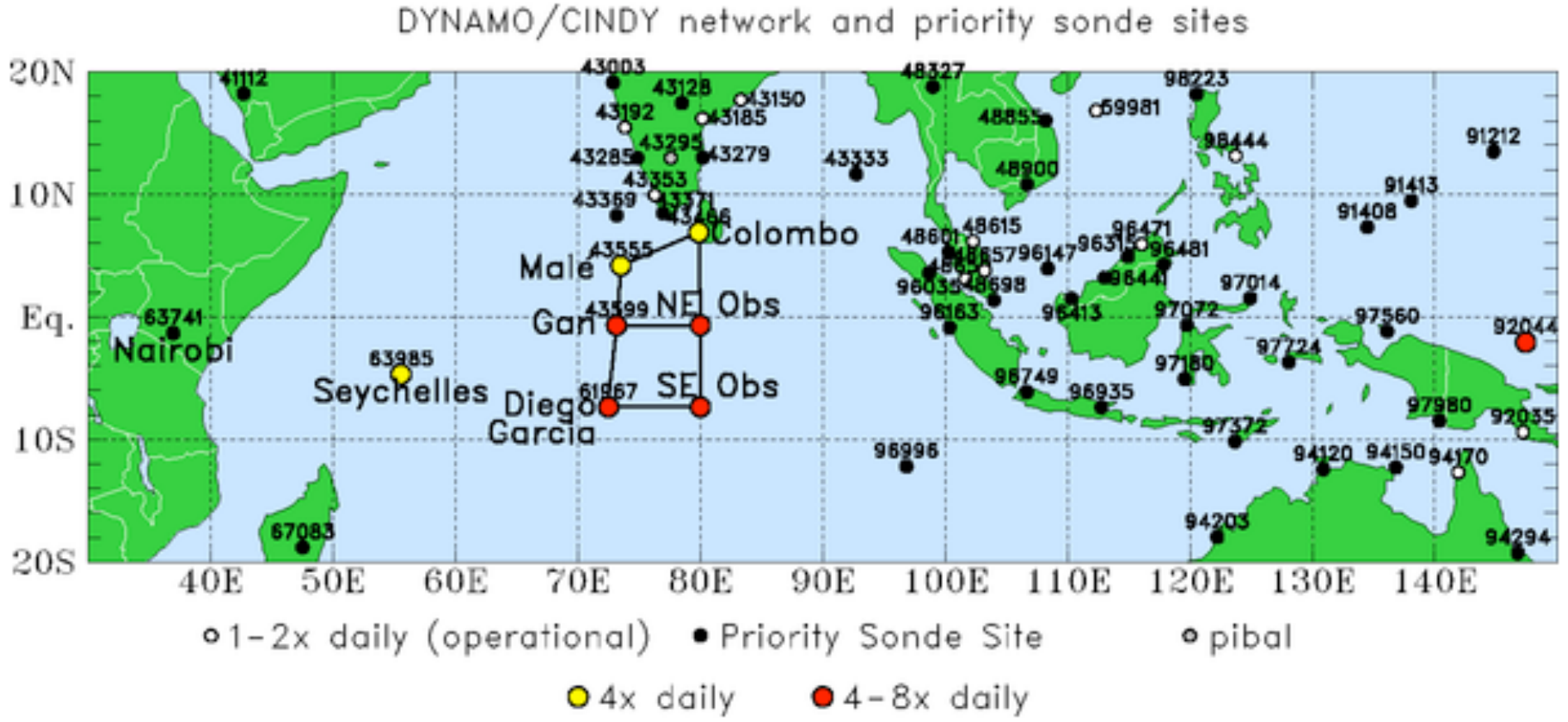
DYNAMO/CINDY network and priority sonde sites
20N
10N
Eq.
10S
20S
40E
50E
60E
70E
80E
90E
100E
110E
120E
130E
140E
Colombo
Male
Gan
NE Obs
SE Obs
Diego Garcia
Seychelles
Nairobi
41112
43003
43128
43150
43192
43185
43295
43285
43279
43353
43369
43371
43366
43555
43599
61867
63741
63985
67083
43333
48327
98223
59981
48855
98444
48900
91212
91413
91408
48615
48601
96471
96481
96147
96441
96035
48698
96163
96413
97014
97072
97560
92044
97724
97180
96749
96935
97980
92035
97372
96996
94120
94150
94170
94203
94294
1-2x daily (operational)
Priority Sonde Site
pibal
4x daily
4-8x daily

DYNAMO/CINDY

OCT-NOV 2011

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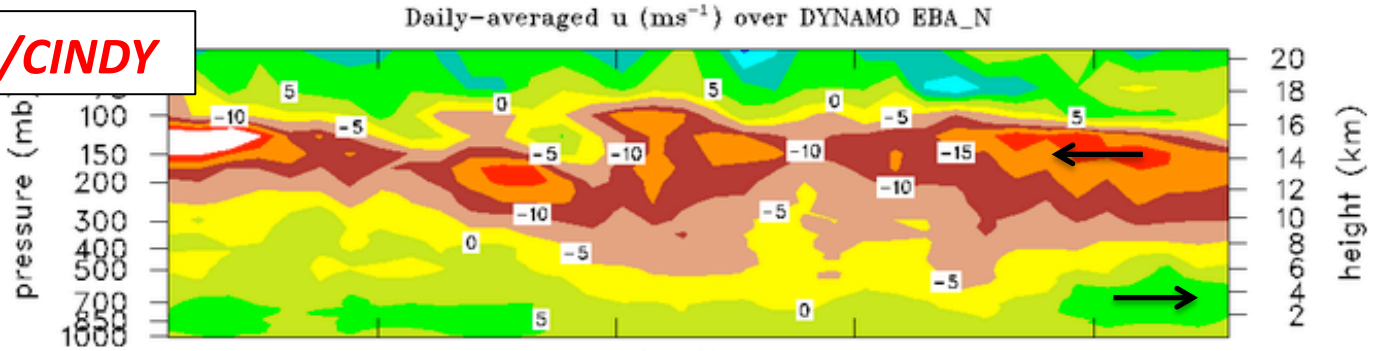
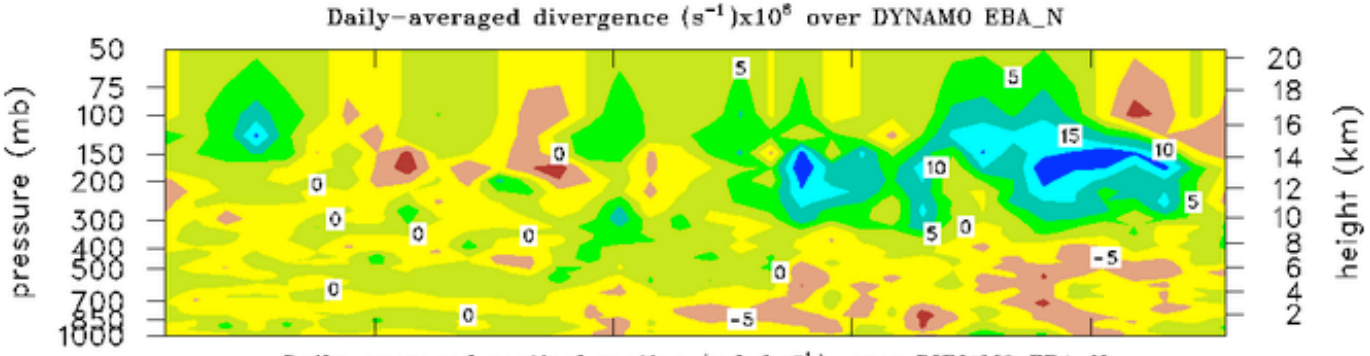


DIV



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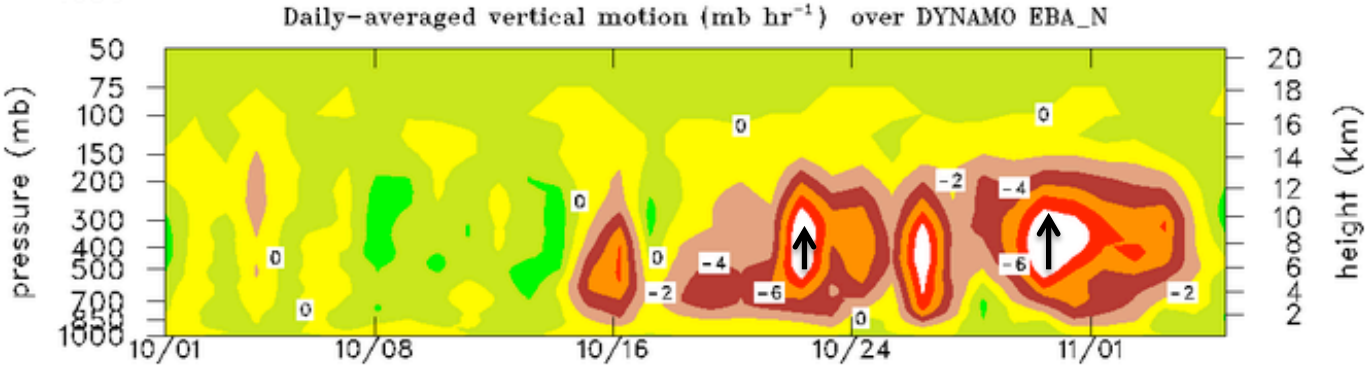

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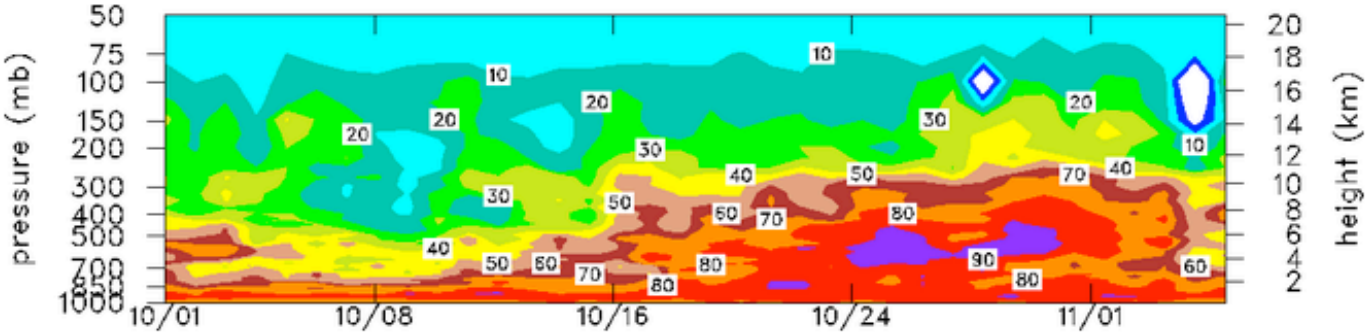

Summary Remarks

- SLH and CSH (v6) LH profiles for 1998-2010 compared to field campaign data
- Similar top-heavy profiles in W. Pac, SCS, Indian Ocean; Q_1 peak in upper troposphere – is it real and if so, what is the cause?
- Lower-tropospheric peak: E. Atlantic, GATE
- Sharp contrast with land – AMMA (substantial stratiform, little shallow convection)
- Will repeat analysis using v7 algorithms