Performance evaluation of RegCM4 in simulating circulation fields over SEACLID/CORDEX-SEA Domain

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Methodology

- 20 years run (1989-2008) using lateral boundary forcing from ECMWF ERA Interim
- exclude 10 grid points near each boundary from the analysis
- Climatology
  - SW monsoon (June-July-August, JJA)
  - NE monsoon (December-January-February, DJF)
- 850 hPa circulation fields (u,v)

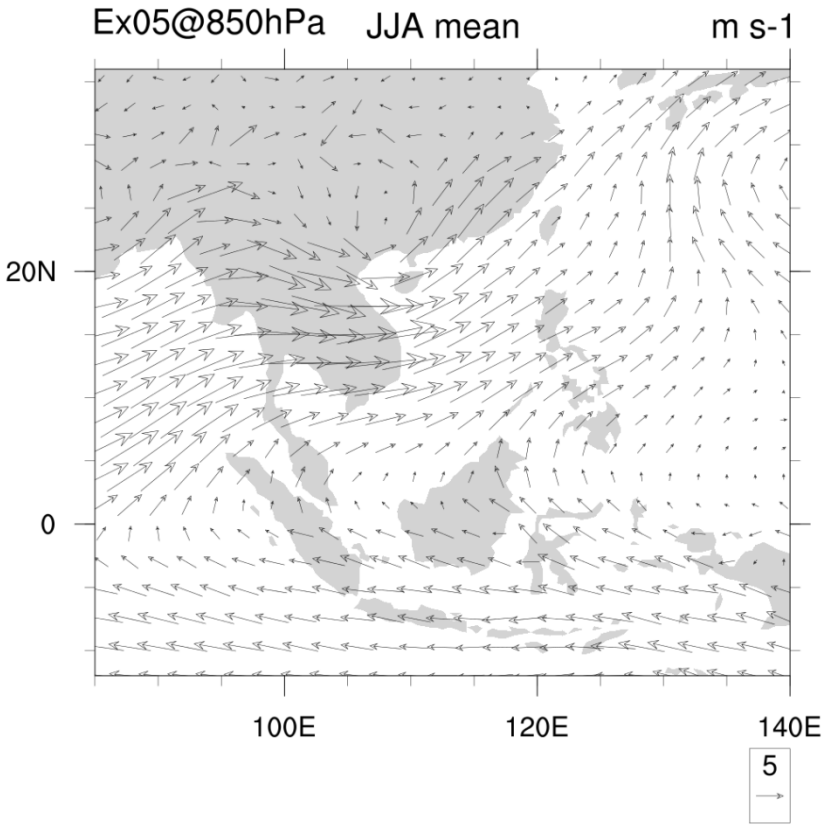
EFFECT OF OCEAN FLUX SCHEMES

1. BATS1e
2. Zeng et al. (1998) ocean model roughness formula 1
3. Zeng et al. (1998) ocean model roughness formula 2

Emanuel cumulus convection scheme

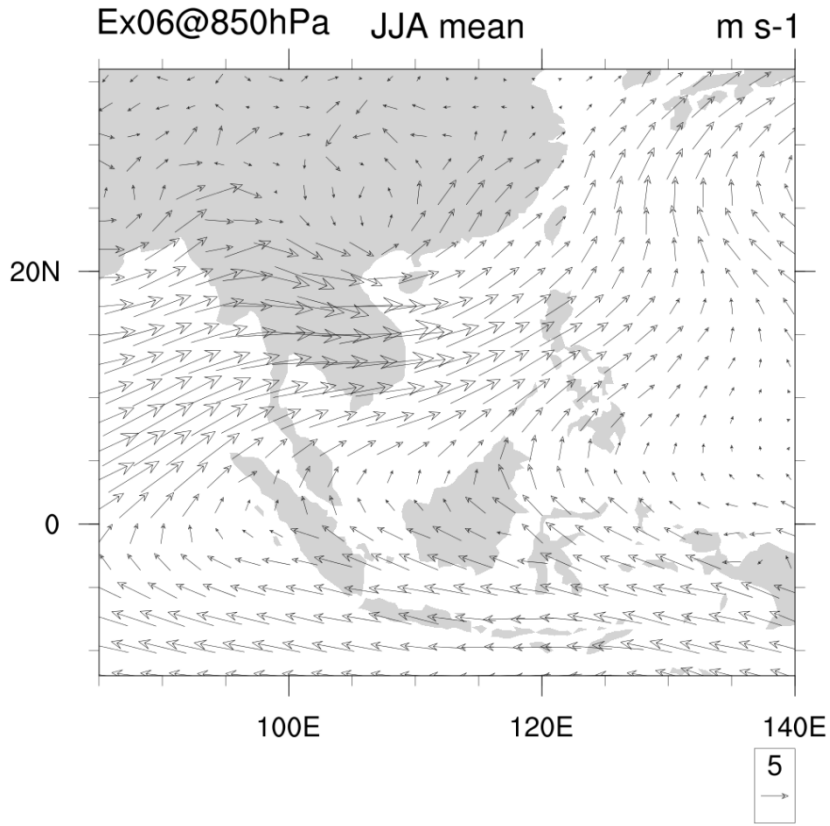
JJA

Ex05 Zeng ocean flux 1



SD U850 = 5.537
SD V850 = 2.042

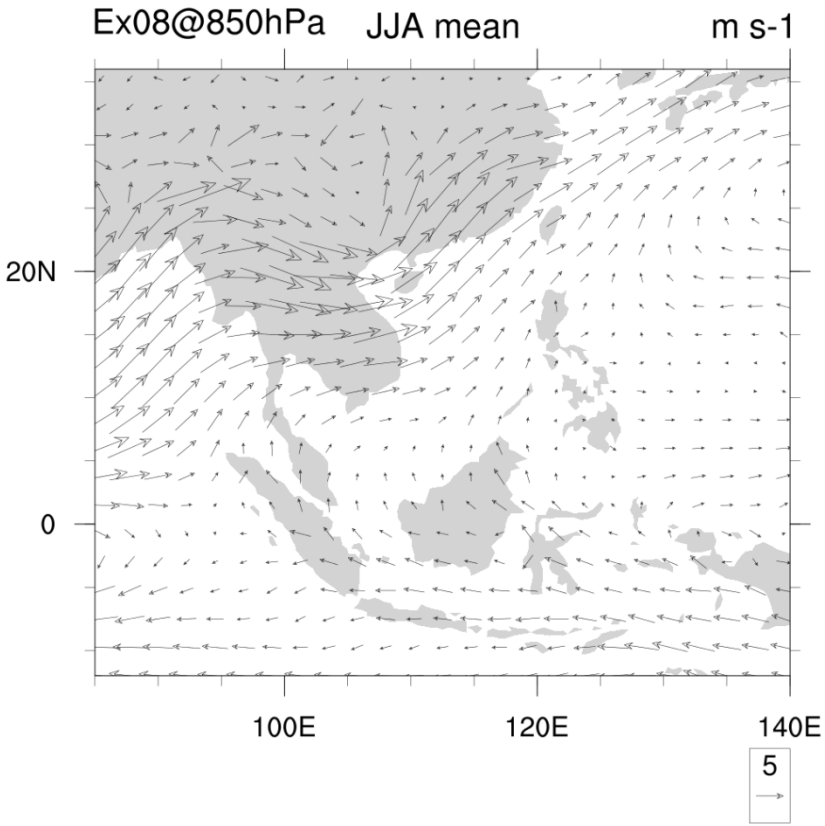
Ex06 Zeng ocean flux 2



SD U850 = 6.053
SD V850 = 1.960

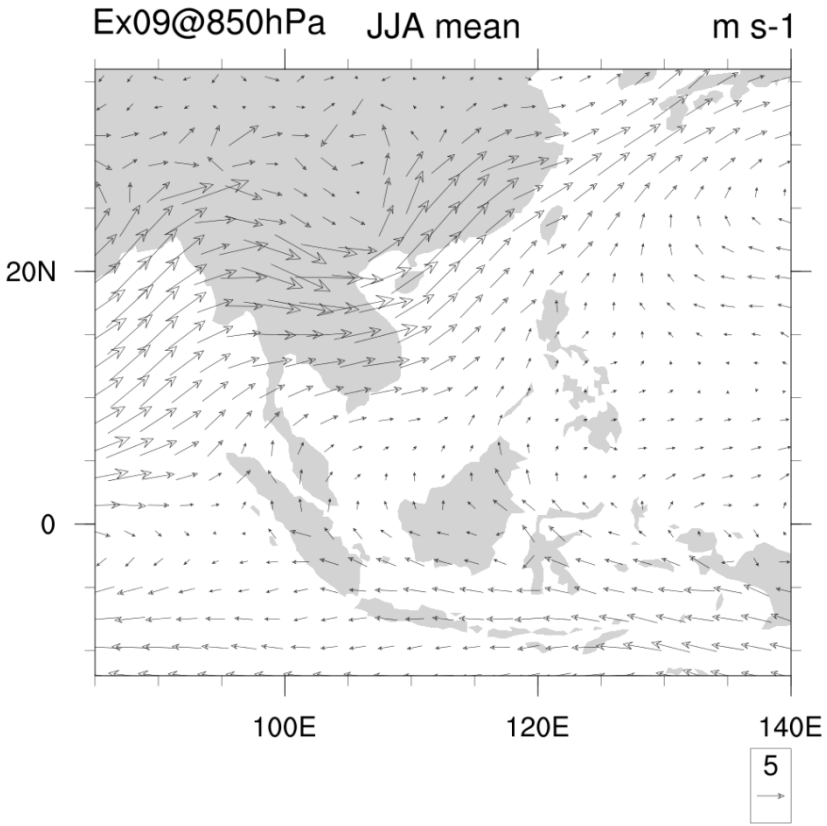
Emanuel (land) + Grell (ocean)

Ex08 Zeng ocean flux 1



SD U850 = 4.007
SD V850 = 2.248

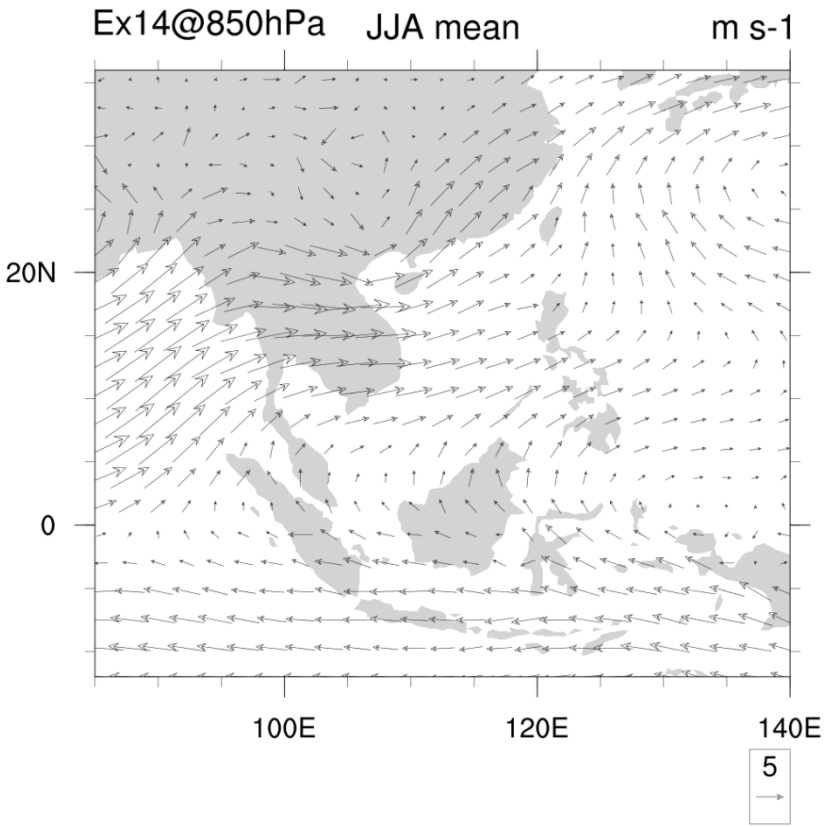
Ex09 Zeng ocean flux 2



SD U850 = 4.167
SD V850 = 2.106

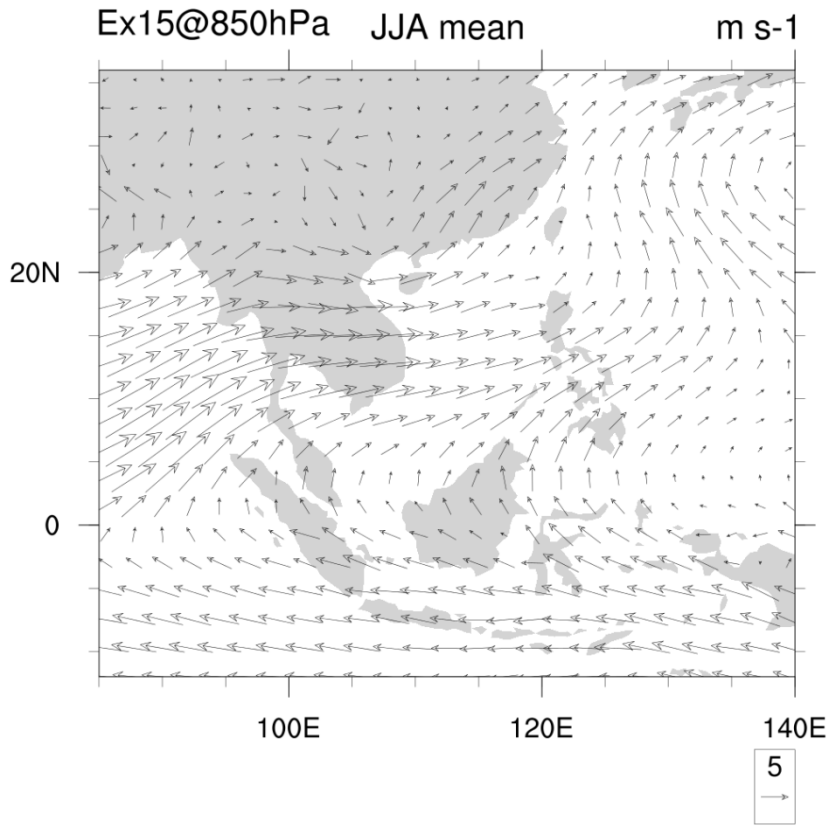
Grell (land) + Emanuel (ocean)

Ex14 Zeng ocean flux 1



SD U850 = 4.440
SD V850 = 1.737

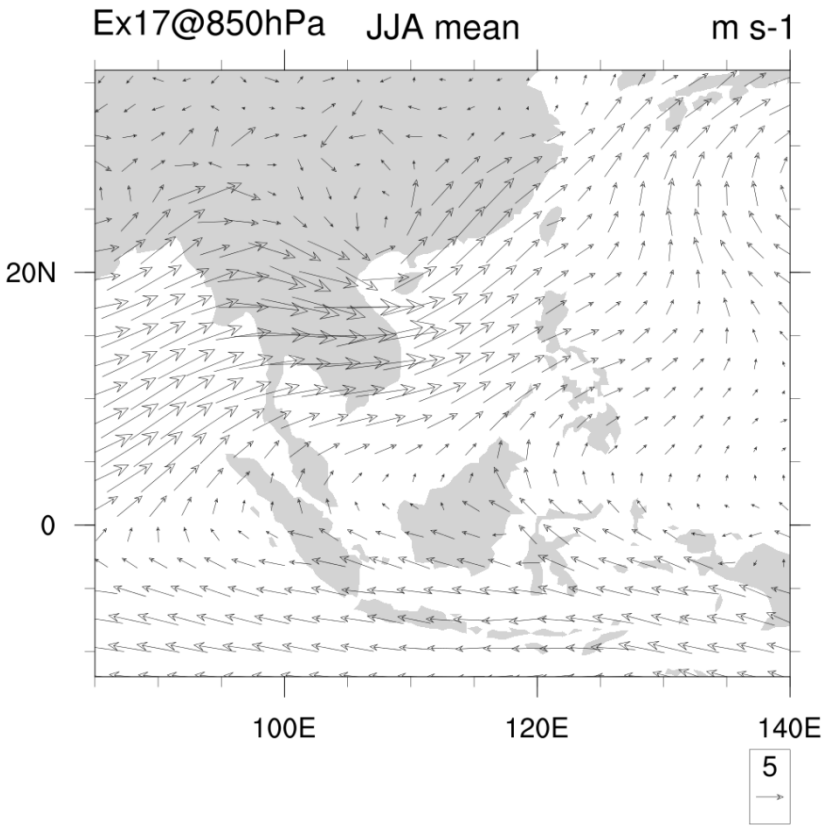
Ex15 Zeng ocean flux 2



SD U850 = 5.082
SD V850 = 1.715

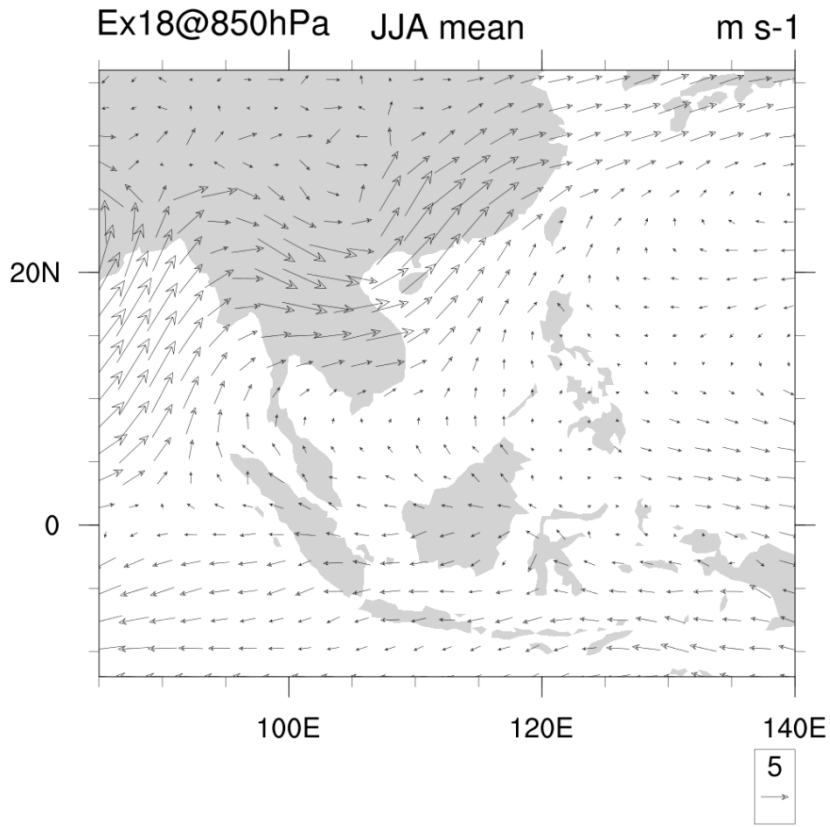
Kuo cumulus convection scheme

Ex17 Zeng ocean flux 1



SD U850 = 5.145
SD V850 = 1.996

Ex18 Zeng ocean flux 2

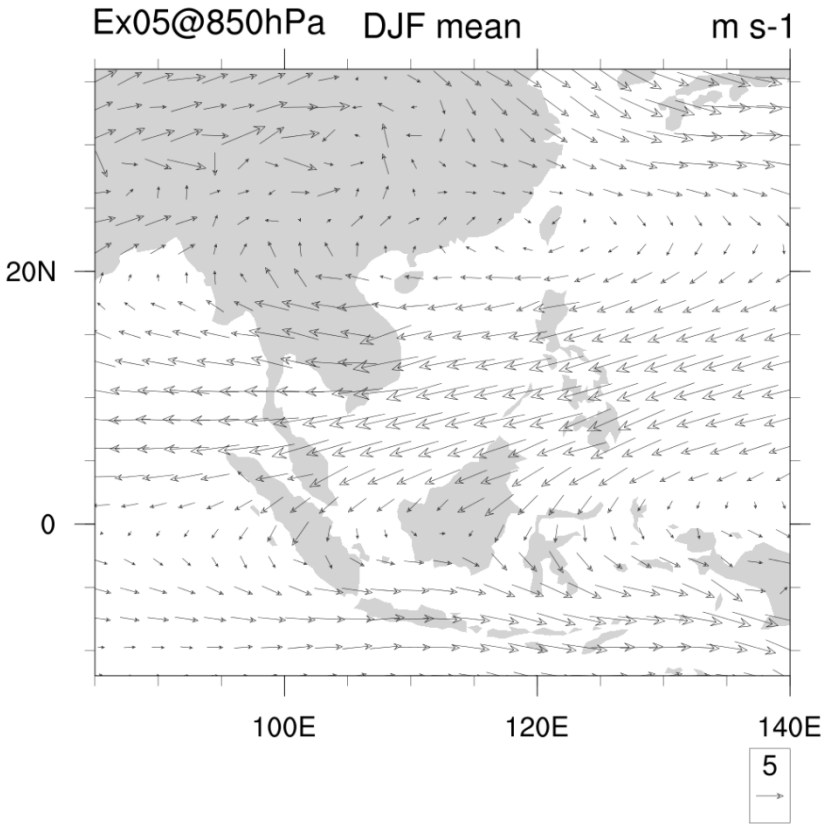


SD U850 = 3.284
SD V850 = 2.409

Emanuel cumulus convection scheme

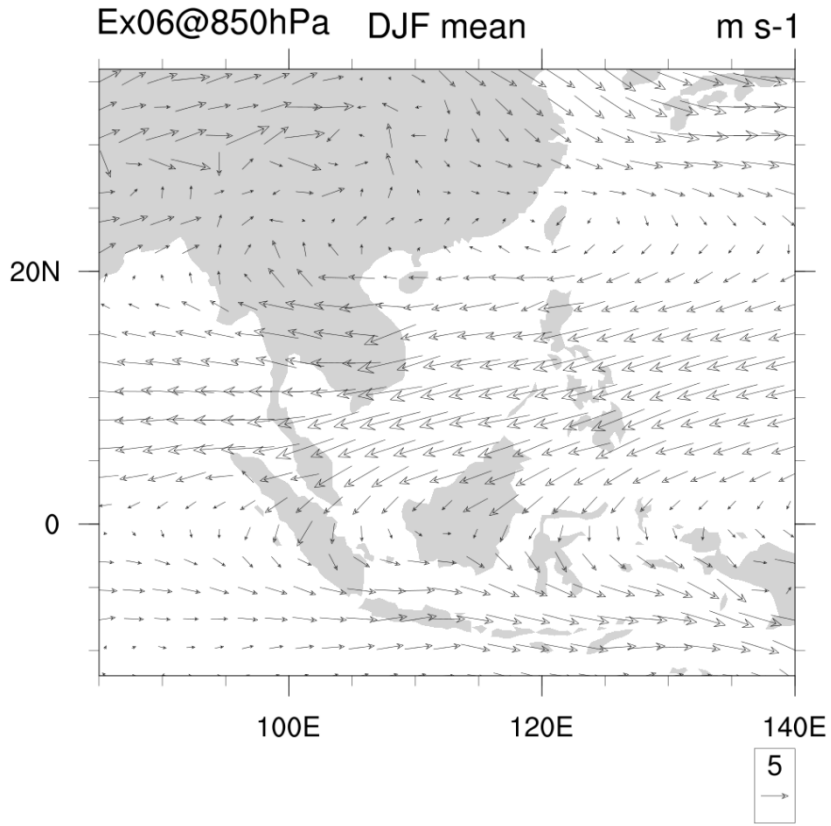
DJF

Ex05 Zeng ocean flux 1



SD U850 = 5.554
SD V850 = 1.757

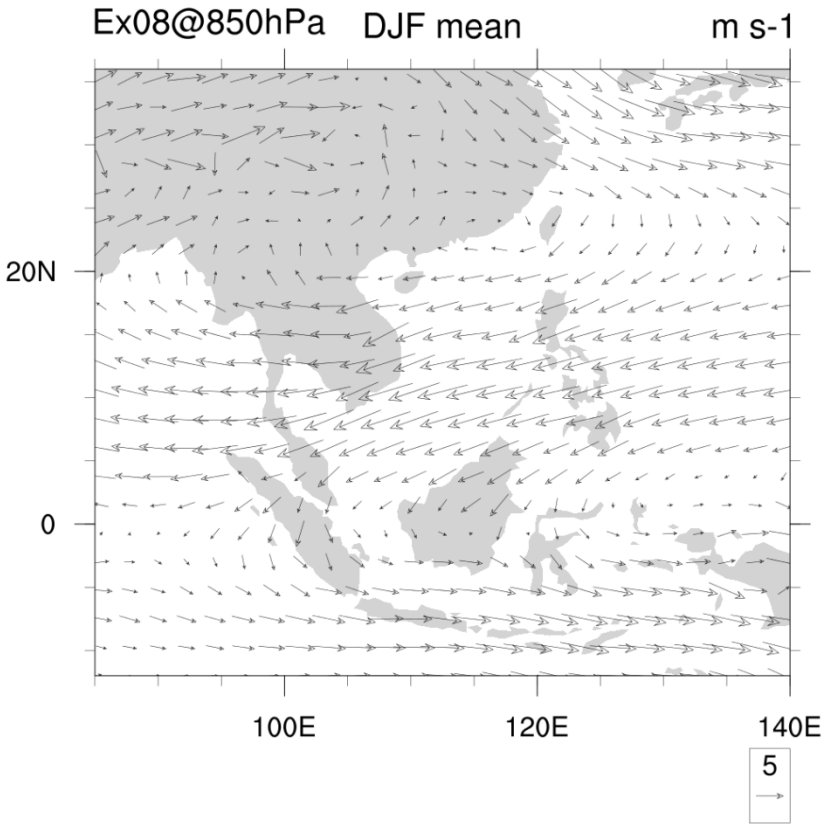
Ex06 Zeng ocean flux 2



SD U850 = 5.481
SD V850 = 1.736

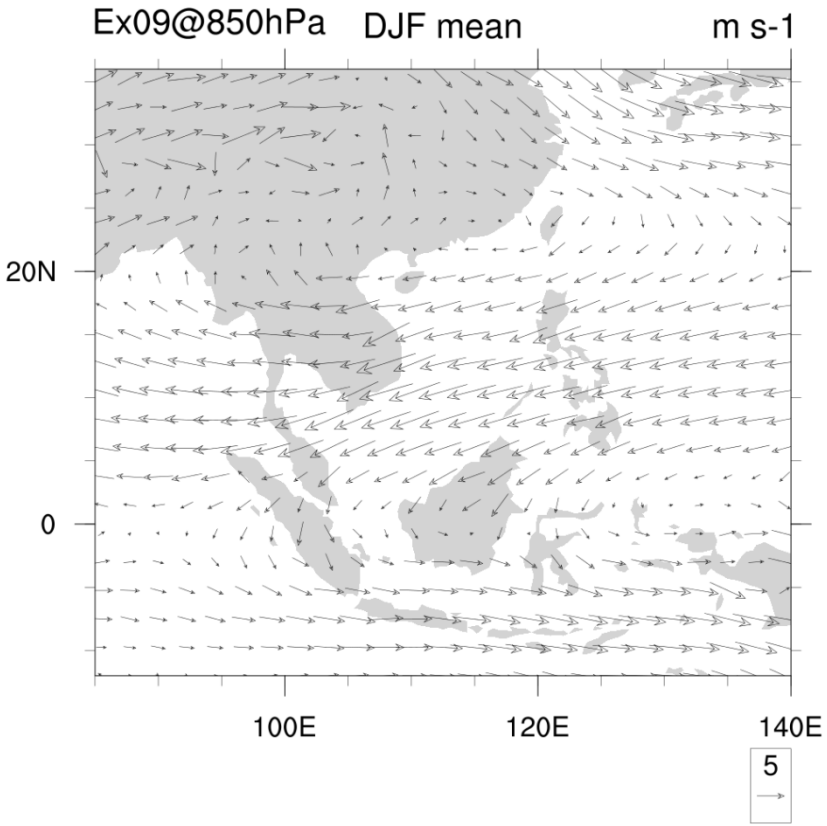
Emanuel (land) + Grell (ocean)

Ex08 Zeng ocean flux 1



SD U850 = 5.314
SD V850 = 1.697

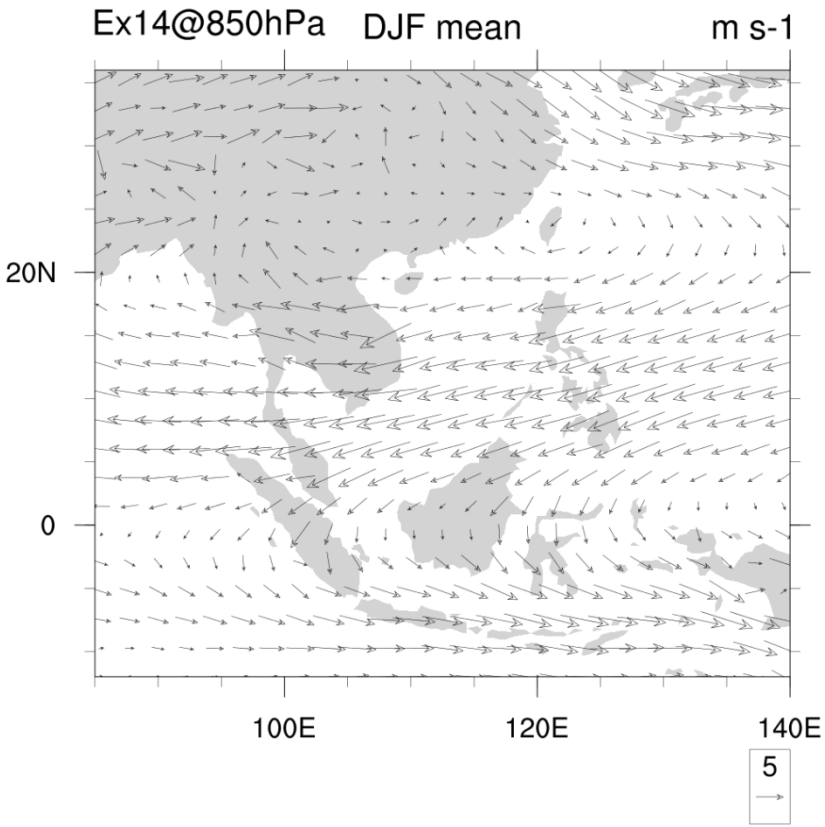
Ex09 Zeng ocean flux 2



SD U850 = 5.245
SD V850 = 1.662

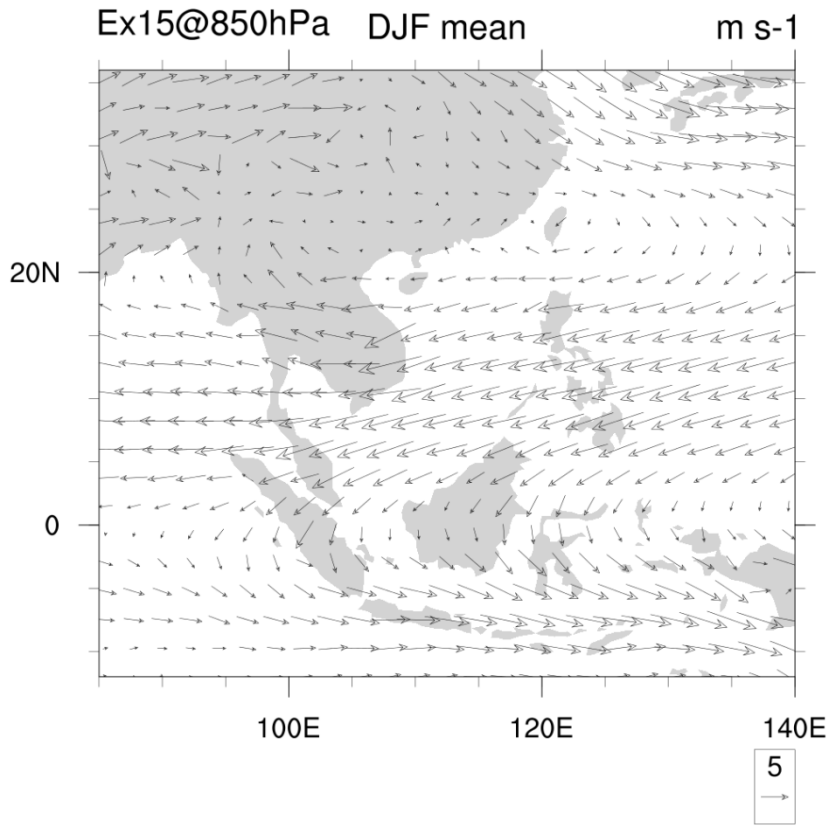
Grell (land) + Emanuel (ocean)

Ex14 Zeng ocean flux 1



SD U850 = 5.554
SD V850 = 1.732

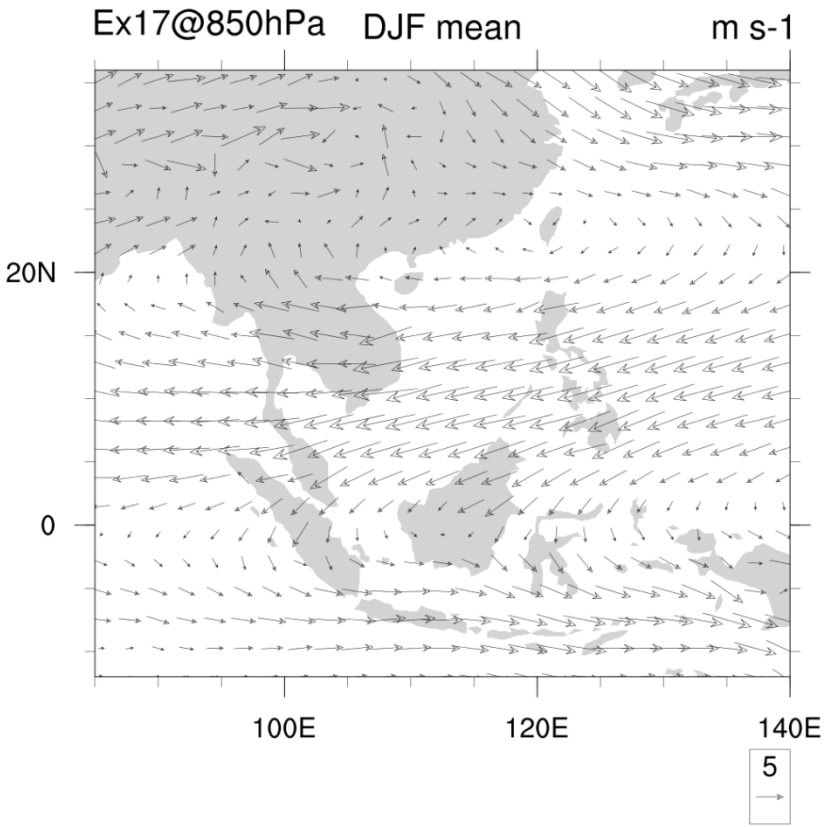
Ex15 Zeng ocean flux 2



SD U850 = 5.442
SD V850 = 1.686

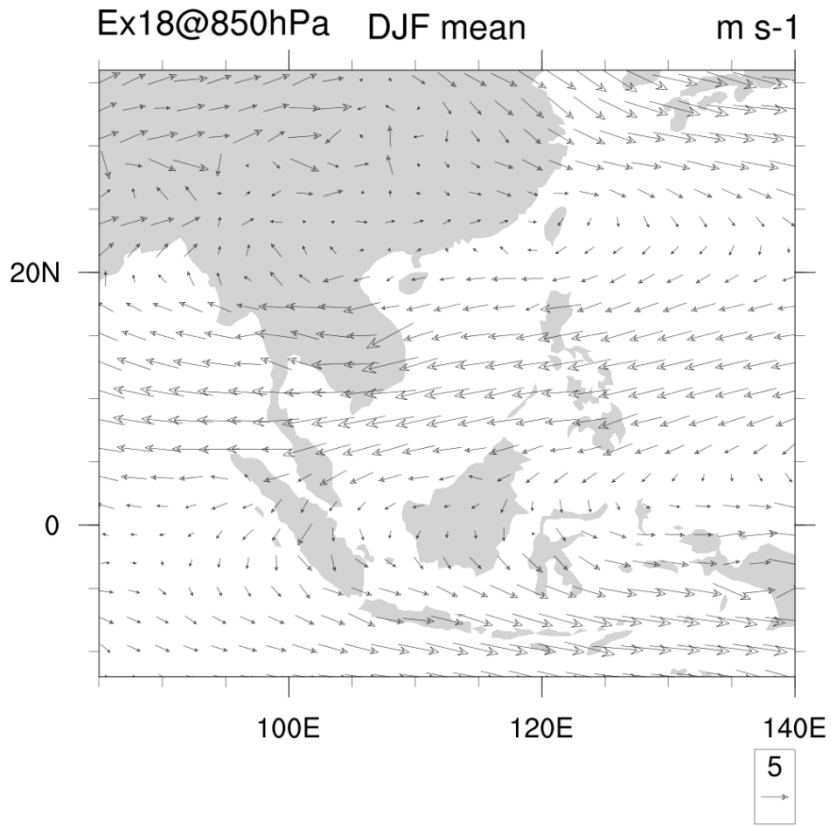
Kuo cumulus convection scheme

Ex17 Zeng ocean flux 1



SD U850 = 5.546
SD V850 = 1.745

Ex18 Zeng ocean flux 2



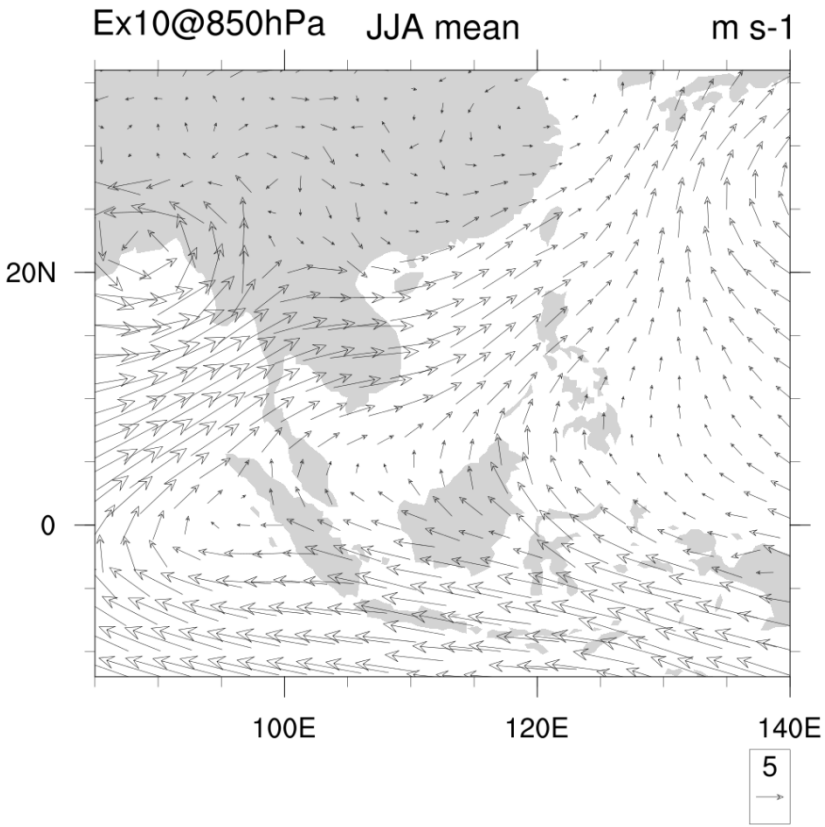
SD U850 = 5.025
SD V850 = 1.498

Conclusion

- Simulated circulation patterns were not much sensitive to the choices of Zeng ocean flux roughness parameter in most cumulus convection schemes, except Kuo scheme.

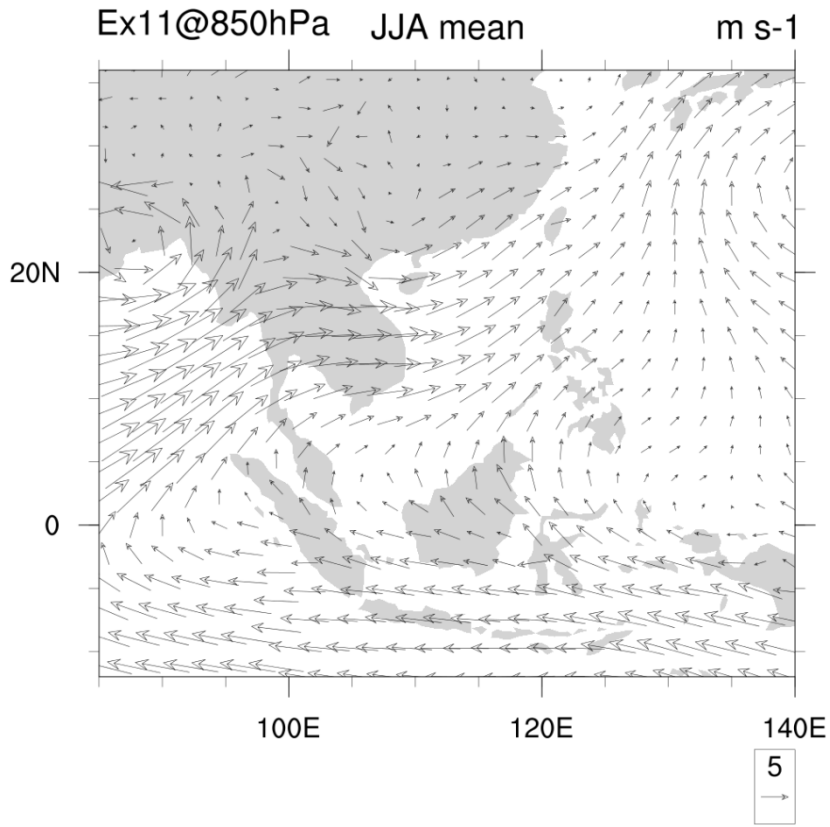
Grell cumulus convection scheme
+ Fritsch-Chappell closure

Ex10 BATS1e



SD U850 =
SD V850 =

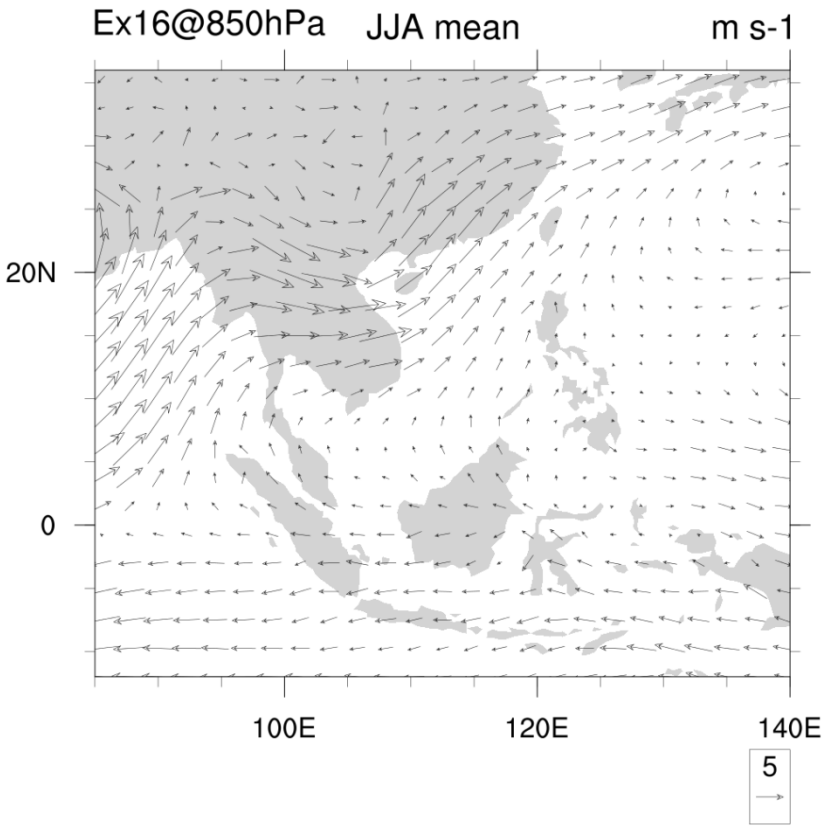
Ex11 Zeng ocean flux 1



SD U850 =
SD V850 =

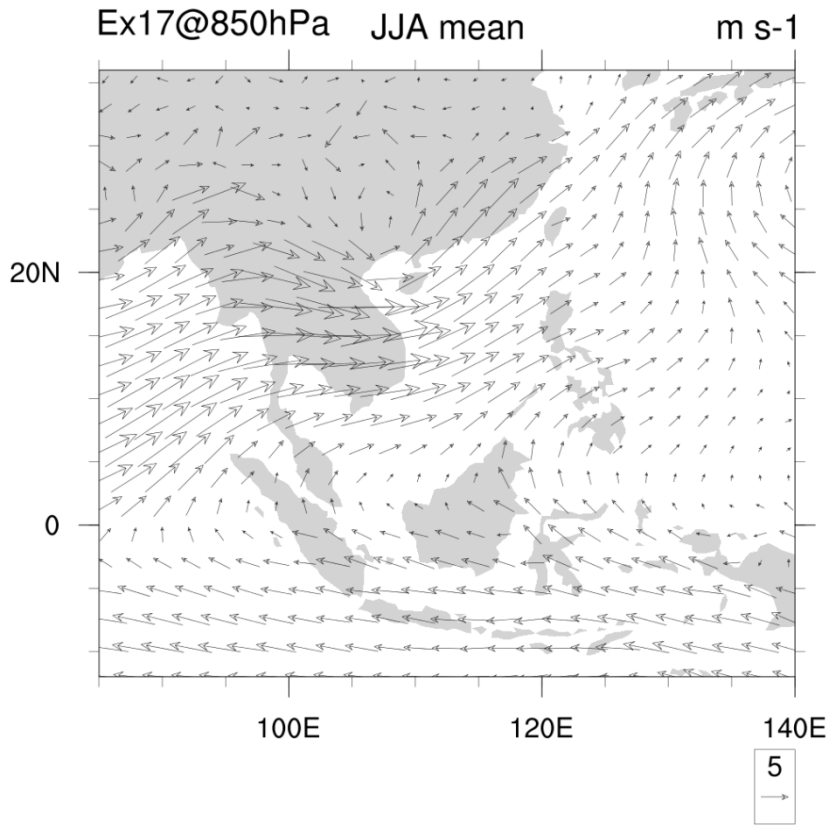
Kuo cumulus convection scheme

Ex16 BATS1e



SD U850 =
SD V850 =

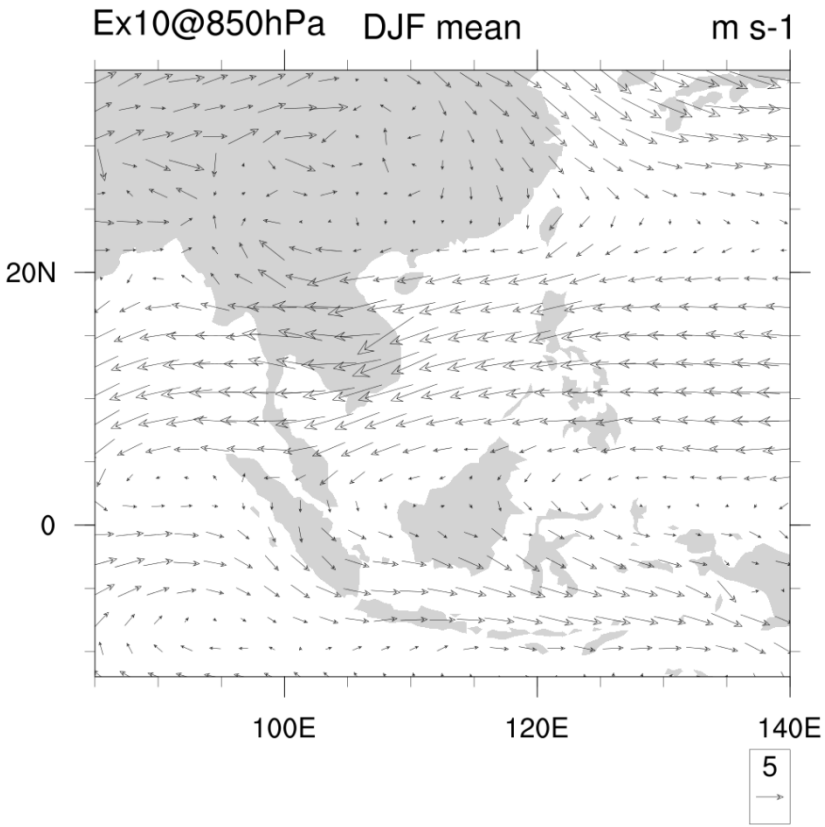
Ex17 Zeng ocean flux 1



SD U850 =
SD V850 =

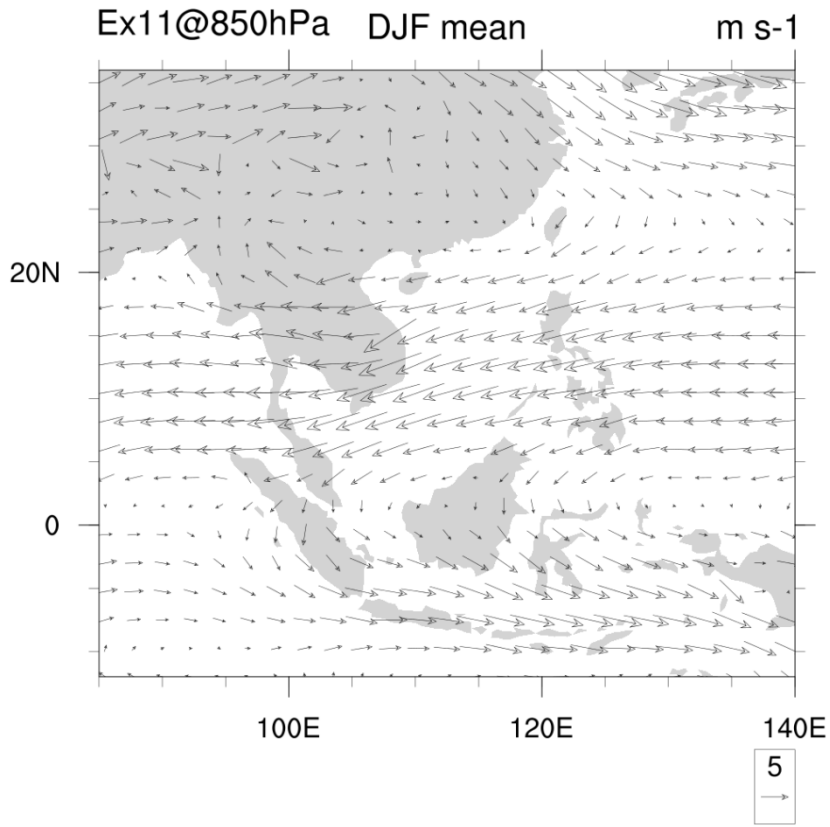
Grell cumulus convection scheme
+ Fritsch-Chappell closure

Ex10 BATS1e



SD U850 =
SD V850 =

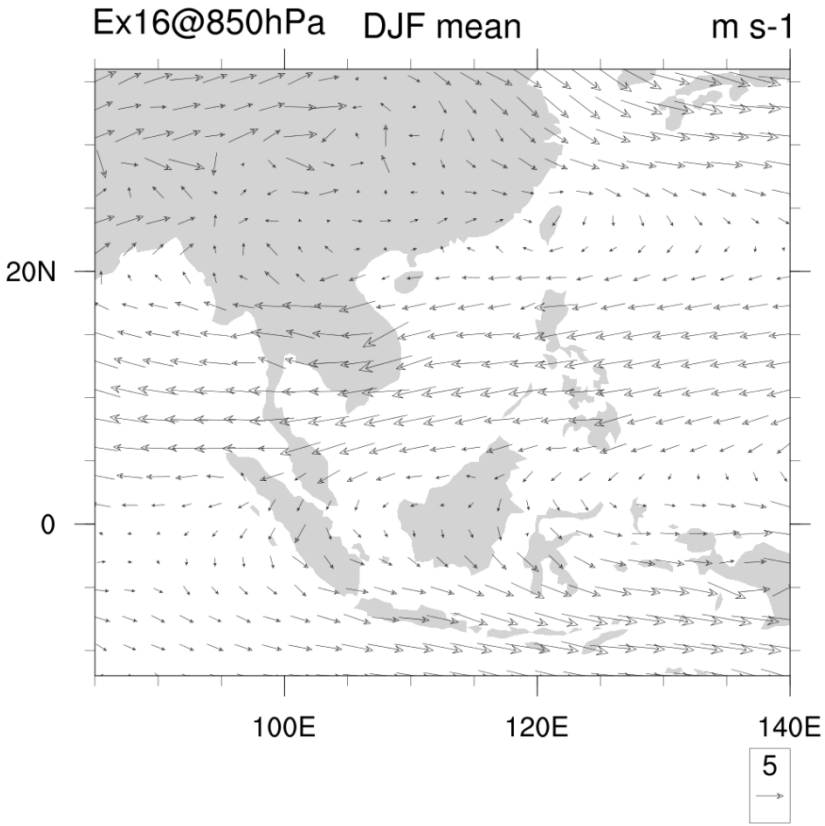
Ex11 Zeng ocean flux 1



SD U850 =
SD V850 =

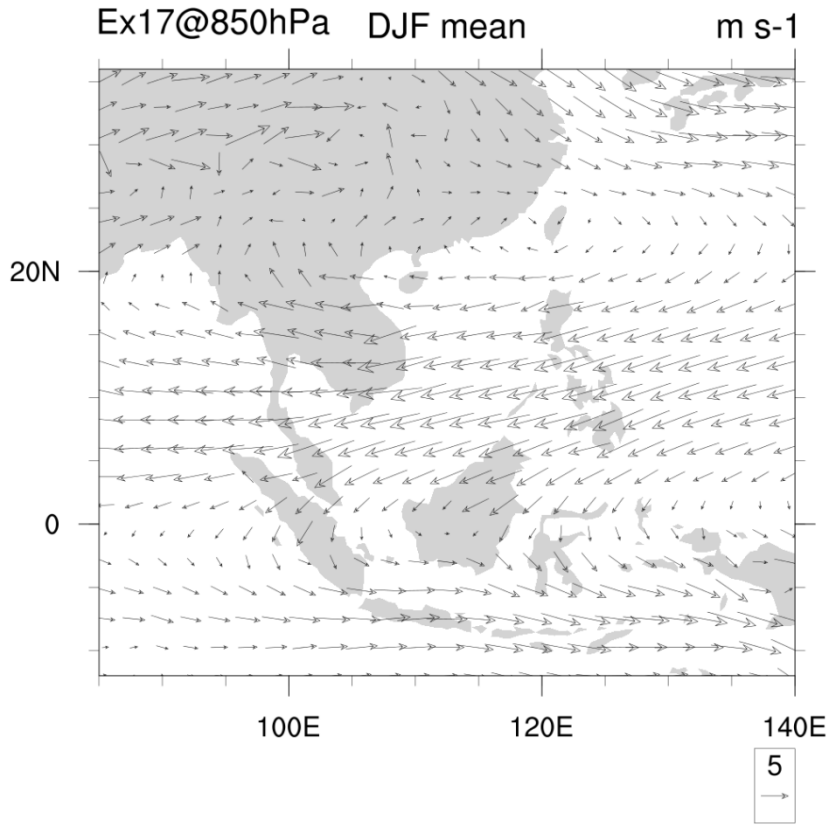
Kuo cumulus convection scheme

Ex16 BATS1e



SD U850 =
SD V850 =

Ex17 Zeng ocean flux 1



SD U850 =
SD V850 =

Conclusion

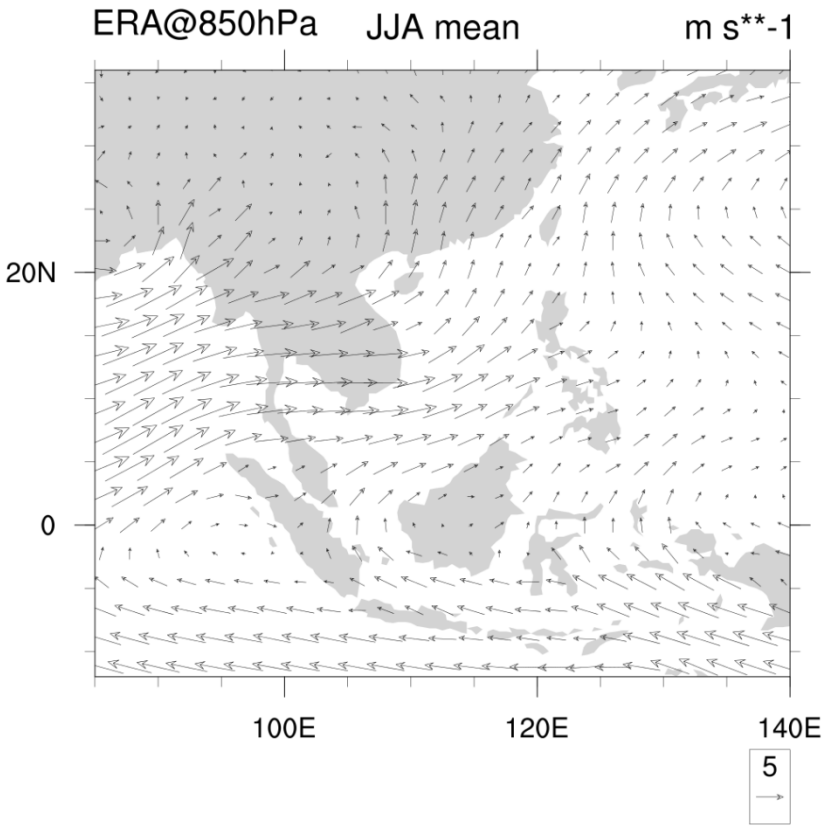
- Simulated circulation patterns were not much sensitive to the choices of Zeng ocean flux roughness parameter in most cumulus convection schemes, except Kuo scheme.
- BATS1e and Zeng ocean flux schemes gave different pattern.

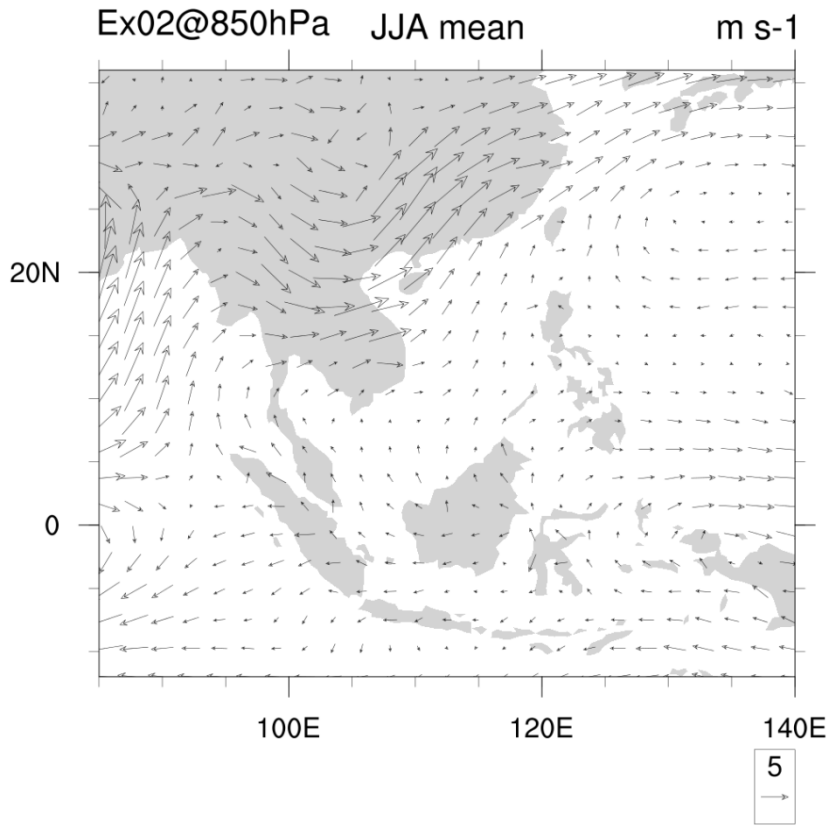
EFFECT OF CUMULUS CONVECTION SCHEMES

1. Grell + Arakawa & Schubert (1974)
2. Grell + Fritsch & Chappell (1980)
3. Emanuel (1991)
4. Emanuel (land) + Grell (ocean)
5. Grell (land) + Emanuel (ocean)
6. Kuo

Grell cumulus convection scheme
+ Arakawa-Schubert closure

ERA Interim **JJA** **Ex02**





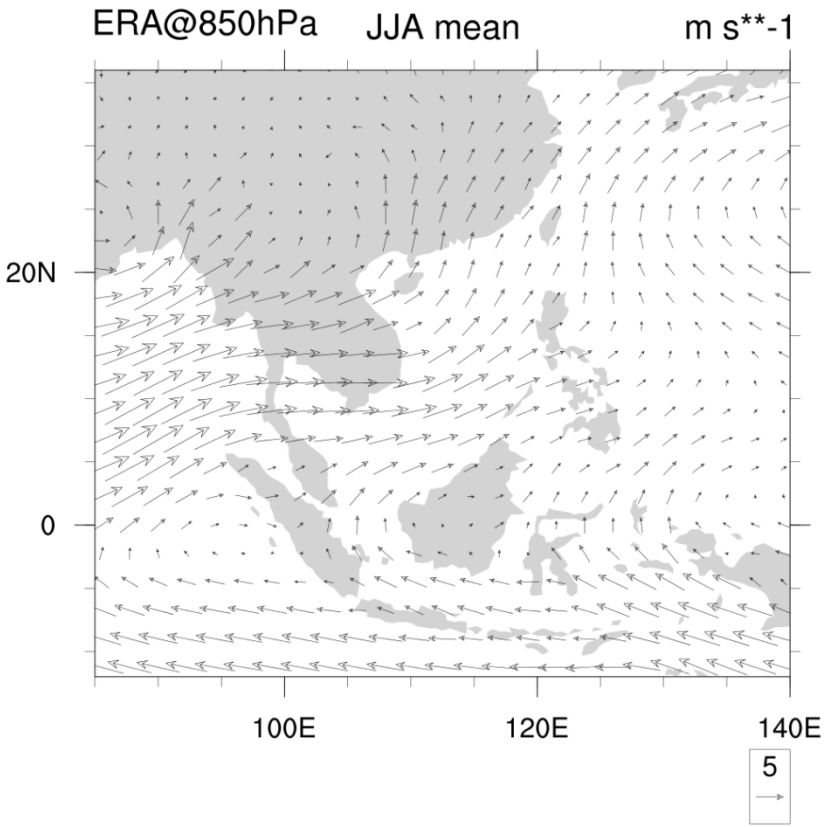
SD U850 = 4.219
SD V850 = 1.239

SD U850 = 2.955
SD V850 = 2.377

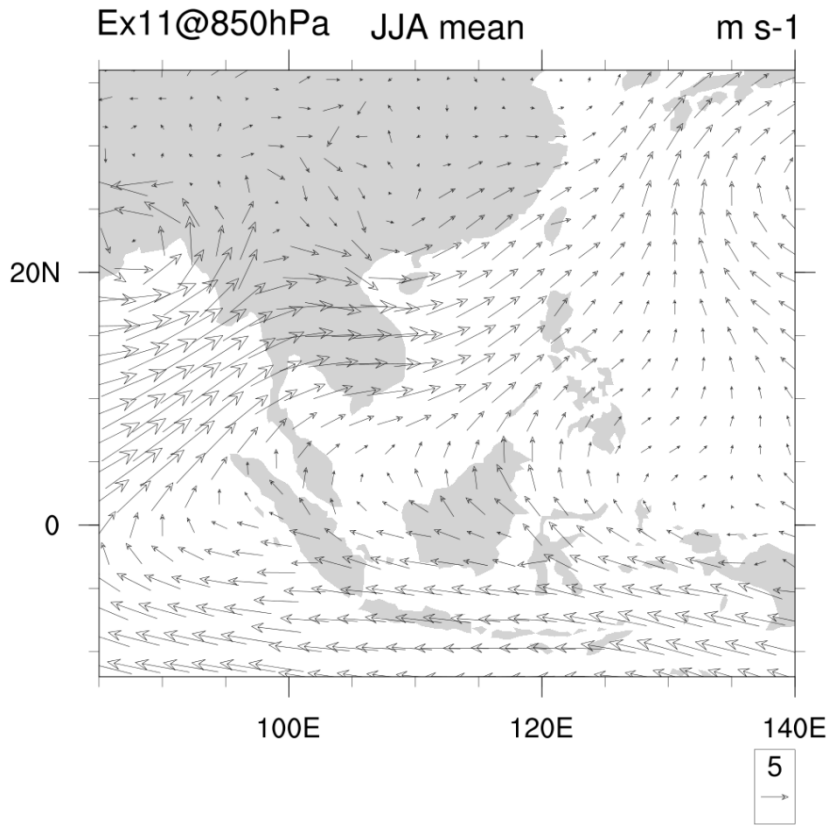
Too weak over the ocean & S.H., too strong over land (south China)

Grell cumulus convection scheme + Fritsch-Chappell closure

ERA Interim



Ex11

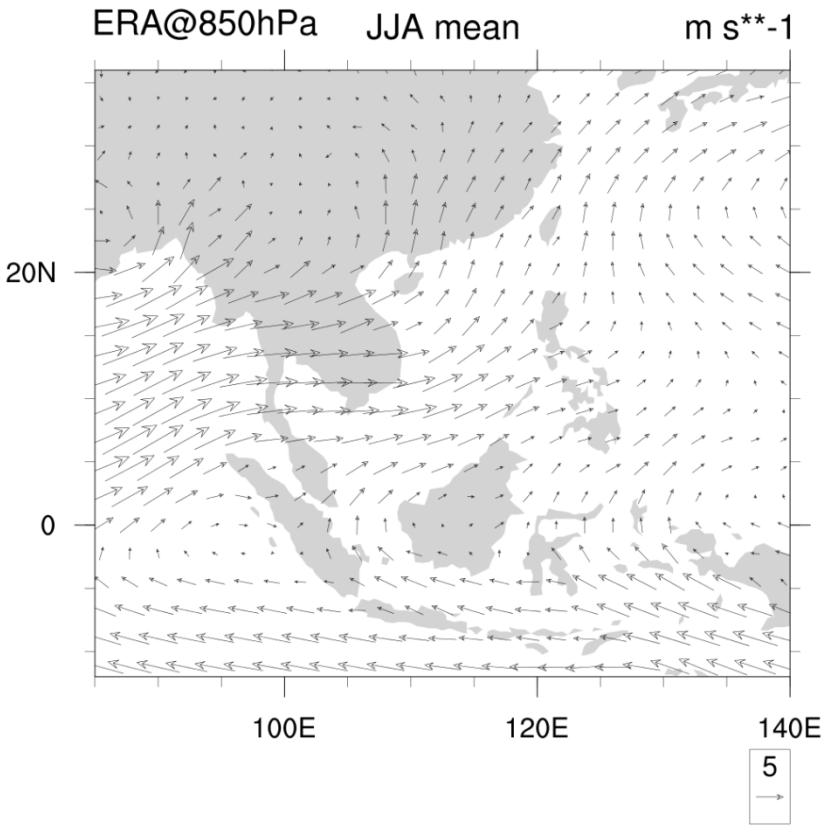


SD U850 = 4.219
SD V850 = 1.239

Better pattern agreement, too strong over land (Indochina) and S.H.

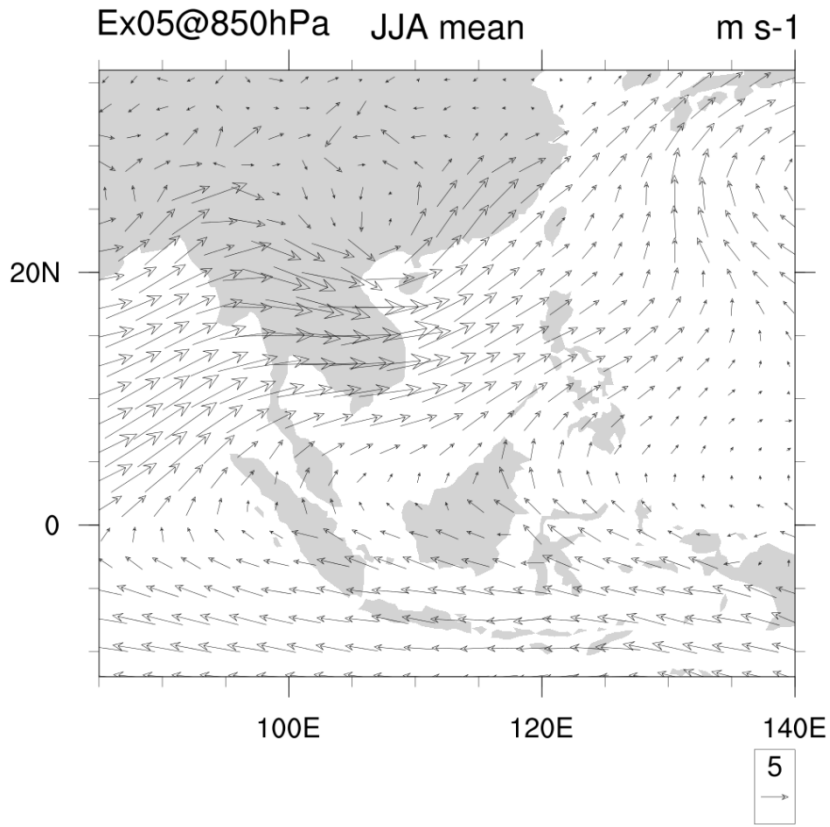
Emanuel cumulus convection scheme

ERA Interim



SD U850 = 4.219
SD V850 = 1.239

Ex05

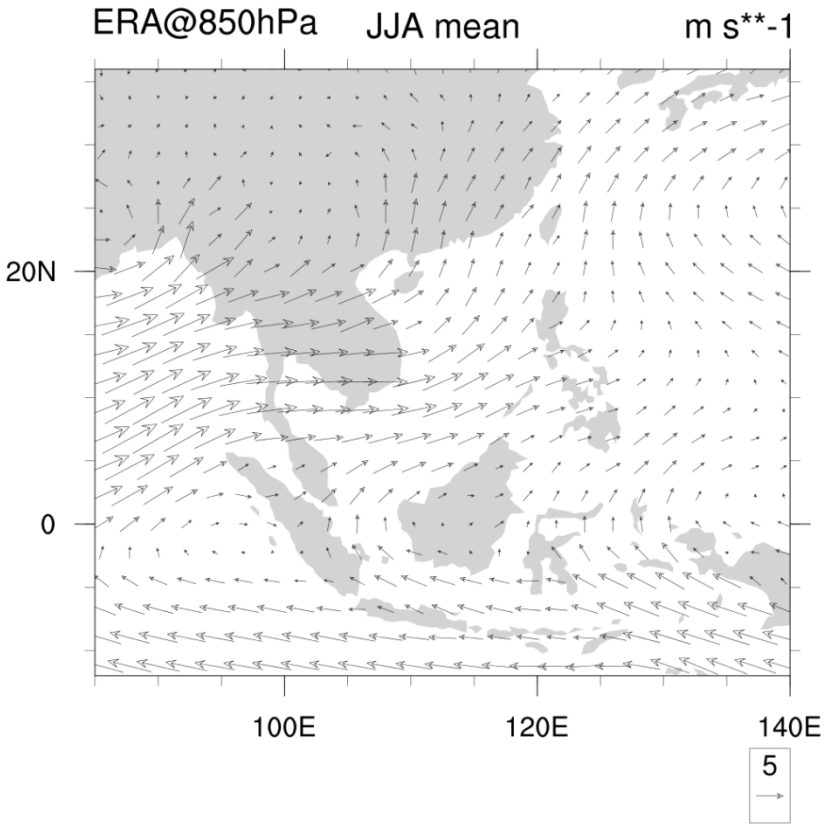


SD U850 = 5.537
SD V850 = 2.042

Too strong over land (Indochina, SH)

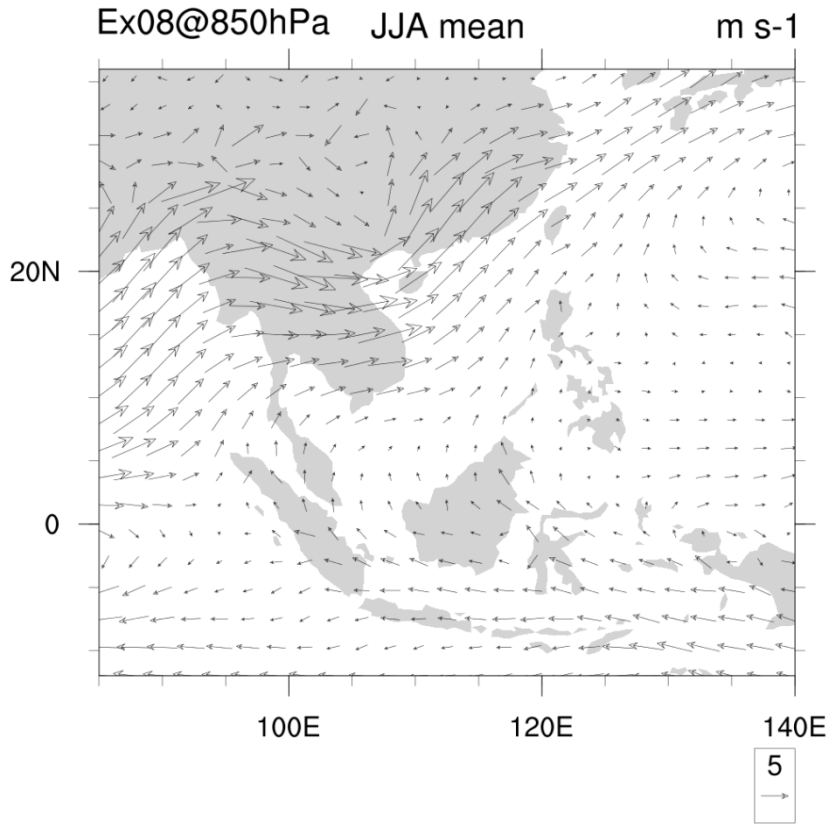
Emanuel (land) + Grell (ocean)

ERA Interim



SD U850 = 4.219
SD V850 = 1.239

Ex08

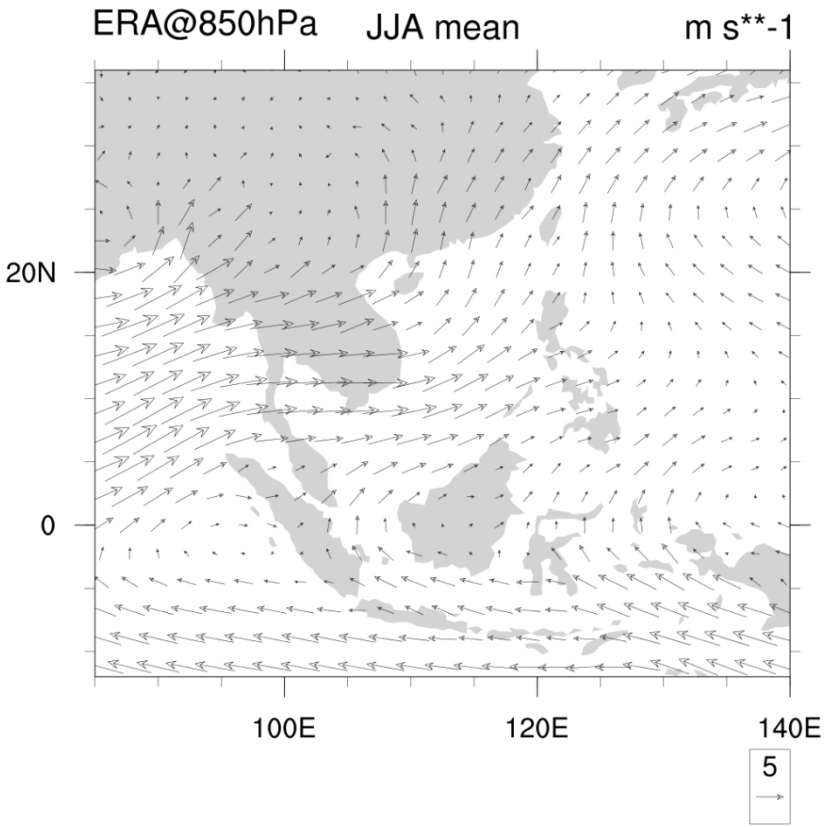


SD U850 = 4.007
SD V850 = 2.248

Too weak over the ocean, too strong over land (southern China)

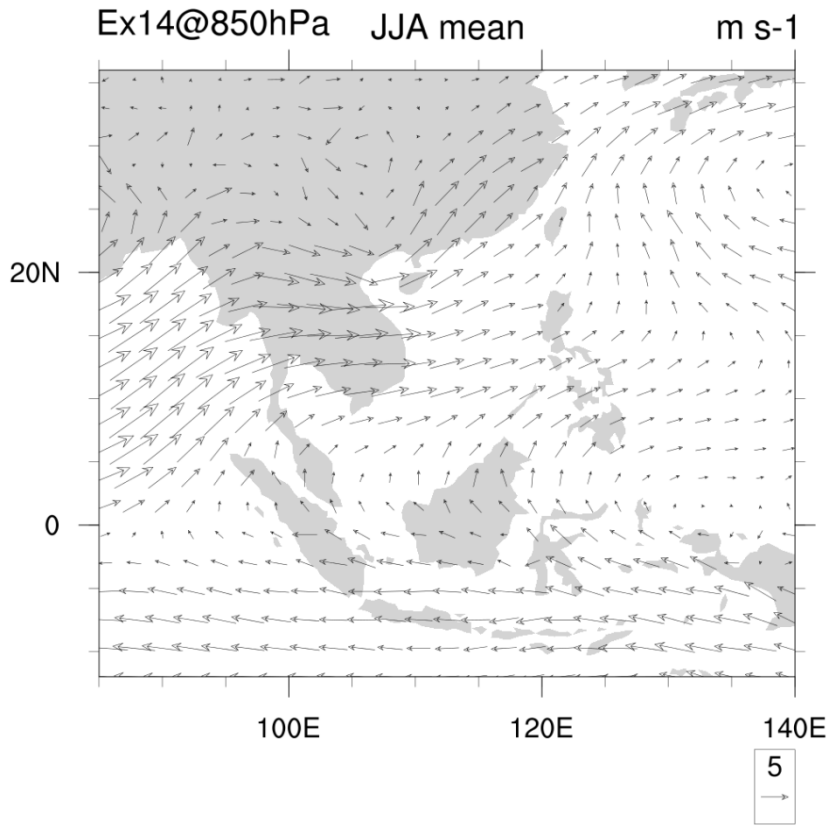
Grell (land) + Emanuel (ocean)

ERA Interim



SD U850 = 4.219
SD V850 = 1.239

Ex14

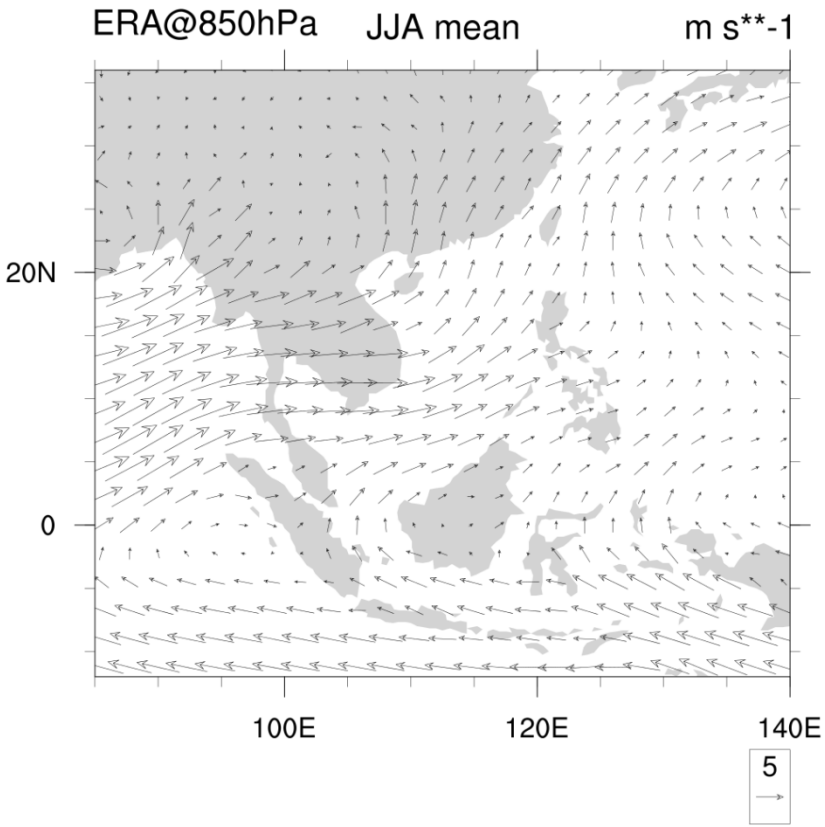


SD U850 = 4.440
SD V850 = 1.737

Overall agreement in pattern

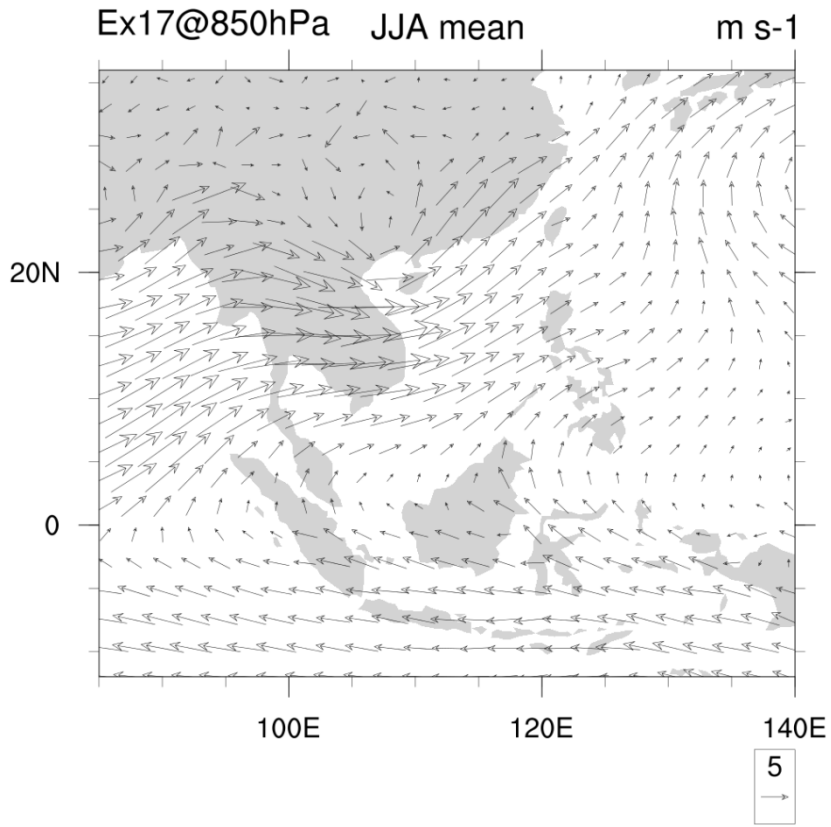
Kuo cumulus convection scheme

ERA Interim



SD U850 = 4.219
SD V850 = 1.239

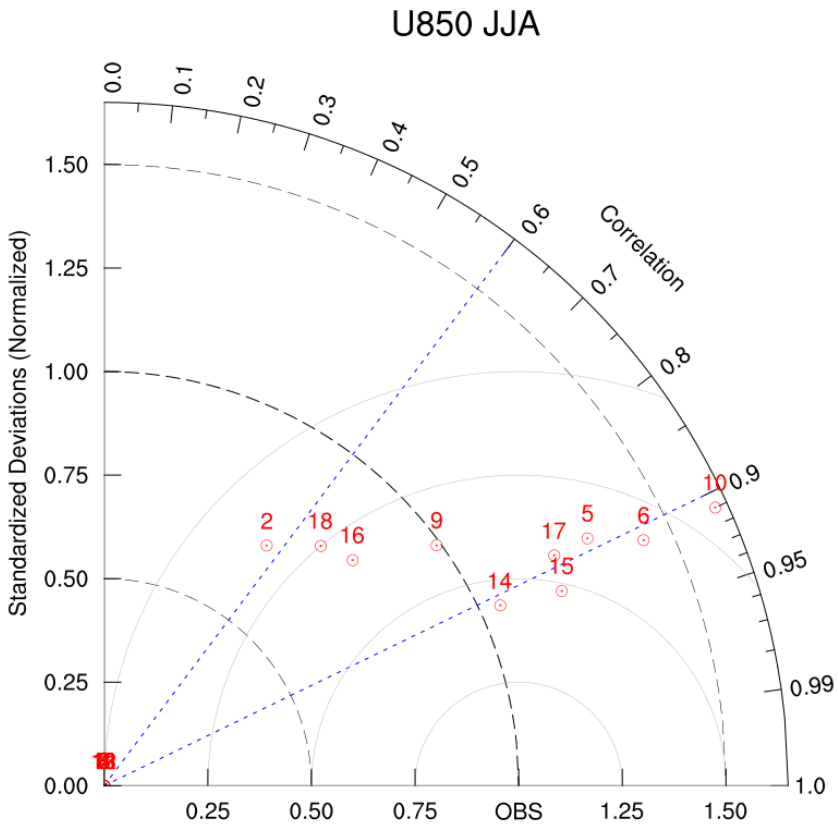
Ex17

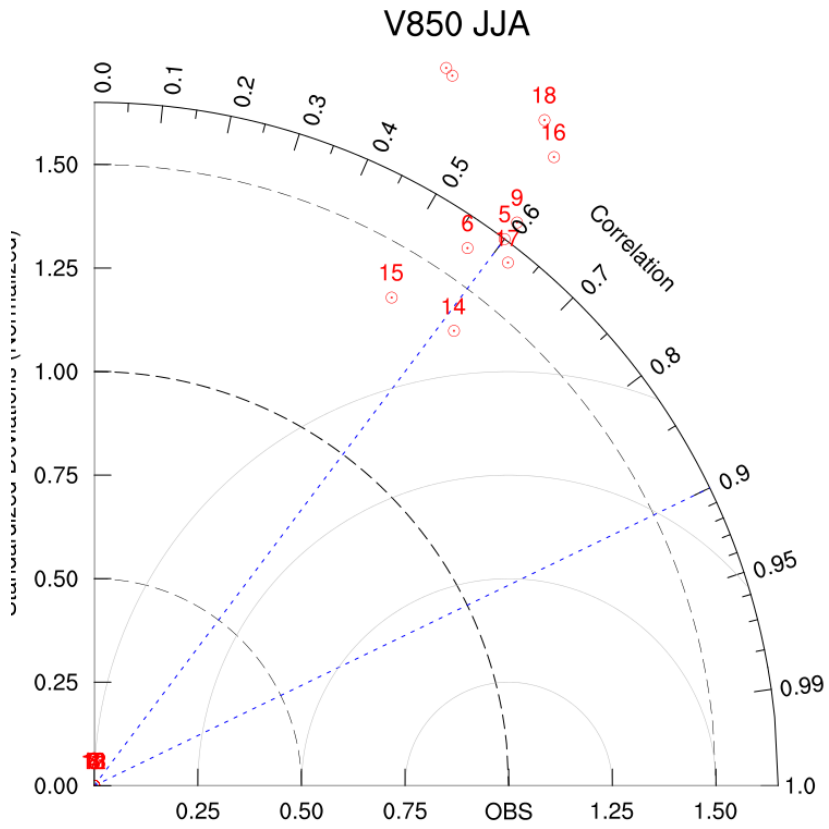


SD U850 = 5.145
SD V850 = 1.996

Too strong in N.H. (land+ocean)

Taylor diagram

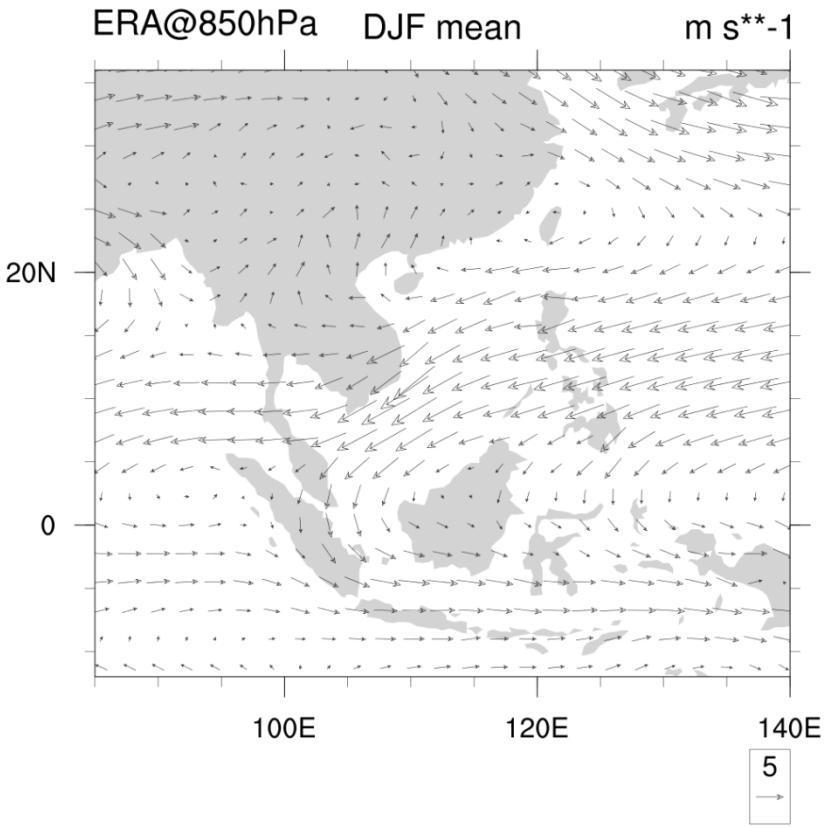


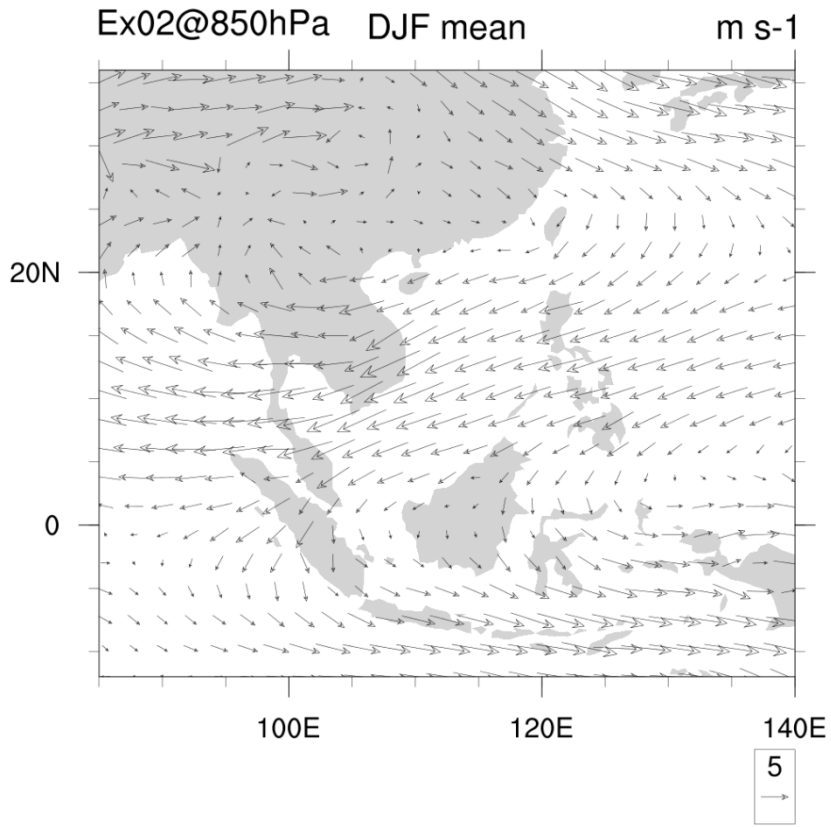


- Grell (land) + Emanuel (ocean) (14, 15)
- Emmanuel (5, 6)

Grell cumulus convection scheme
+ Arakawa-Schubert closure

ERA Interim **DJF** **Ex02**



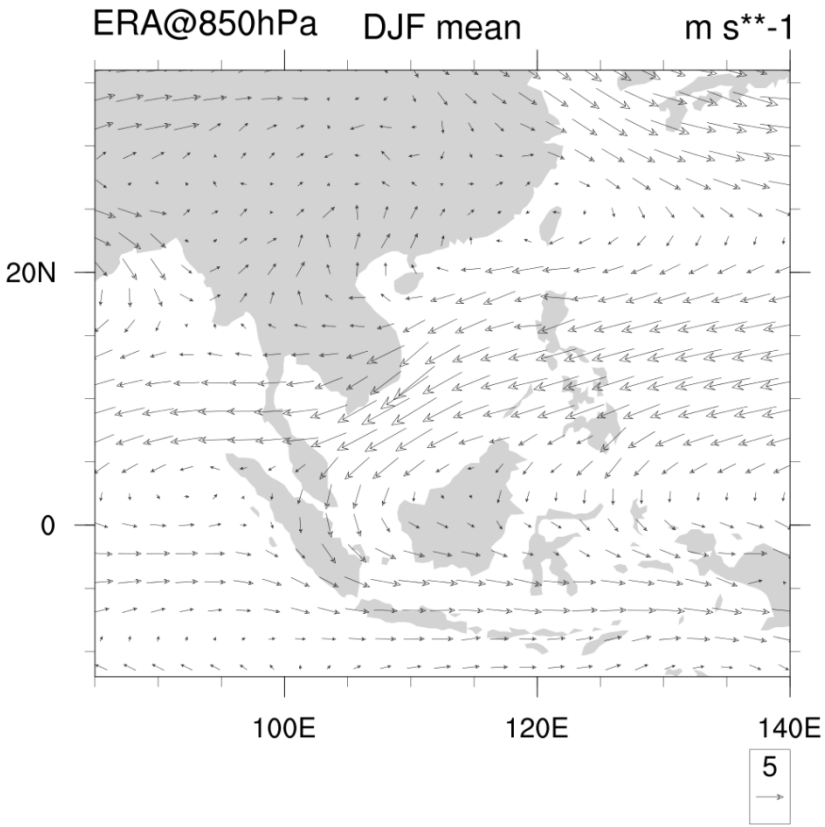


SD U850 = 4.096
SD V850 = 1.527

SD U850 = 5.347
SD V850 = 1.786

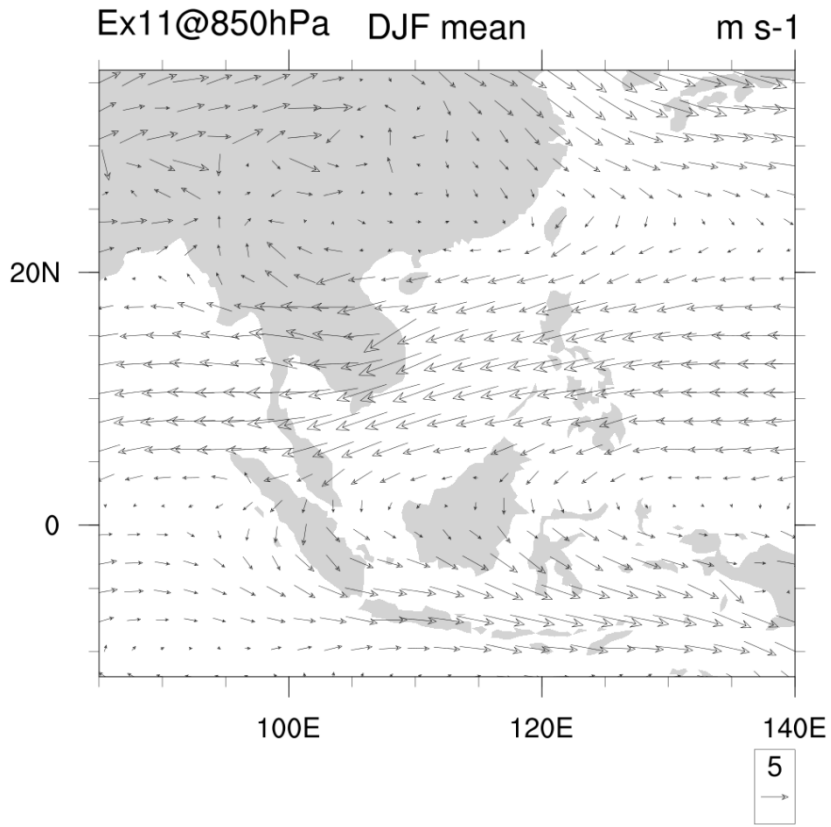
Grell cumulus convection scheme
+ Fritsch-Chappell closure

ERA Interim



SD U850 = 4.096
SD V850 = 1.527

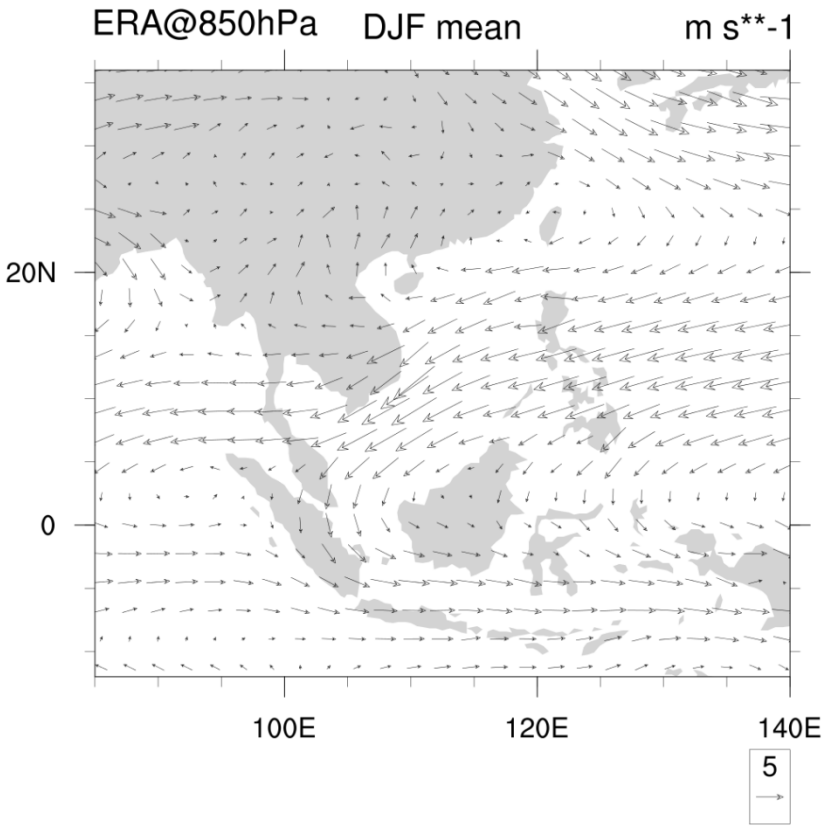
Ex11



SD U850 =
SD V850 = 1.518

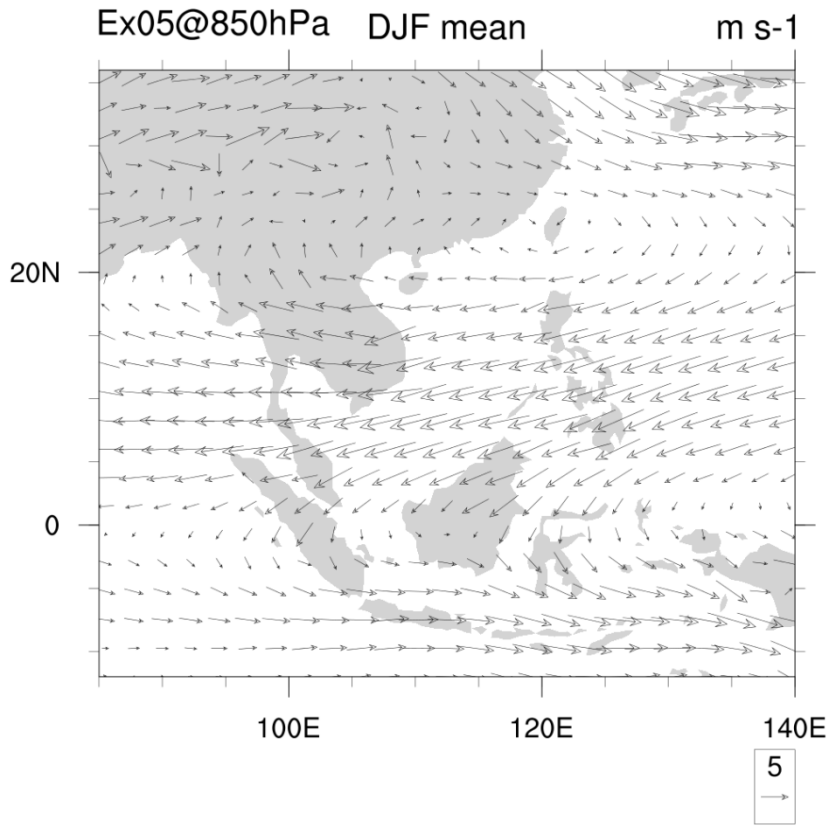
Emanuel cumulus convection scheme

ERA Interim



SD U850 = 4.096
SD V850 = 1.527

Ex05

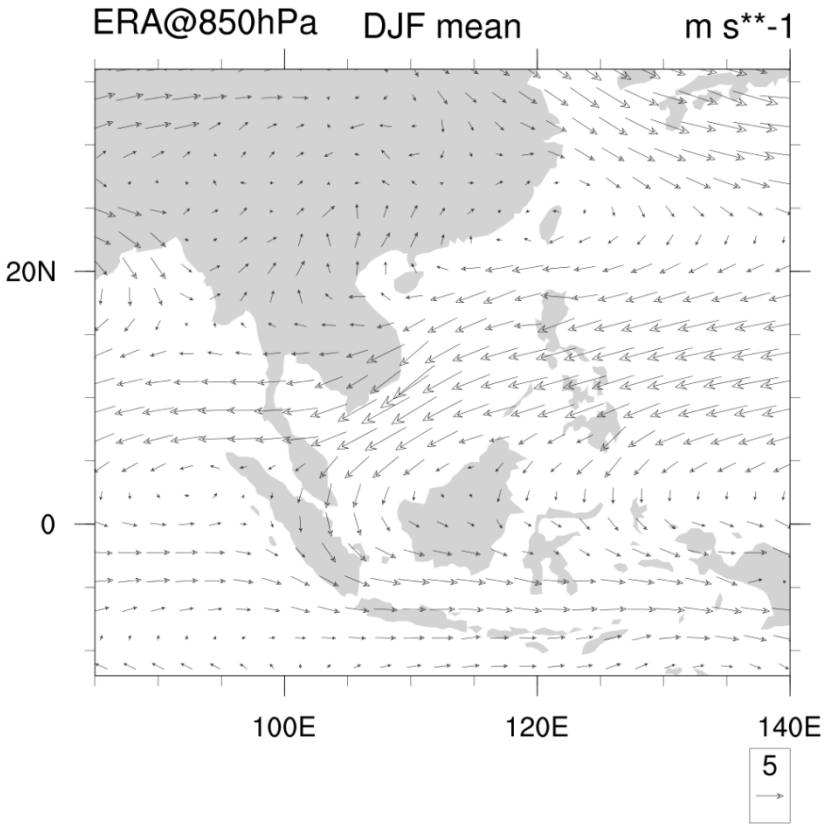


SD U850 = 5.554
SD V850 = 1.757

Too strong over the South China Sea and Borneo

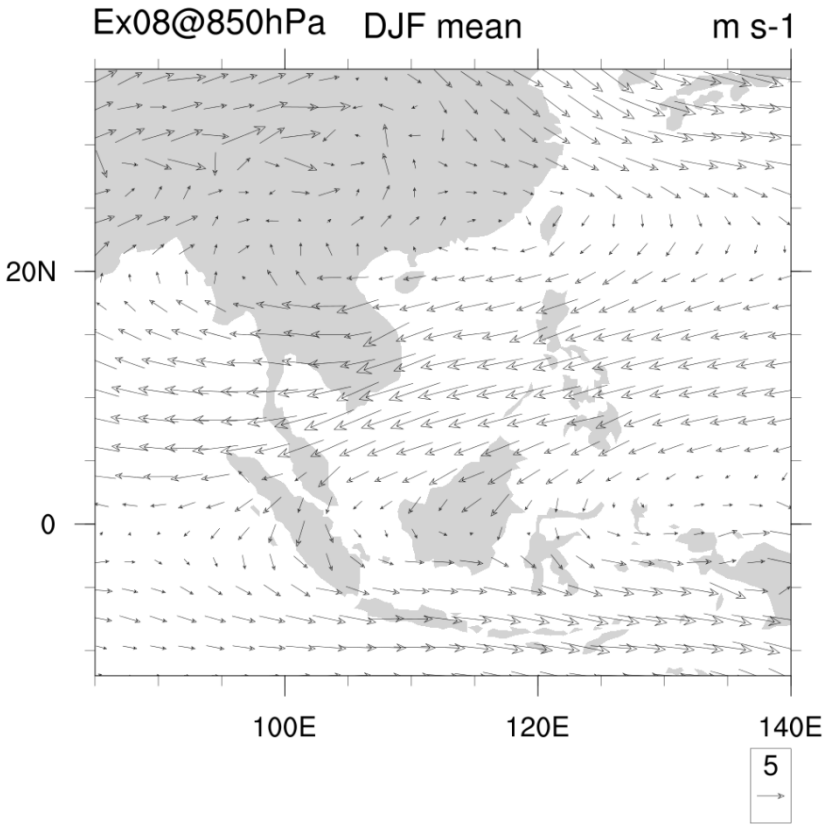
Emanuel (land) + Grell (ocean)

ERA Interim



SD U850 = 4.096
SD V850 = 1.527

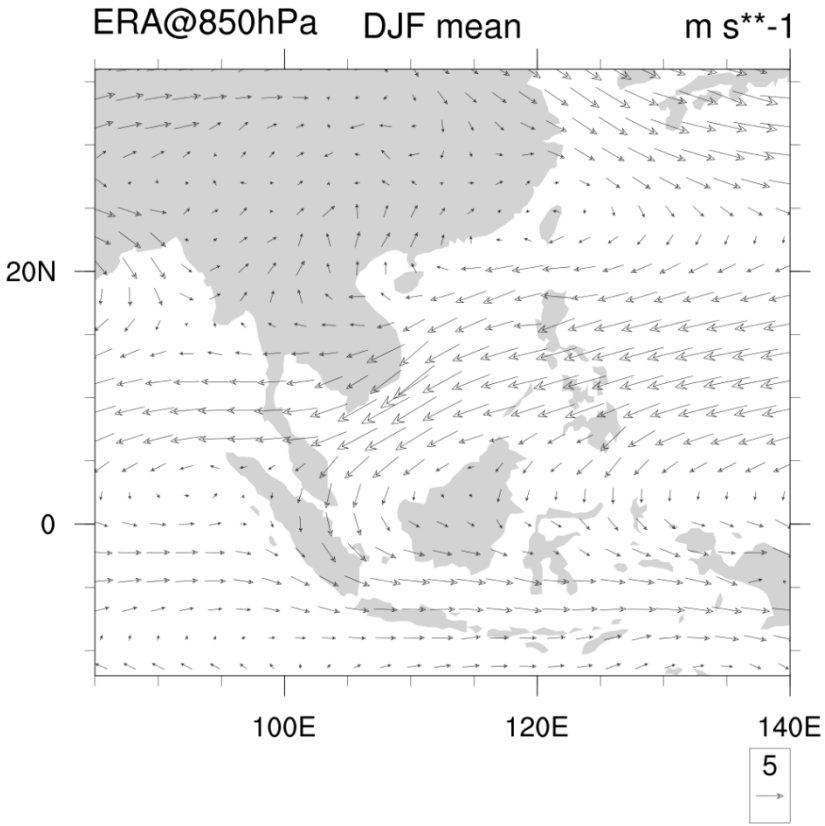
Ex08



SD U850 = 5.314
SD V850 = 1.697

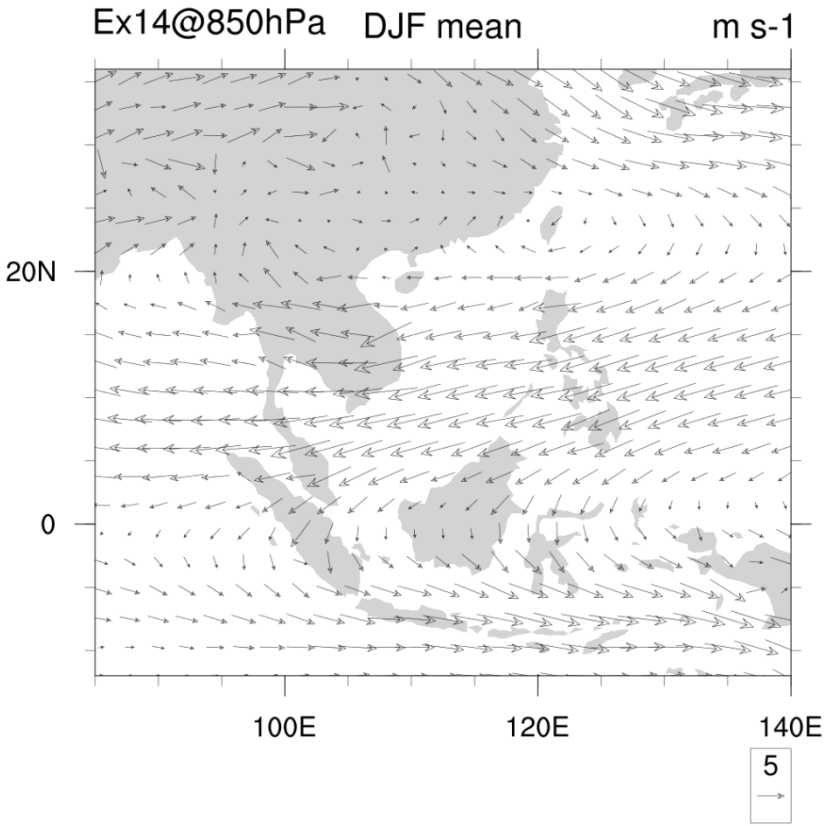
Grell (land) + Emanuel (ocean)

ERA Interim



SD U850 = 4.096
SD V850 = 1.527

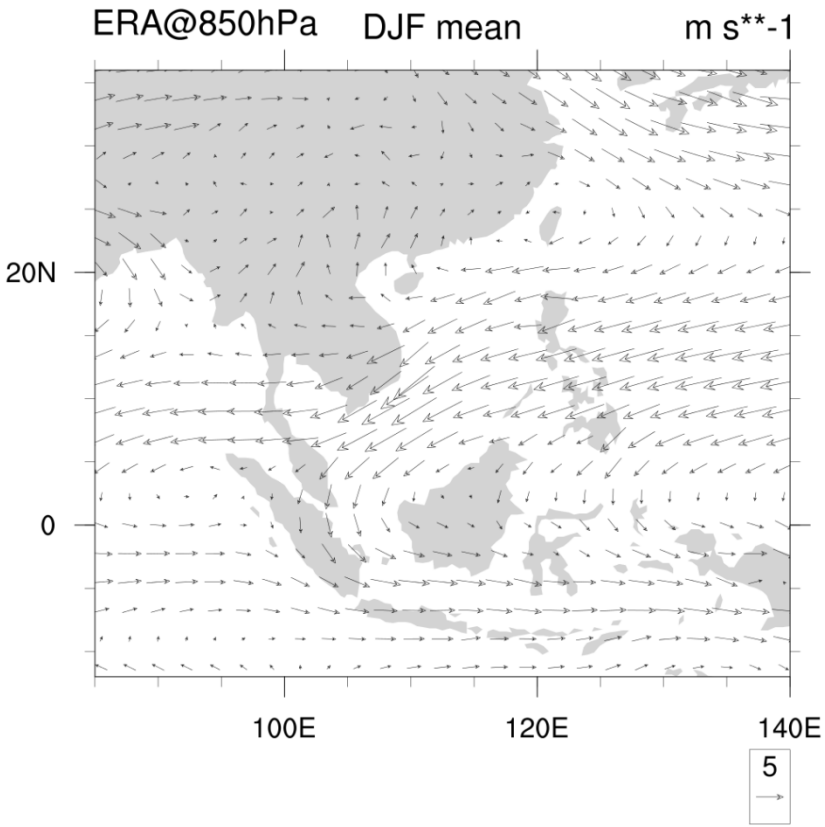
Ex14



SD U850 = 5.554
SD V850 = 1.732

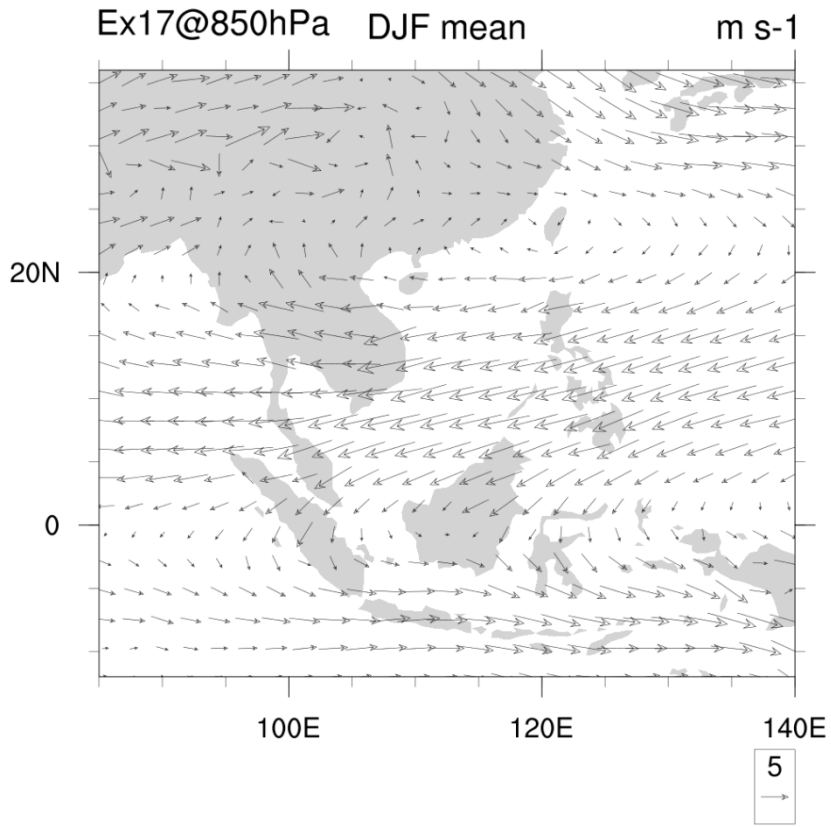
Kuo cumulus convection scheme

ERA Interim



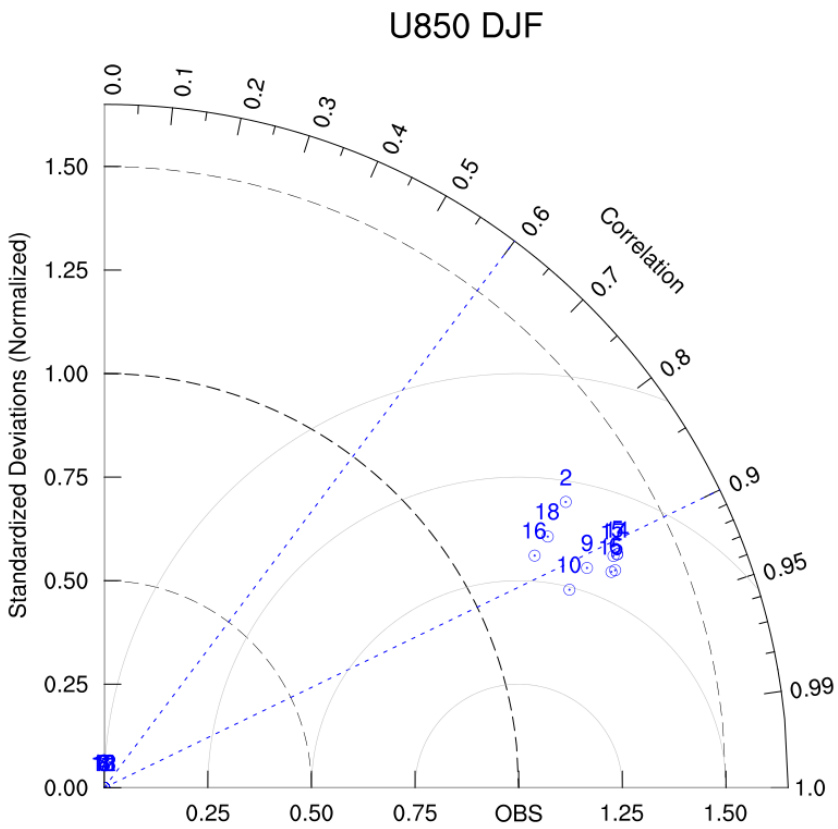
SD U850 = 4.096
SD V850 = 1.527

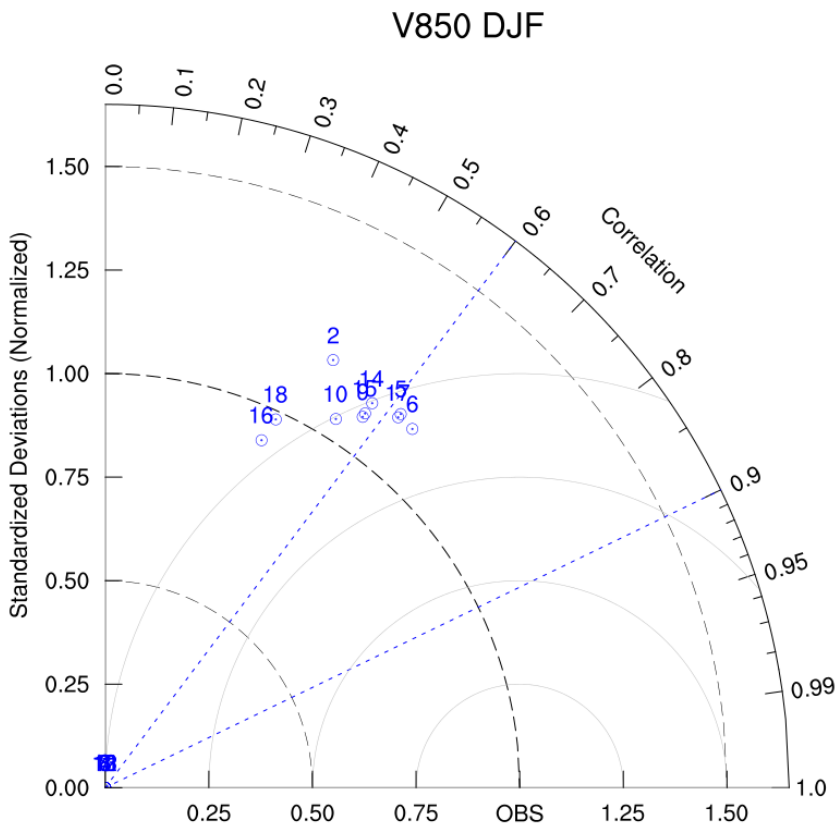
Ex17



SD U850 = 5.546
SD V850 = 1.745

Taylor diagram





- Closer agreement among experiments in NE monsoon season
- Overestimation of variability

Conclusion

- Simulated circulation patterns were not much sensitive to the choices of Zeng ocean flux roughness parameter
- BATS1e and Zeng ocean flux schemes gave different pattern
- Simulated circulation patterns were sensitive to the choices of cumulus convection scheme
- The Grell (land) + Emanuel (ocean) gave better results in terms of correlation, standard deviation and rms difference.