CPTEC
Centro de Previsão de Tempo e Estudos Climáticos

MINISTÉRIO DA CIÊNCIA E TECNOLOGIA
INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS

CSSP Brazil: Annual Workshop

WP2 Review of INPE work in 2017/18 and plans for 2018/19

Silvio Nilo Figueroa, Gilvan Sampaio, Caio Coelho, Dayana Castilho, Paulo Kubota, Enver Ramirez, Wanderson Santos, L. Alves, Chris Jones, Robin Chadwick.

CPTEC / INPE / MCTIC

EXETER, Monday 25th to Wednesday 27th June 2018

WWW.CPTEC.INPE.BR

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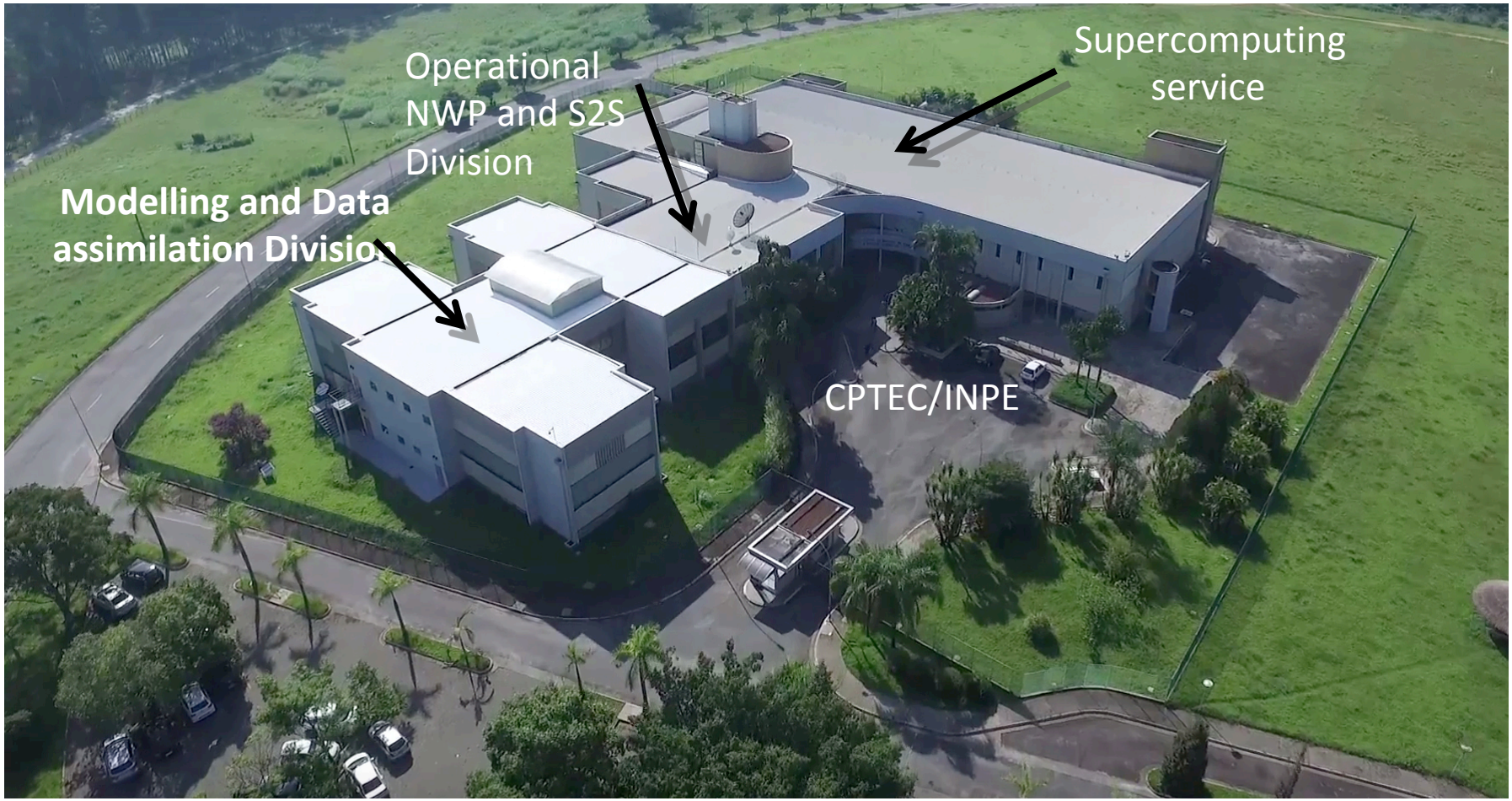

Operational
NWP and S2S
Division
Supercomputing
service
Modelling and Data
assimilation Division
CPTEC/INPE

CSSP – Activities – WP2 - coupled modeling and rainfall REVIEW

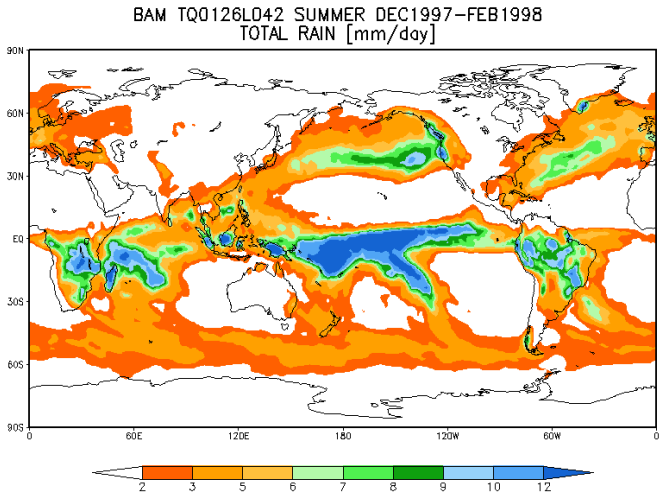
1. AMIP simulations by using the CPTEC global atmospheric Model (BAM), period 1979-2014. Focusing in three main areas:
    1. The South American Monsoon System: Amazon convection, SACZ, LLJ at eastern Andes and Upper-level circulation, diurnal cycle of precipitation.
    2. Teleconnections patterns: Pacific-South American Pattern (PSA) and Madden-Julian Oscillation (MJO) and 3) Land-atmosphere coupling.

    So far the CPTEC BAM model has been used to perform a 10-year long AMIP style simulation (computational limitation). Some preliminary results are presented here.

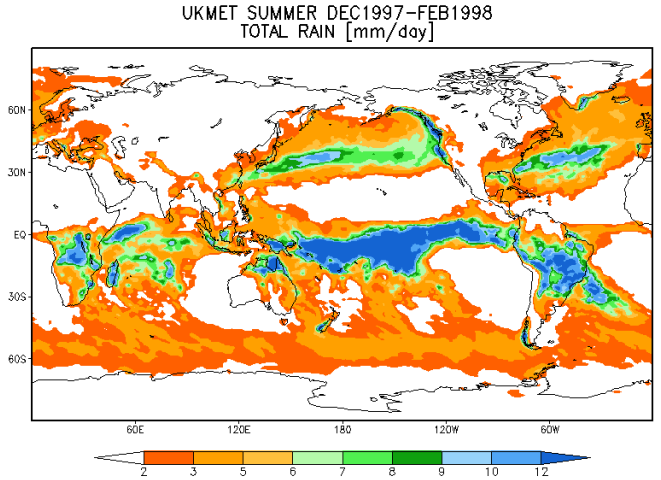
2. Single Column models (SCMs) intercomparison. CPTEC_SCM and UKMet-SCM
    1. Exchange experiences in SCMs development.
    2. Sensitivity experiments during Go-Amazon: convection, PBL, surface processes, microphysics, aerosol and radiation.

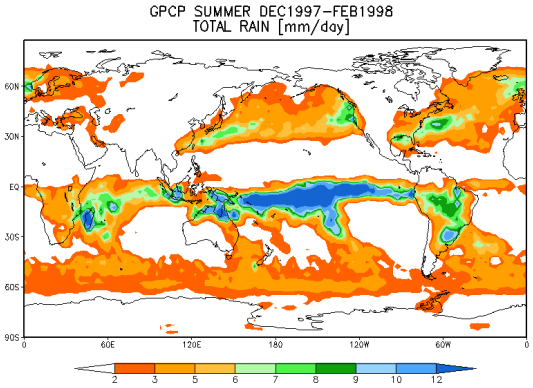
    Enver traveling to UKMet was cancelled due to his Visa problem. However many experiments by using the CPTEC SCM are going on.
3. Future projections/downscaling/land-use (Gilvan already explained on this issue).
4. Met Office visiting scientists to INPE? And/or INPE visiting scientists to Met Office. In discussion

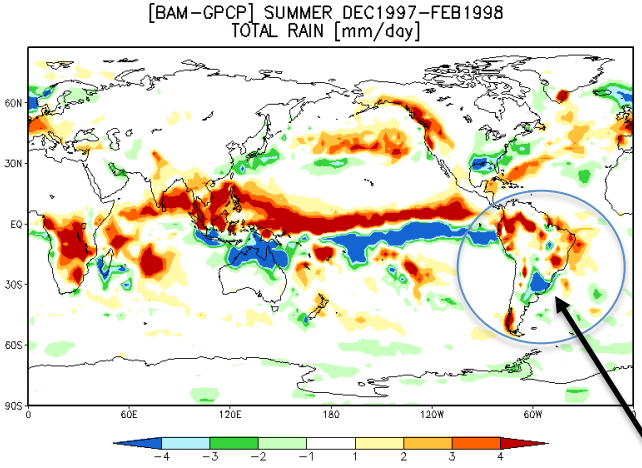
CPTEC:10-year long AMIP style (1995-2004), preliminary results.
UKMET: AMIP simulation (1979-2014)

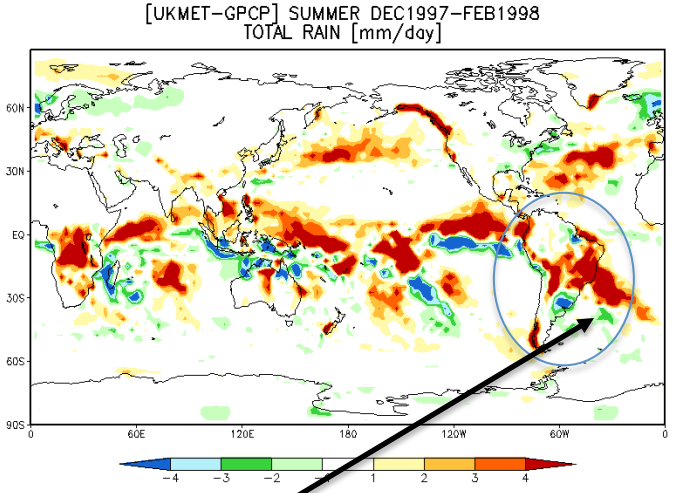


EL NIÑO 97/98







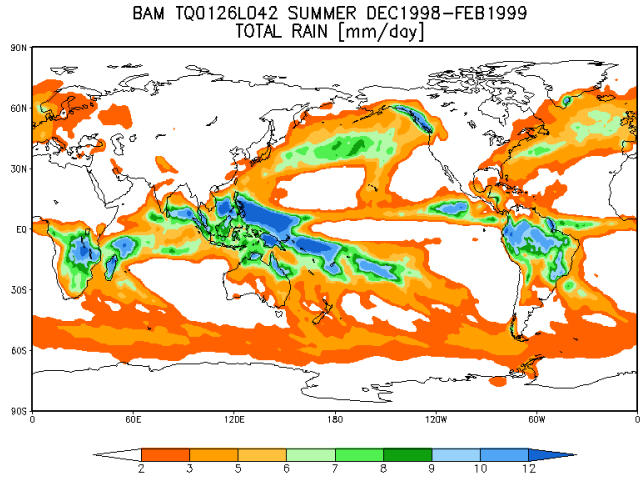


ERRORS

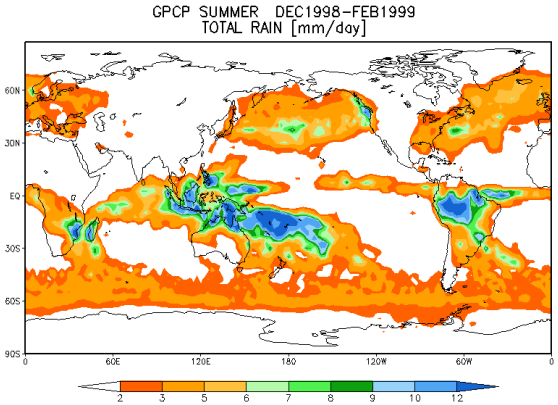
CPTEC. Southern South America, Amazon

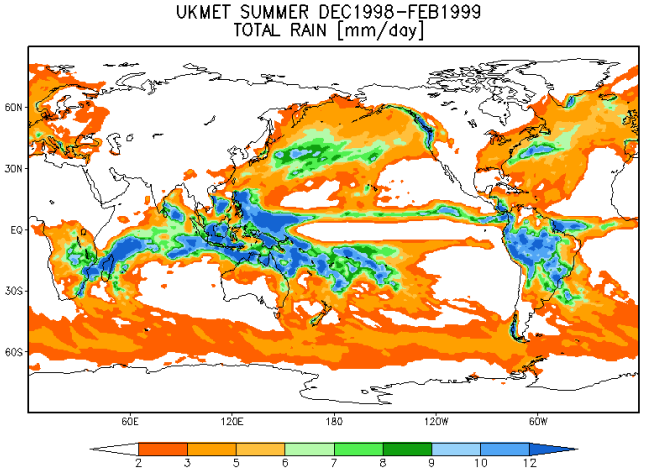
UKMET: Southern South America, SACZ, Andes

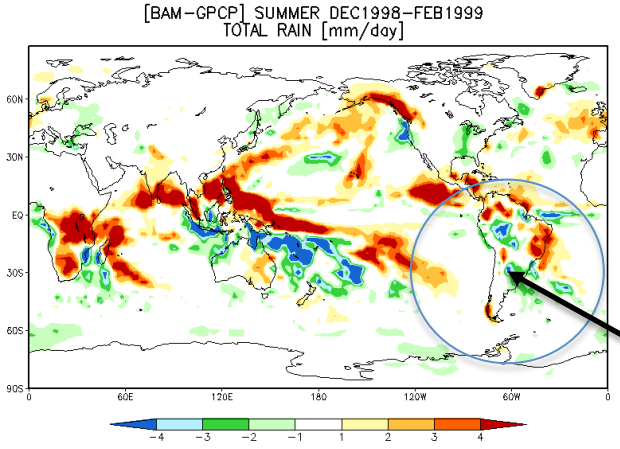
AMIP style simulation
CPTEC and UKMET Global Models

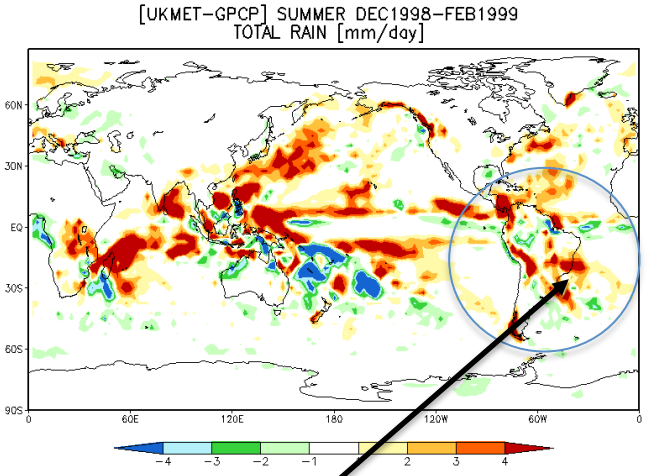


LA NIÑA 98/99









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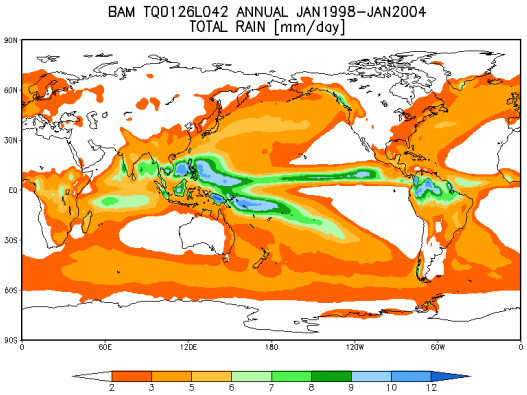
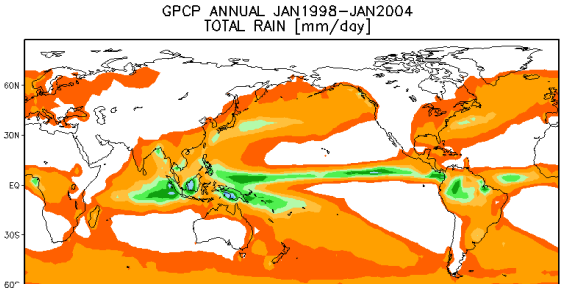
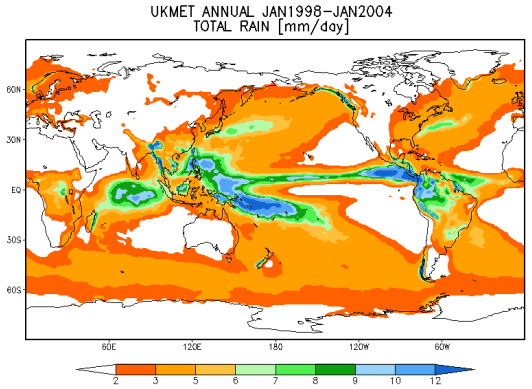
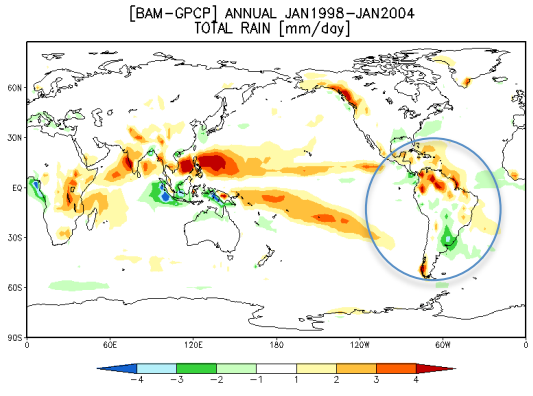
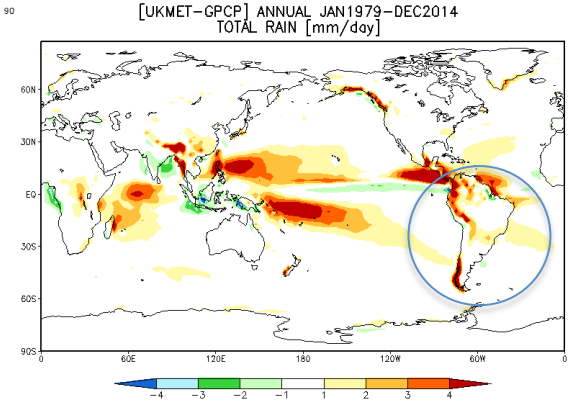
ANNUAL PRECIPITATION

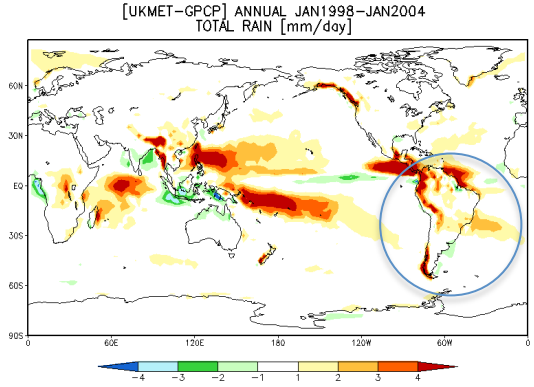












CPTEC: AMIP Style simulation (1998-2004)

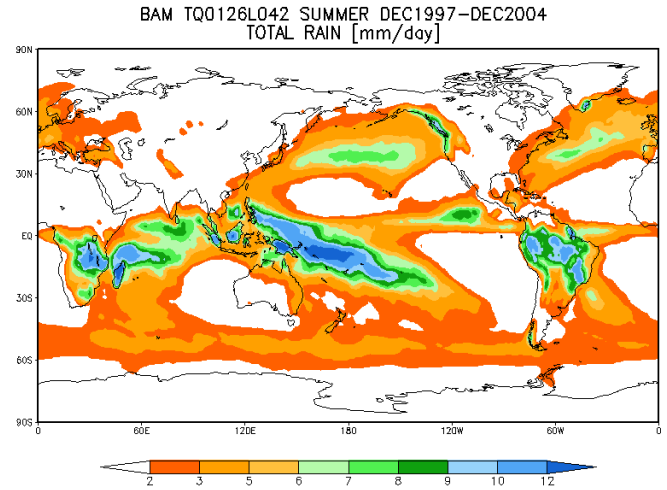
UKMET: AMIP simulation (1979-2014)

UKMET: AMIP simulation (1998-2004)

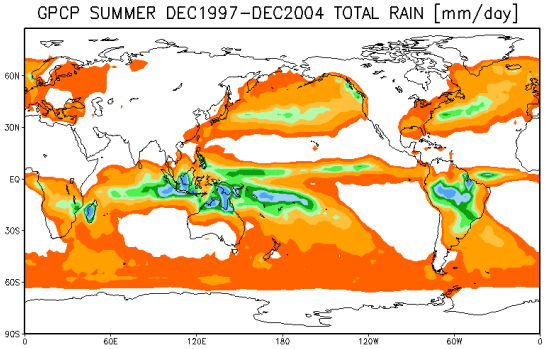
CPTEC. Southern South America, Amazon

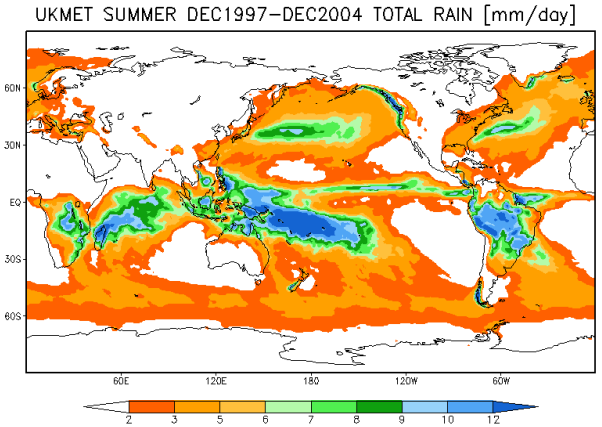
UKMET: SACZ, Andes

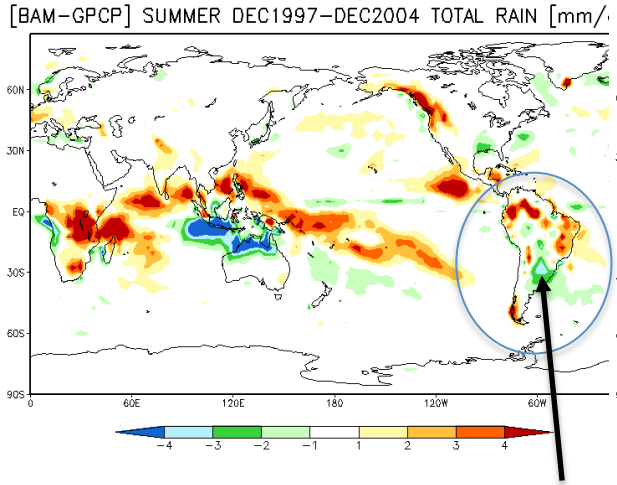
AMIP style simulation
CPTEC and UKMET Global Models



DJF PRECIPITATION







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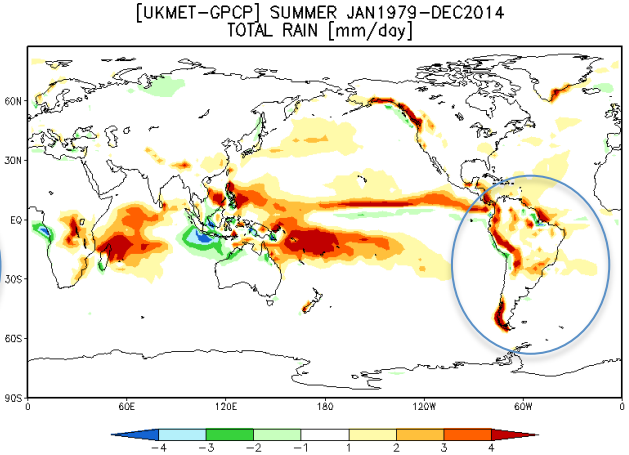
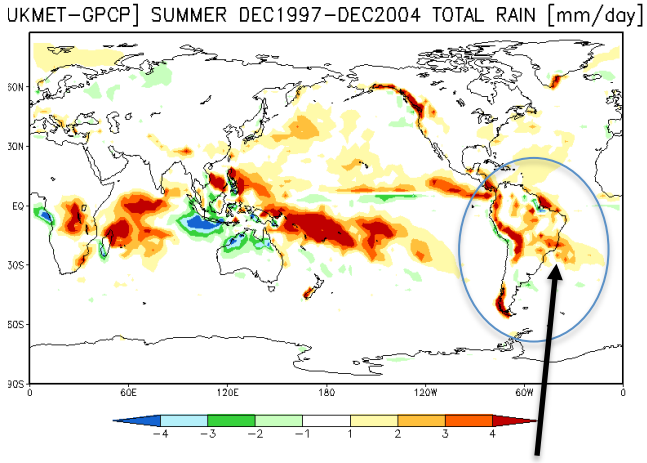
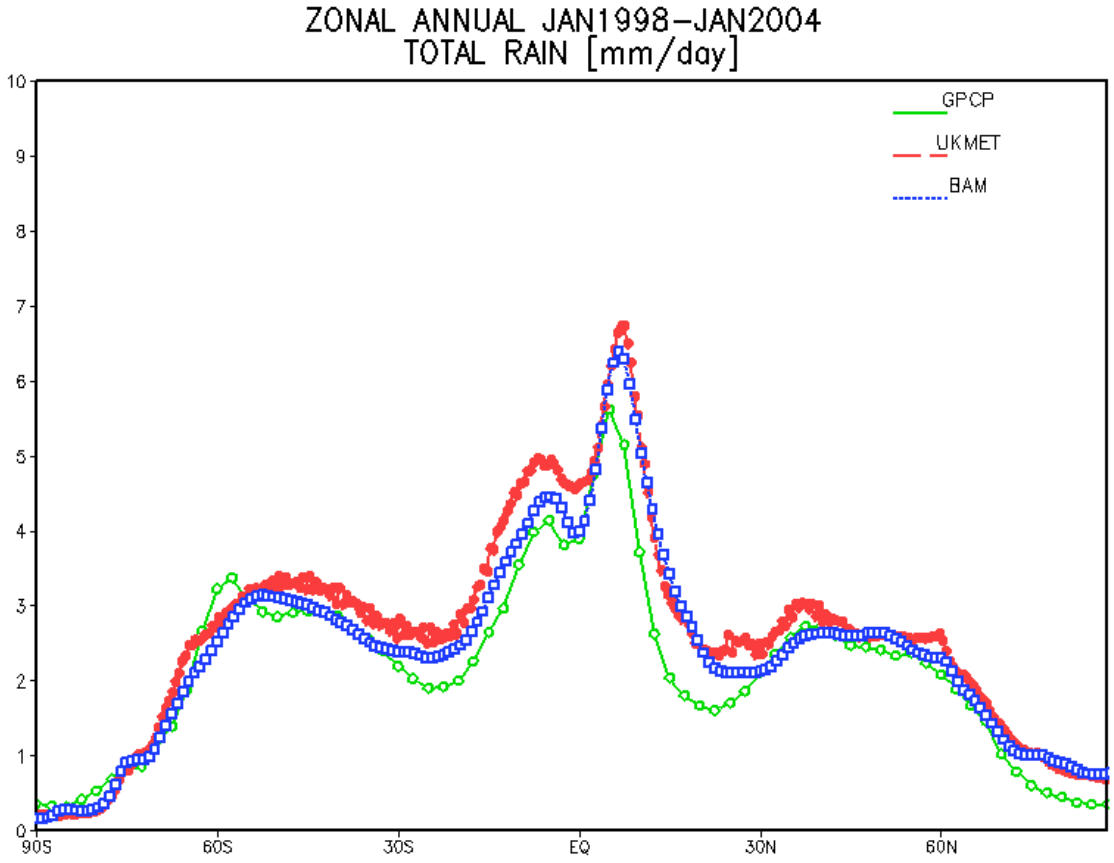


UKMET: AMIP simulation (1979-2014)

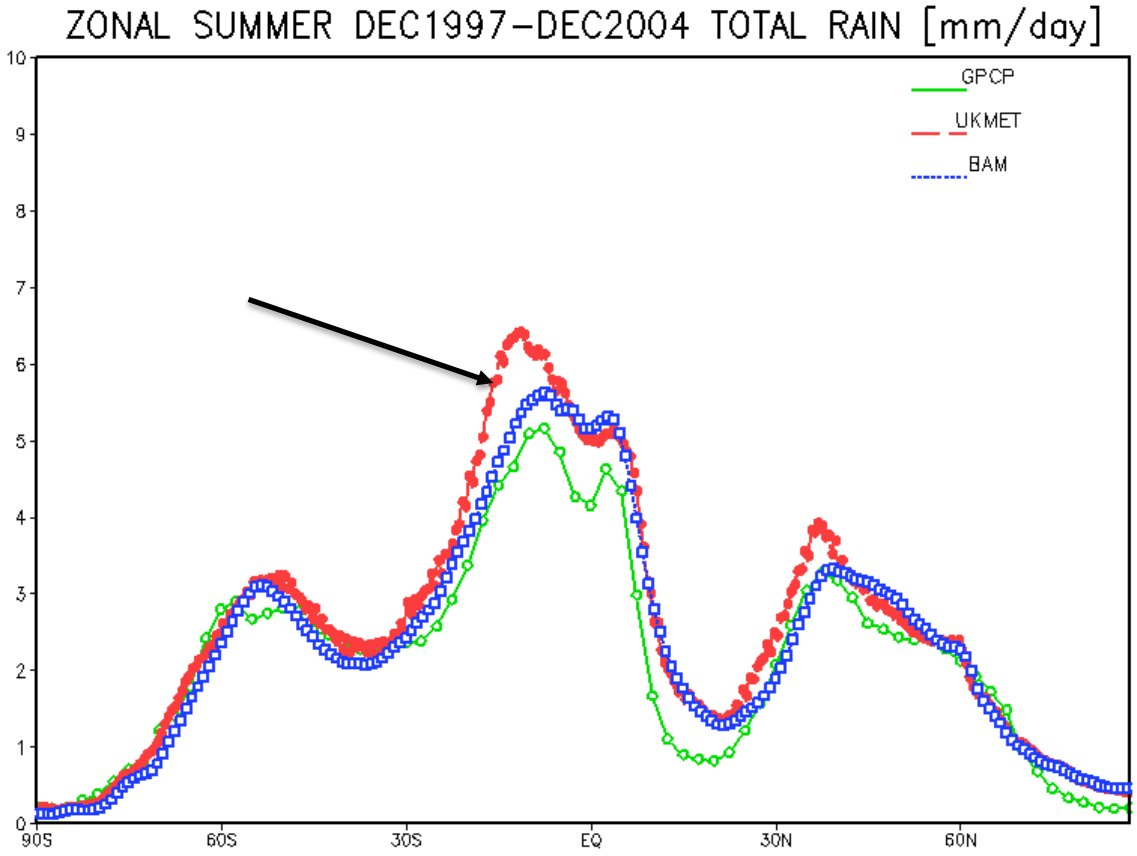


UKMET: AMIP simulation (1998-2004)

AMIP style simulation
CPTEC and UKMET Global Models



AMIP style simulation
CPTEC and UKMET Global Models



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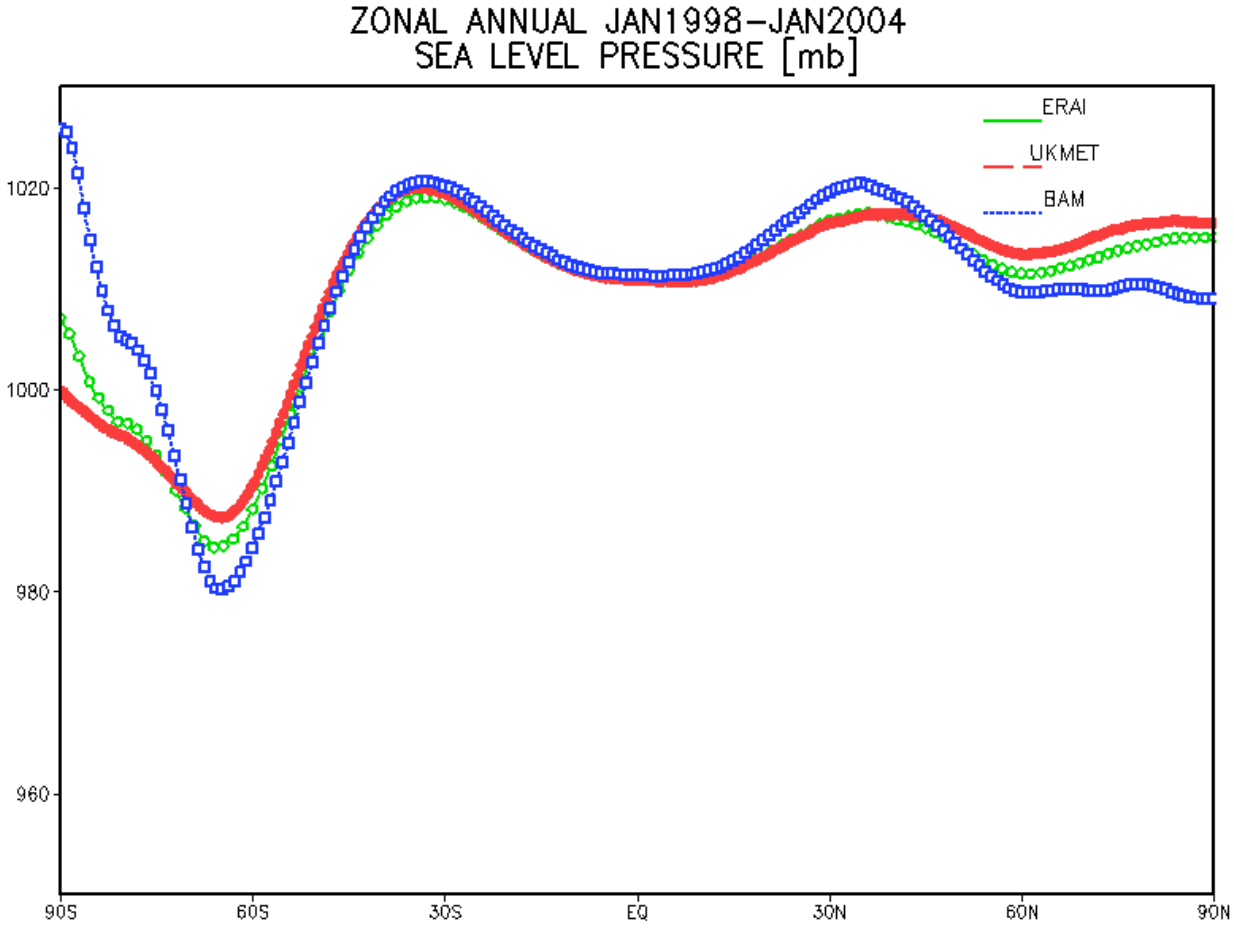
CPTEC and UKMET Global Models



AMIP style simulation
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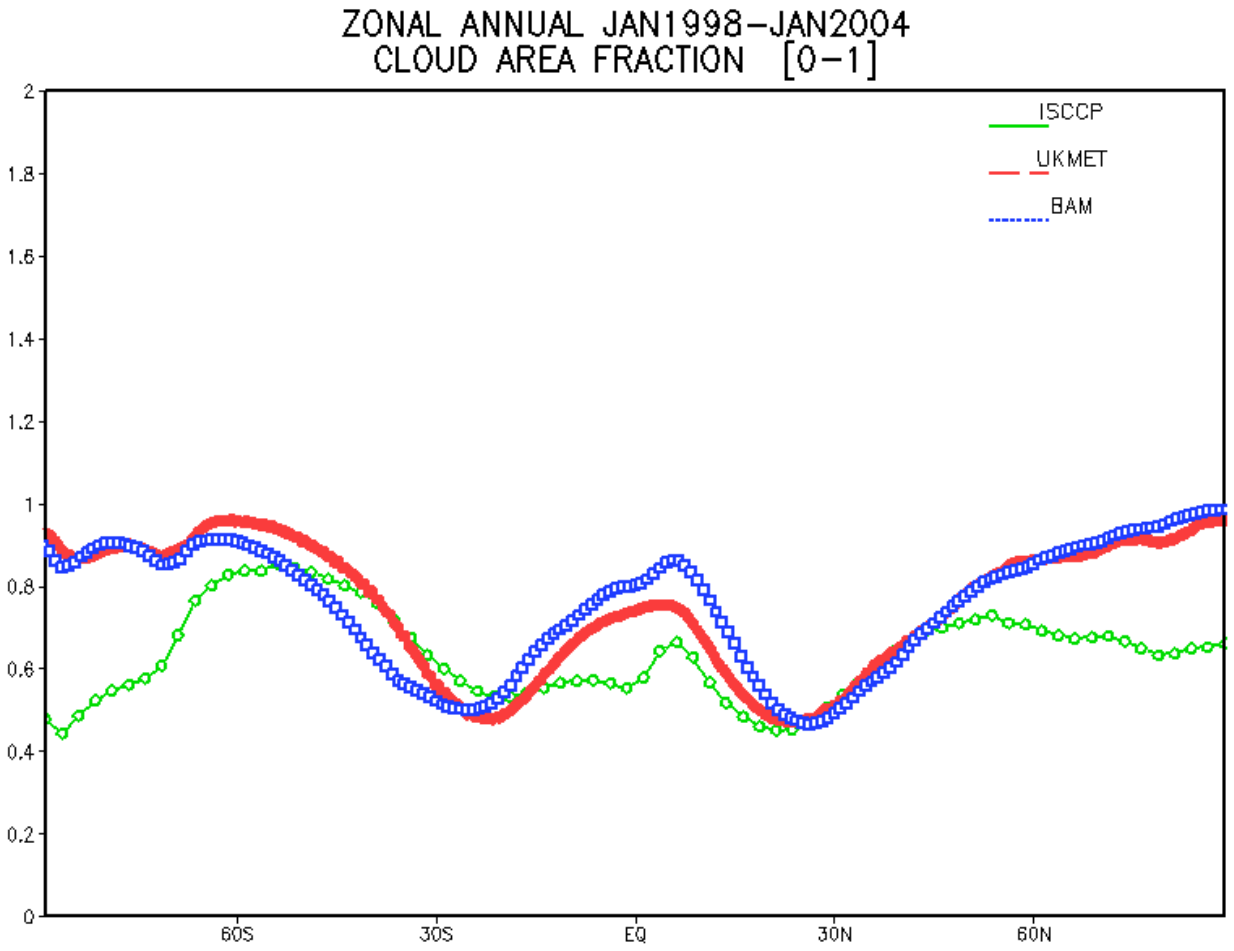

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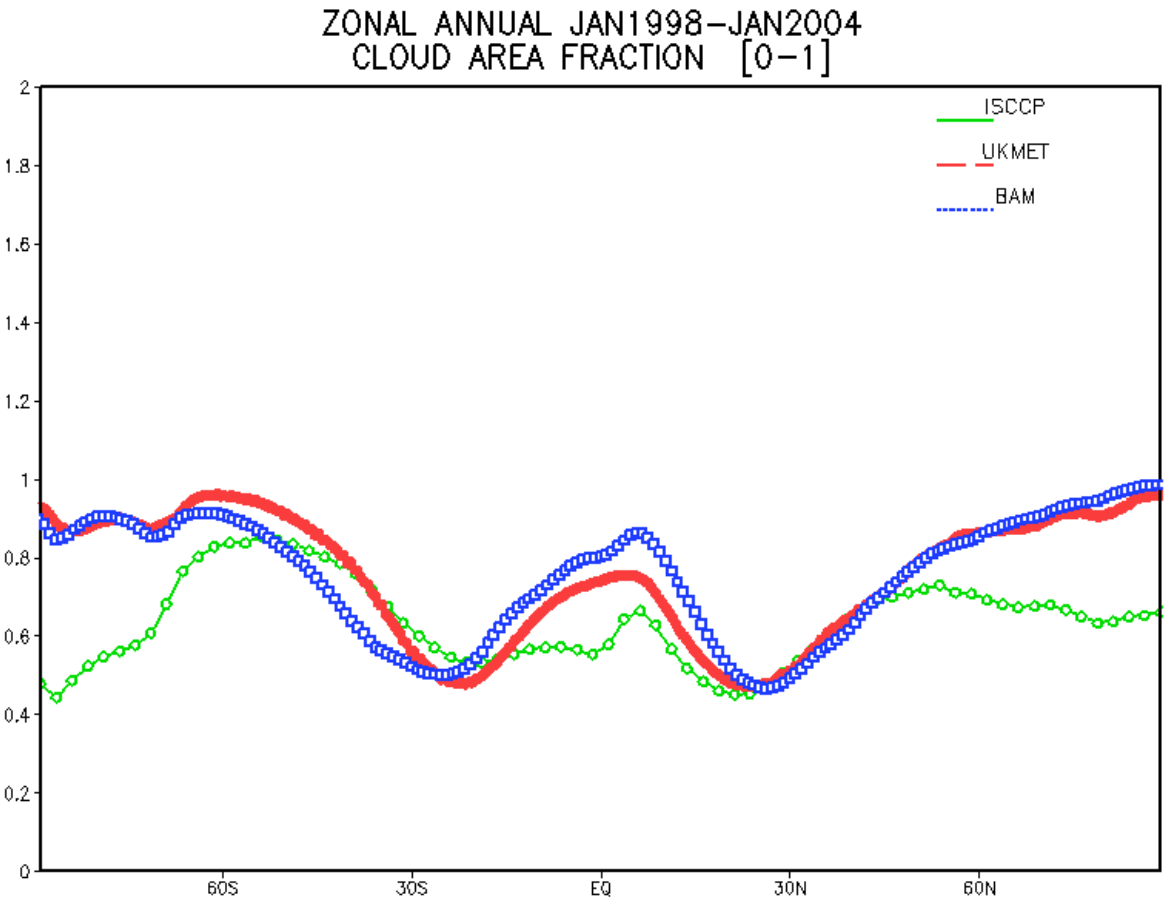


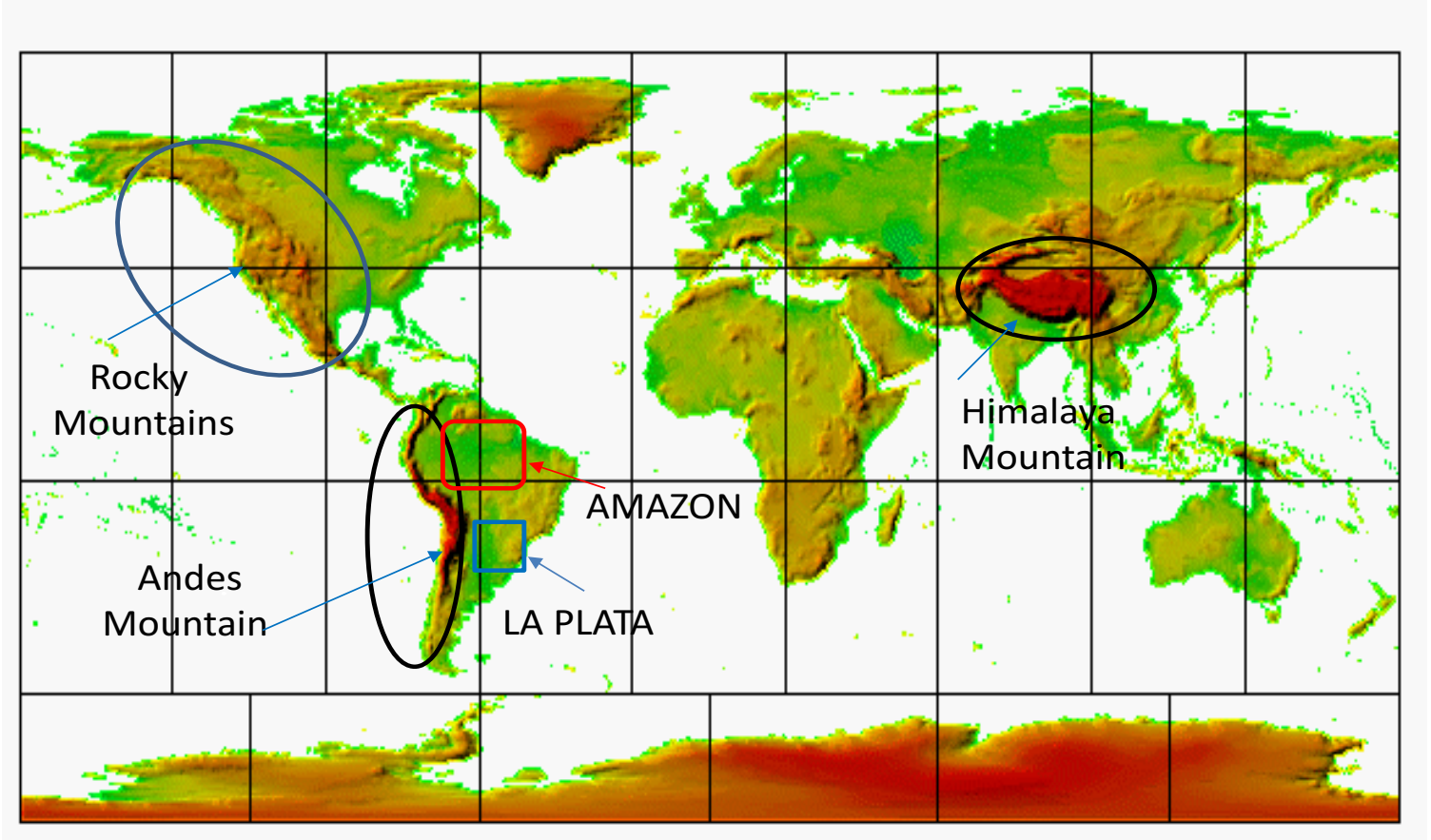
FUTURE COLLABORATIONS

Understand why the systematic biases in both atmospheric models (Precipitation, radiation and clouds).

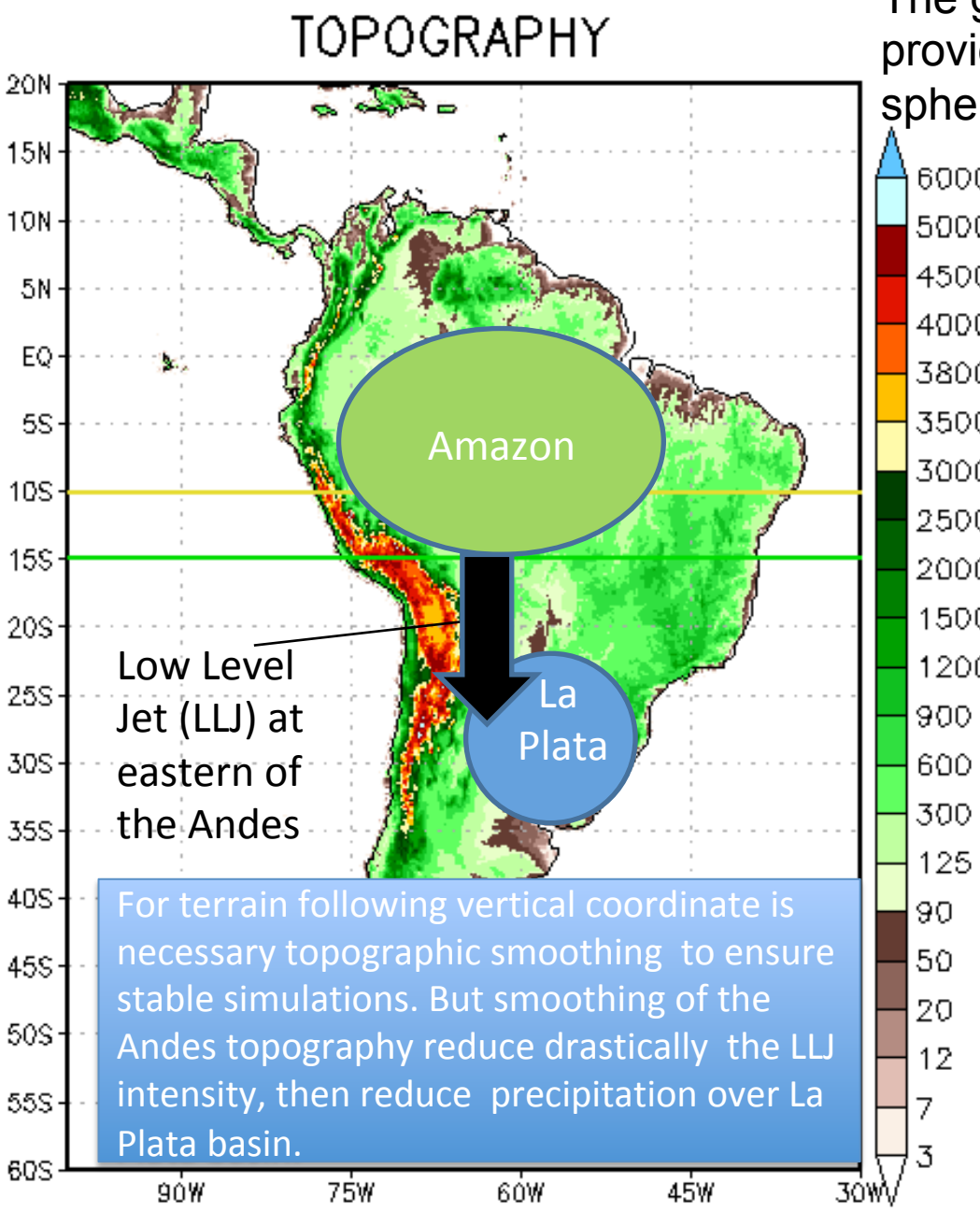
Dynamics? Convection? PBL? Land Surface?. Aerosol?. Chemistry?.

Maybe is necessary the interaction ocean-atmosphere to reduce these errors.

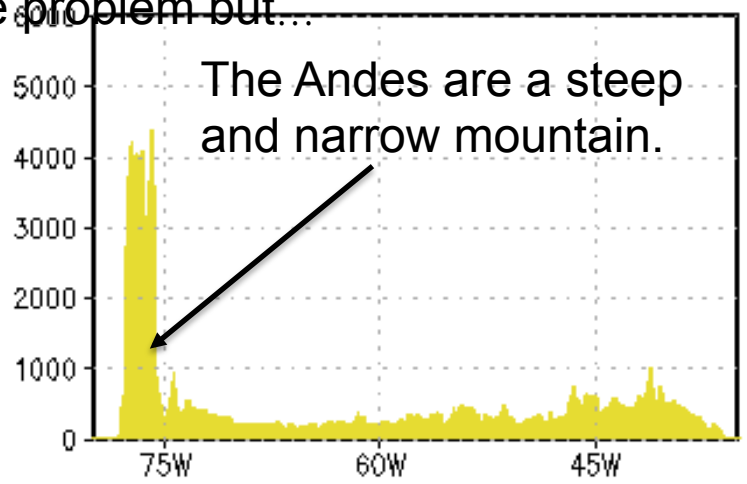
GLOBAL TOPOGRAPHY

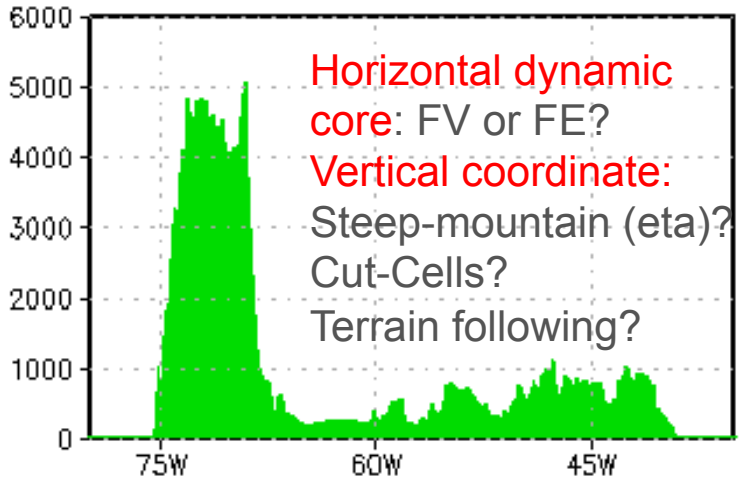


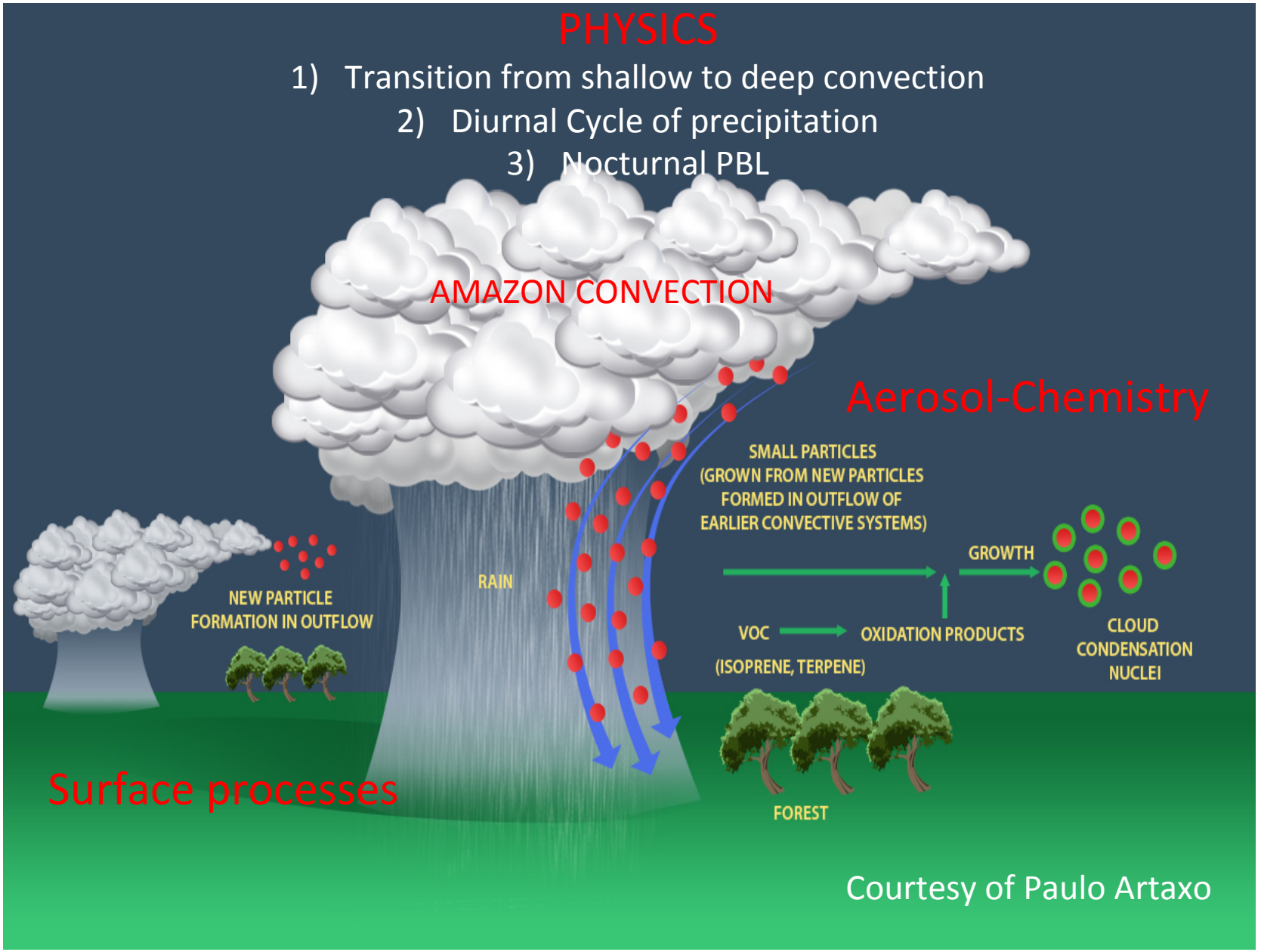
The global spectral transform method provided a very elegant solution to the sphere problem but…



For terrain following vertical coordinate is necessary topographic smoothing to ensure stable simulations. But smoothing of the Andes topography reduce drastically the LLJ intensity, then reduce precipitation over La Plata basin.






PHYSICS
1) Transition from shallow to deep convection
2) Diurnal Cycle of precipitation
3) Nocturnal PBL
AMAZON CONVECTION
Aerosol-Chemistry
SMALL PARTICLES
(GROWN FROM NEW PARTICLES
FORMED IN OUTFLOW OF
EARLIER CONVECTIVE SYSTEMS)
GROWTH
NEW PARTICLE
FORMATION IN OUTFLOW
RAIN
VOC
OXIDATION PRODUCTS
(ISOPRENE, TERPENE)
CLOUD
CONDENSATION
NUCLEI
Surface processes
FOREST
Courtesy of Paulo Artaxo

The first version of the new CPTEC couple model (BAM-v0+MOM5) has been already validated. However the newest version (BAM-v1+MOM5) is still in validation.

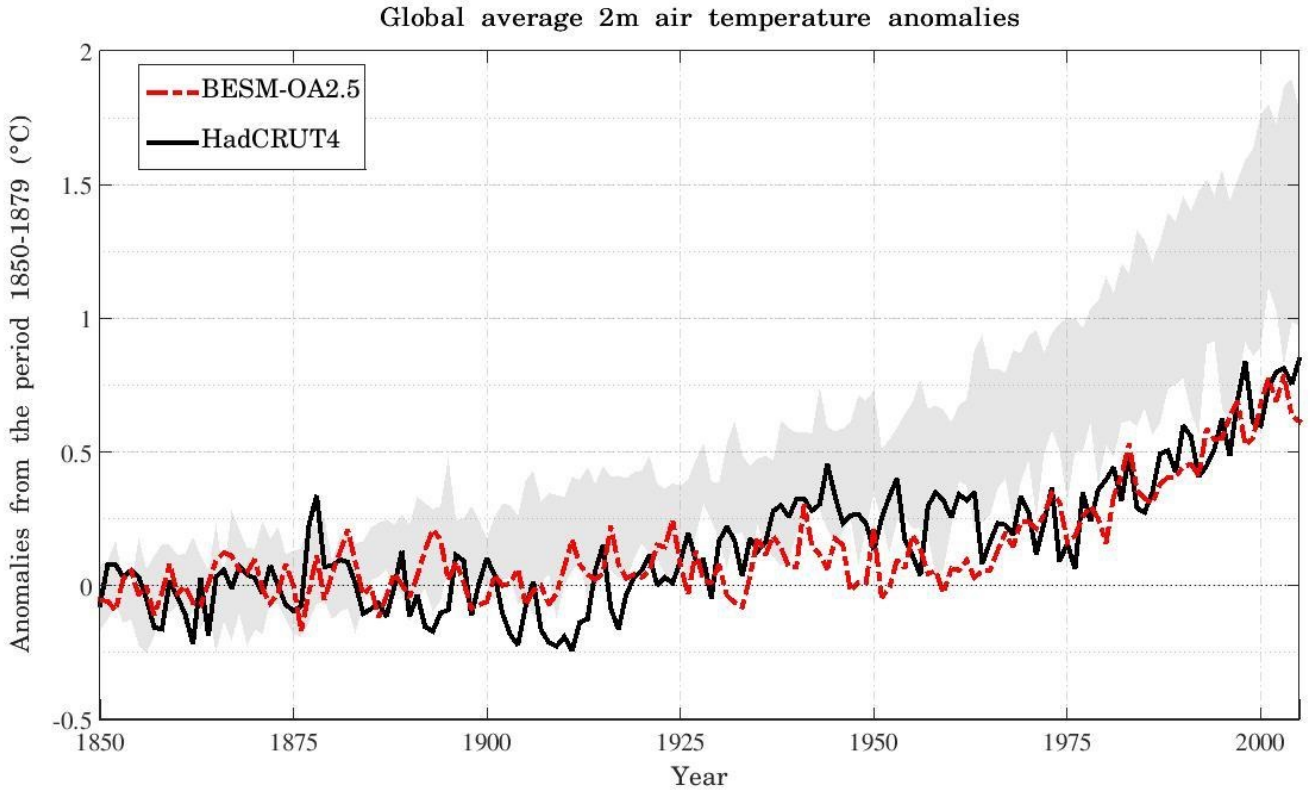


Figure. Global averaged 2-m annual mean air temperature anomalies relative to the period 1850–1879 for BESM-OA2.5 (dashed red line) and observation (solid black line). The grey shadow represents the spread of 11 CMIP5 models (historical greenhouse gas-GHG simulations). Vega et al. (2018) (GMD in discussion).

CSSP – Activities – WP2 - coupled modeling and rainfall

FUTURE PLANS 2018/19

1. AMIP simulations by using the CPTEC global atmospheric Model (BAM), period 1979-2014. Focusing in three main areas:

    1. The South American Monsoon System: Amazon convection, SACZ, LLJ at eastern Andes and Upper-level circulation, diurnal cycle of precipitation.
    2. Teleconnections patterns: Pacific-South American Pattern (PSA) and Madden-Julian Oscillation (MJO)
    3. Land-atmosphere coupling.

- Researchers:
- INPE: S.N. Figueroa, G. Sampaio, C. Coelho, L. Alves, E. Ramirez, D. Castilho and P. Kubota.
- UKMET: Robin Chadwick, Chris Jones, ……

CSSP – Activities – WP2 - coupled modeling and rainfall

2. Single Column models (SCMs) intercomparison. BAM1D and UKMet-SCM

1. Exchange experiences in SCMs development.
2. Sensitivity experiments during Go-Amazon: convection, PBL, surface processes, microphysics, aerosol and radiation.

- Researchers:

INPE: E. Ramirez, S.N. Figueroa and P. Kubota
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3. Future projections/downscaling/land-use:

Researchers:
INPE: L. Alves, G. Sampaio, S.N. Figueroa
UKMET:

CSSP – Activities – WP2 - coupled modeling and rainfall

4. Met Office visiting scientists to INPE? And/or INPE visiting scientists to Met Office

(i) Convection (shallow, deep convection, Microphysics)
(ii) Aerosols and Chemistry
(iii) PBL and land surface
(iv) DYNAMICS: Dynamic core for complex topography (e.g. ANDES).

INPE: D. Castilho, P. Kubota, E. Ramirez,…
UKMET:
Convection?
Aerosol-Chemistry?
PBL and land surface?
Dynamics?.

Thank You