Projet évaluation : précipitation et nuages du Global-Meso

Groupe Global-Meso:

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Objectifs du projet d'évaluation

- Développer des méthodes d'évaluation complémentaires aux méthodes courrament utilisées
- Évaluation objective de nouveaux aspects des modèles
- Identifier des faiblesses dans les paramétrages
- Appuyer la comparaison des modèles
- Apprentissage (analyse des observations est intéressante en soi)

Plan de la présentation

- Bref résumé du modèle Global-Meso
- Évaluation de la précipitation
- Interaction nuages-rayonnement
- Évaluation des nuages

Model configuration: dynamical

	Current GEM-op	Proposed GEM-meso
Horizontal resolution	0.9° (400x200)	(800x600) 0.45° (800x400)
No. of vertical levels	28	58
Timestep	45 min.	15 min.

Model configuration: physics

- MoisTKE for boundary-layer clouds
- Shallow convection with Kuo Transient
- Deep convection with Kain-Fritsch
- Grid-scale condensation with a modified Sundqvist scheme (consun)

Précipitation(1)

- Dans un premier temps, nous allons comparer de façon *qualitative* puis *quantitative* la précipitation des modèles GEM-op et GEM-Meso à celle de l'analyse *GPCP*

Precip analysis: GPCP

Global Precipitation Climatology Project
NASA- Laboratory for Atmospheres

- combines satellite data: SSM/I, NOAA, GEOSAT
- and “upscaled” rain gauge data: GPCC (7000 stations)
- produce *global lat-lon maps* of precipitation estimate and estimate of *absolute error*
- monthly averages on 2.5x2.5 global grids
- daily averages on 1x1 global grids
- 3 hour averages on 0.25x0.25 grids (SSM/I + geosat)
- since 1979 to present

Model Precipitation

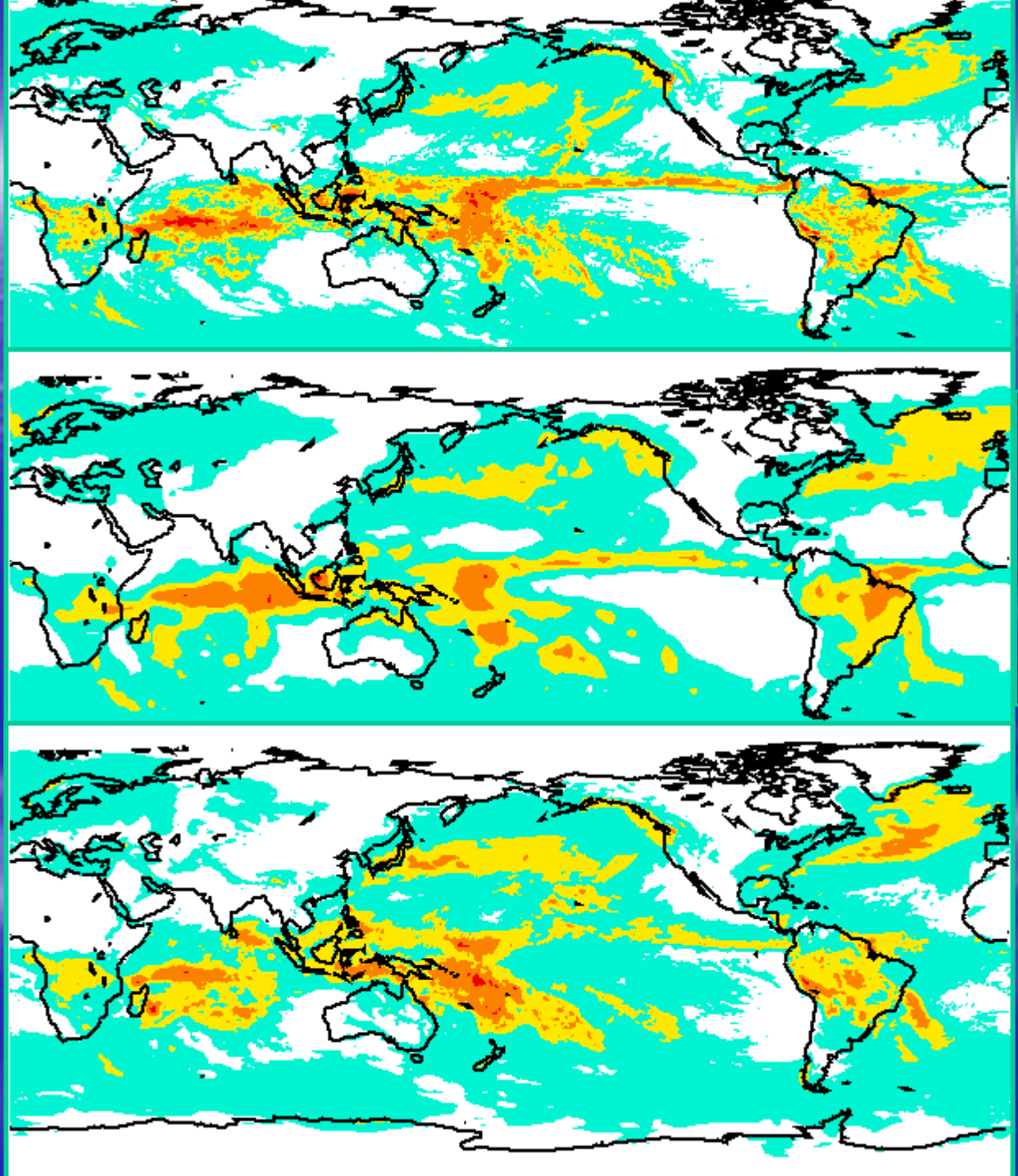
- Series of 132 hour long simulations spanning the 2001-2002 winter and the 2002 summer
- Global-Meso and GEM-op models
- Both models use operational analysis

JAN 2002
PR

MESO

GPCP

OP



Contours:

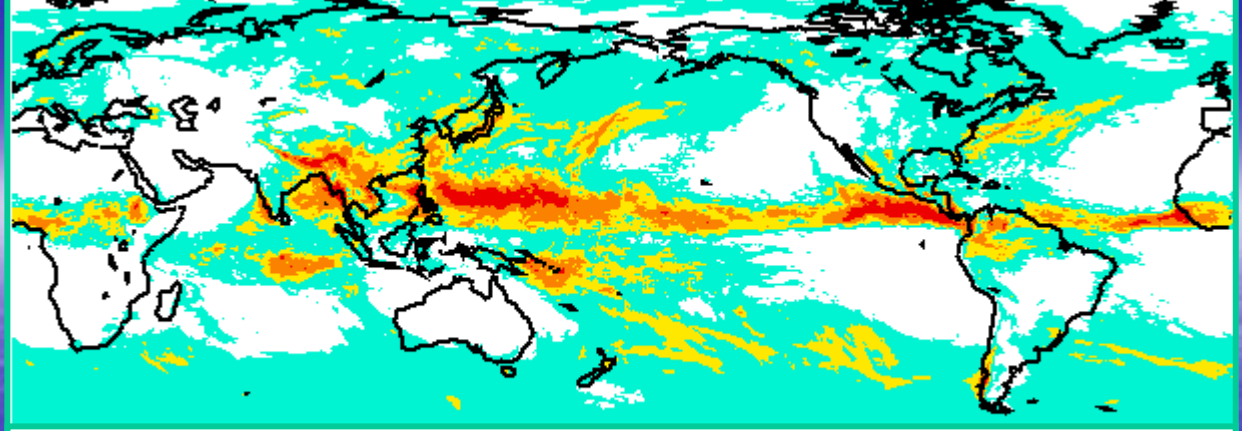
0-1 mm
1-5
5-10
10-20
>20

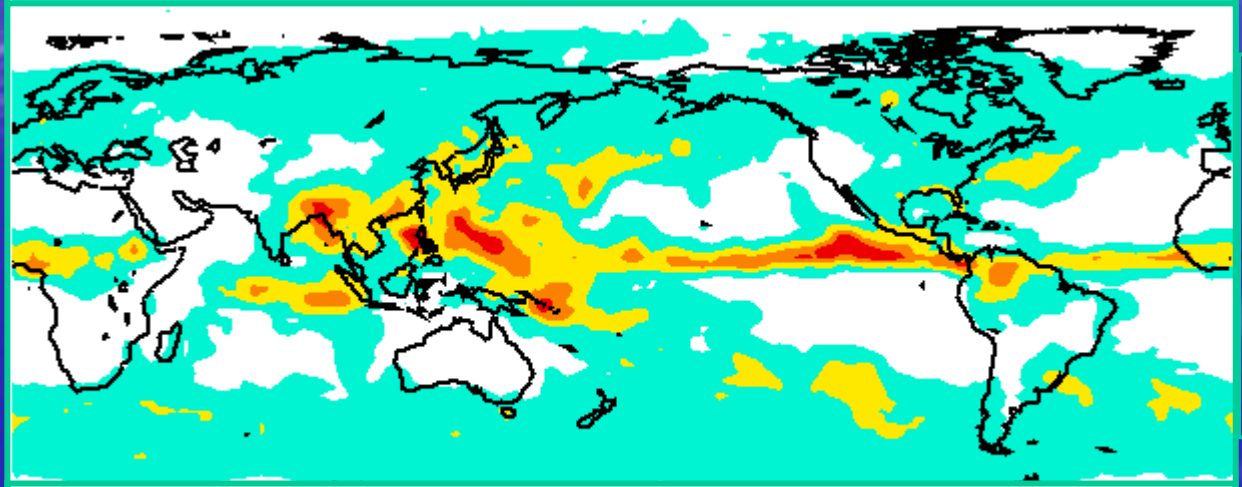
JUL 2002
PR

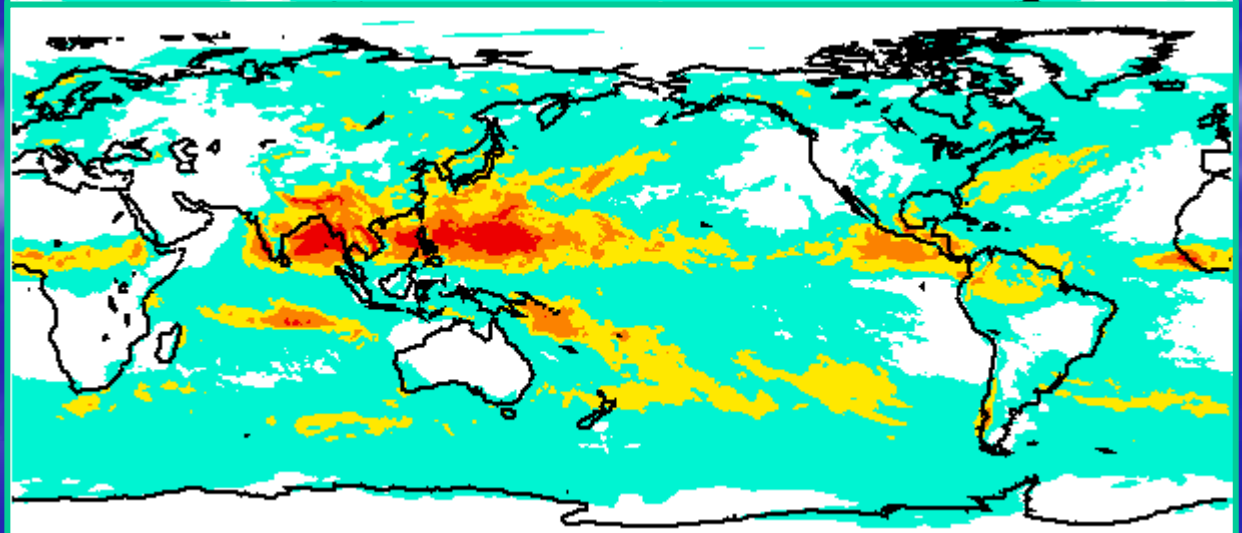
MESO

GPCP

OP



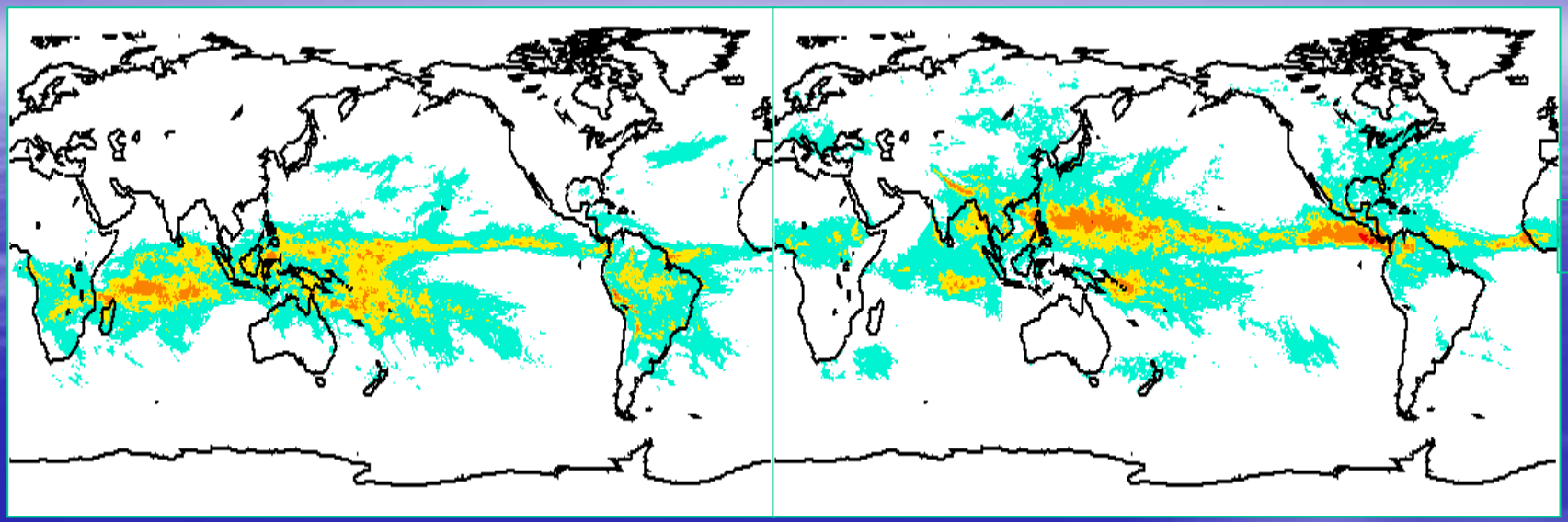




Contours:

0-1 mm
1-5
5-10
10-20
>20

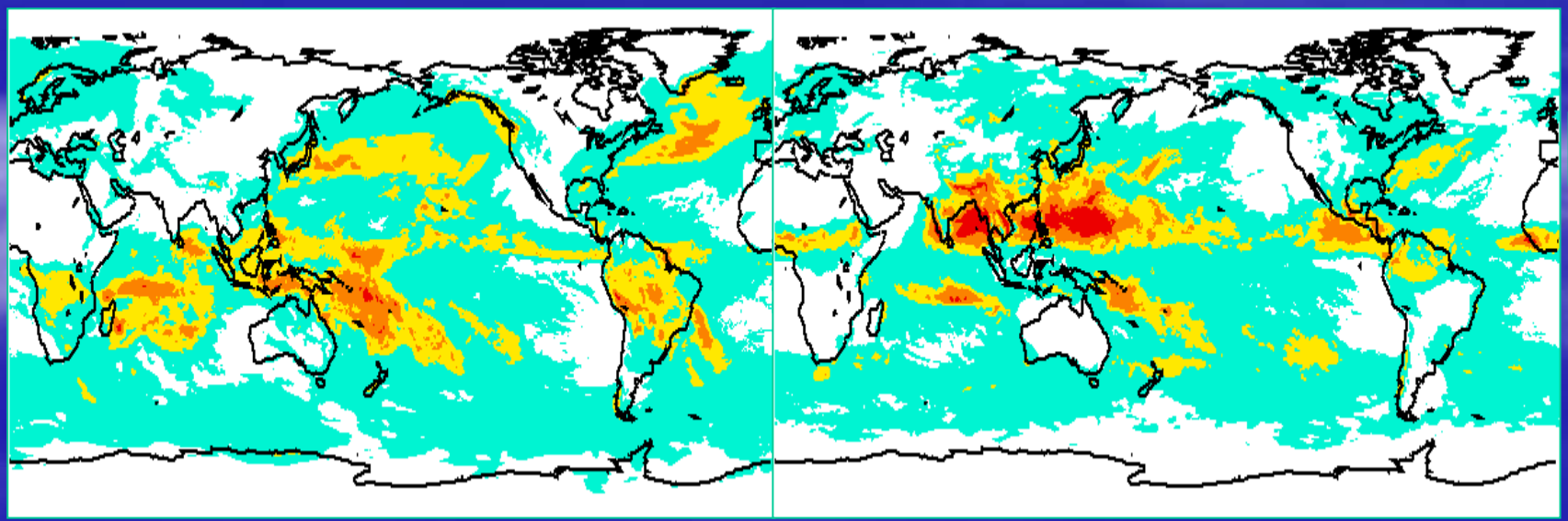
Convective precipitation



MESO

Jan 2002

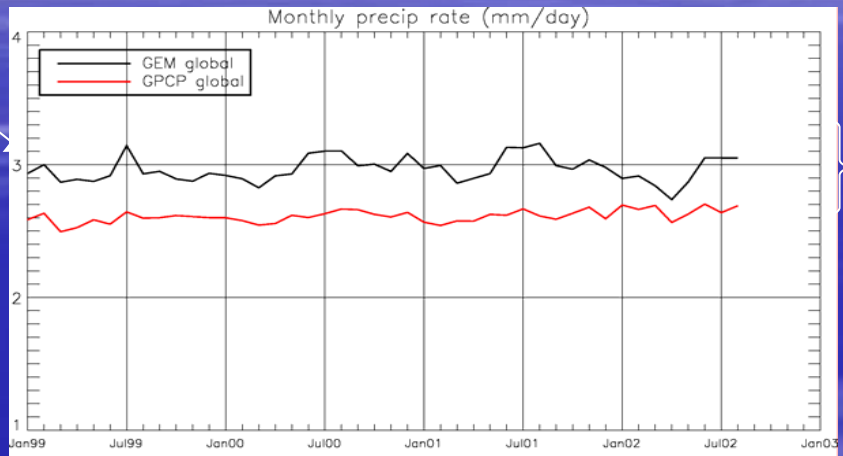
Jul 2002



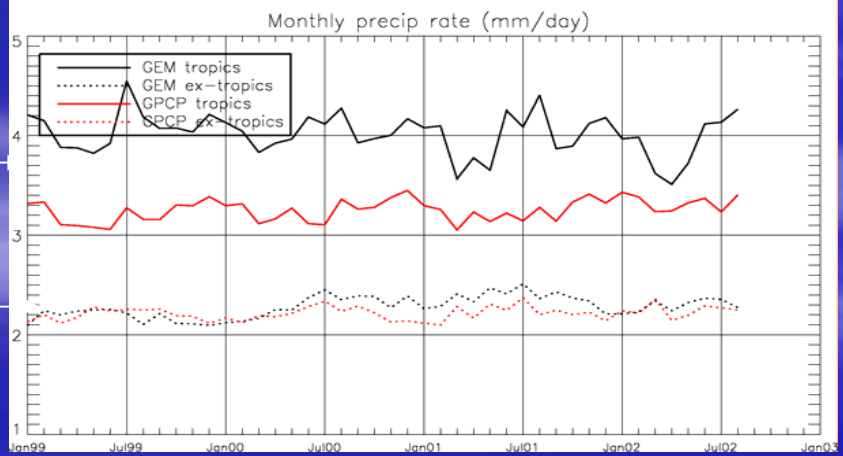
OP

Monitoring of monthly precip from operational models

Global average



Overestimation of ≈ 0.4 mm/day



Tropics

Extra-Tropics

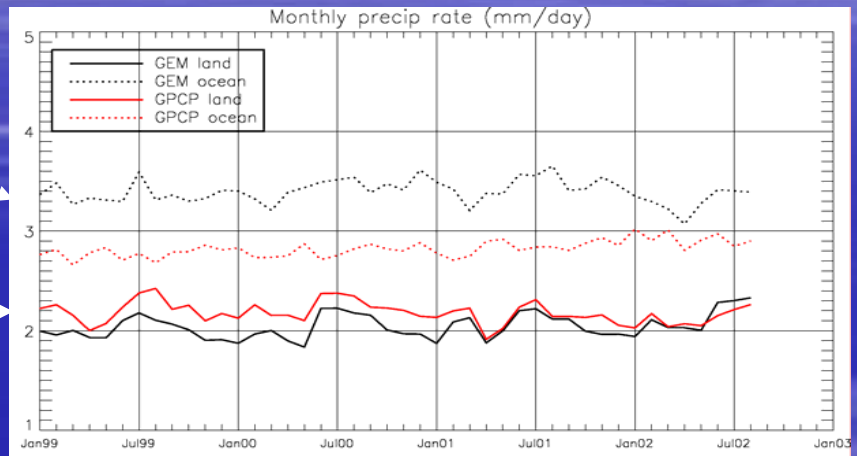
44 mois

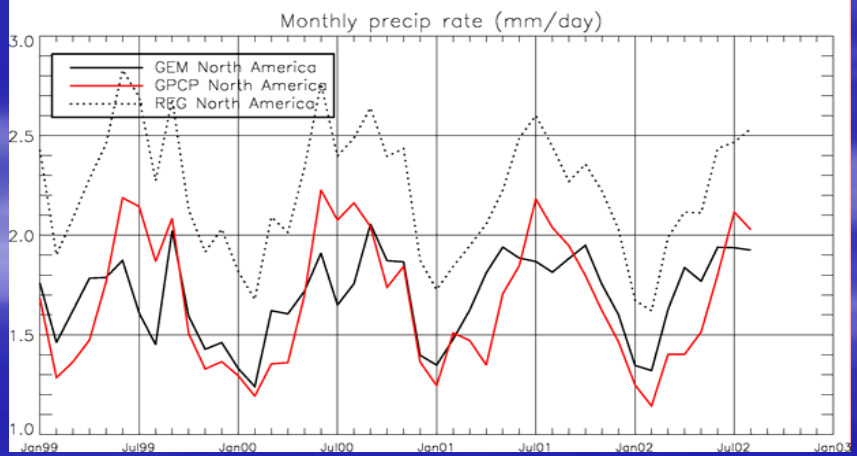
Monitoring of monthly precip from operational models

Ocean

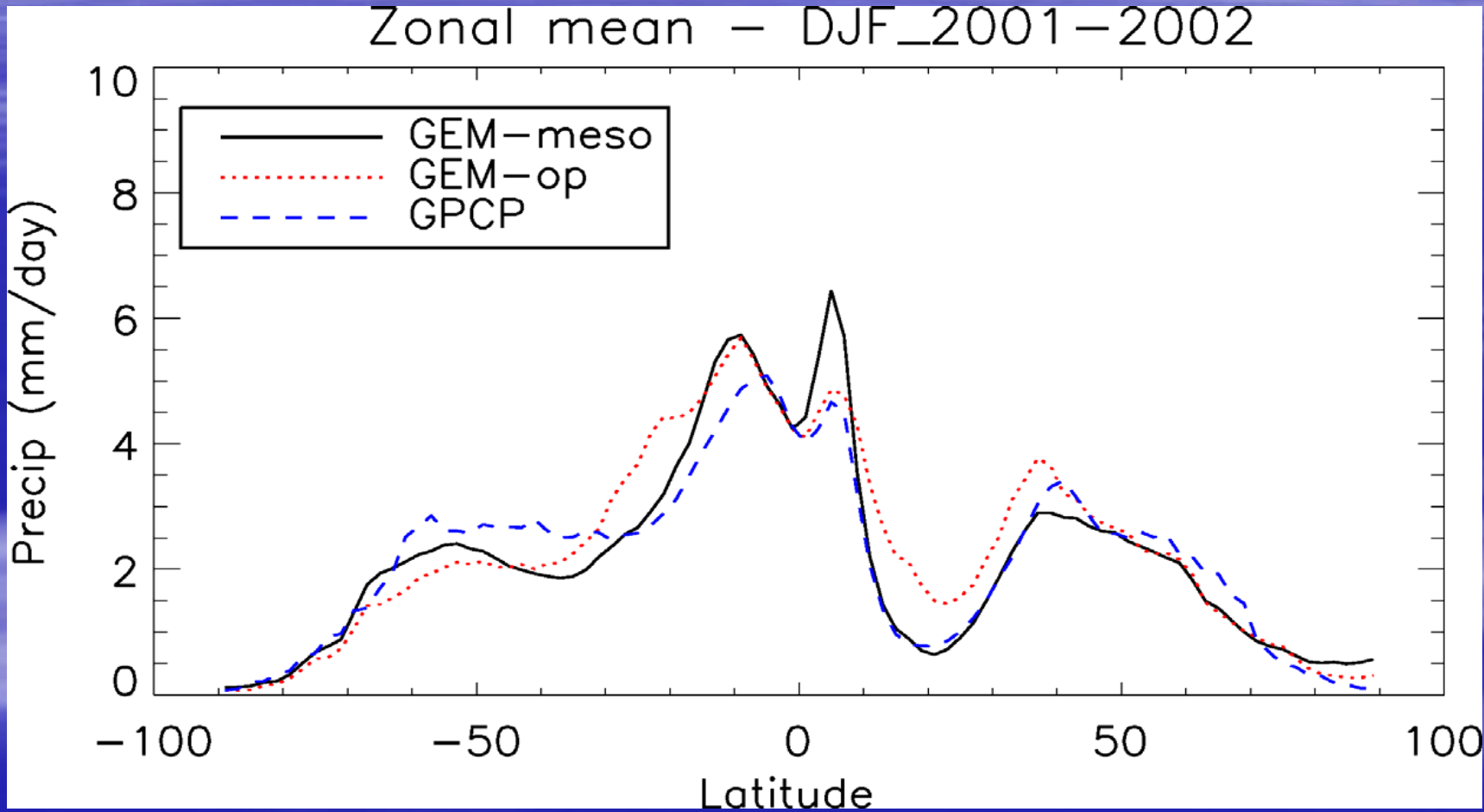
Land

North-America

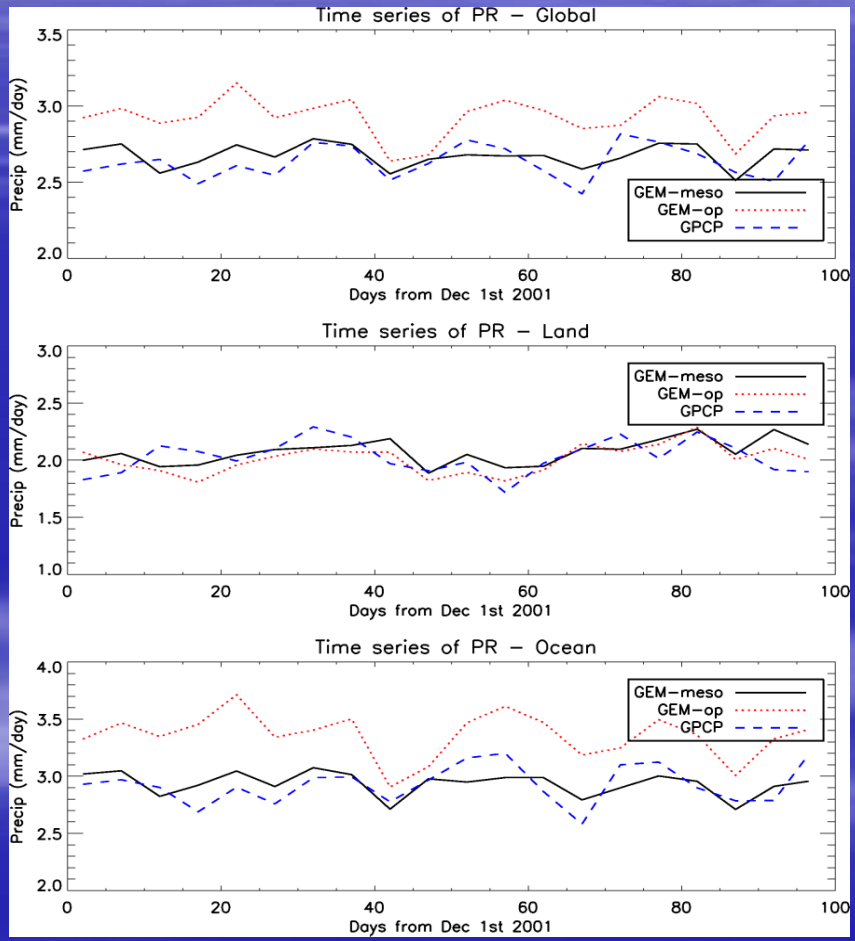




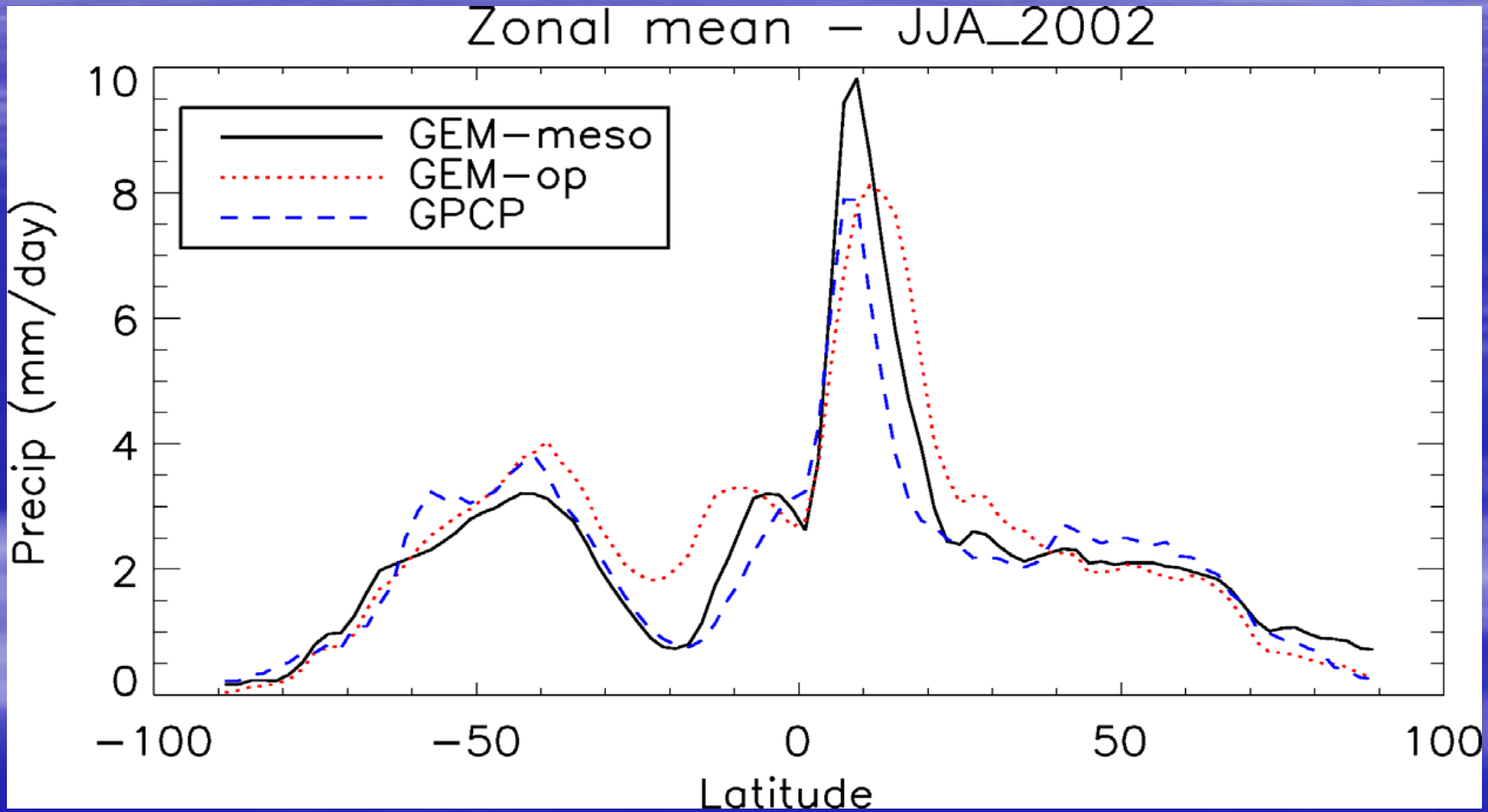
Seasonal zonal average



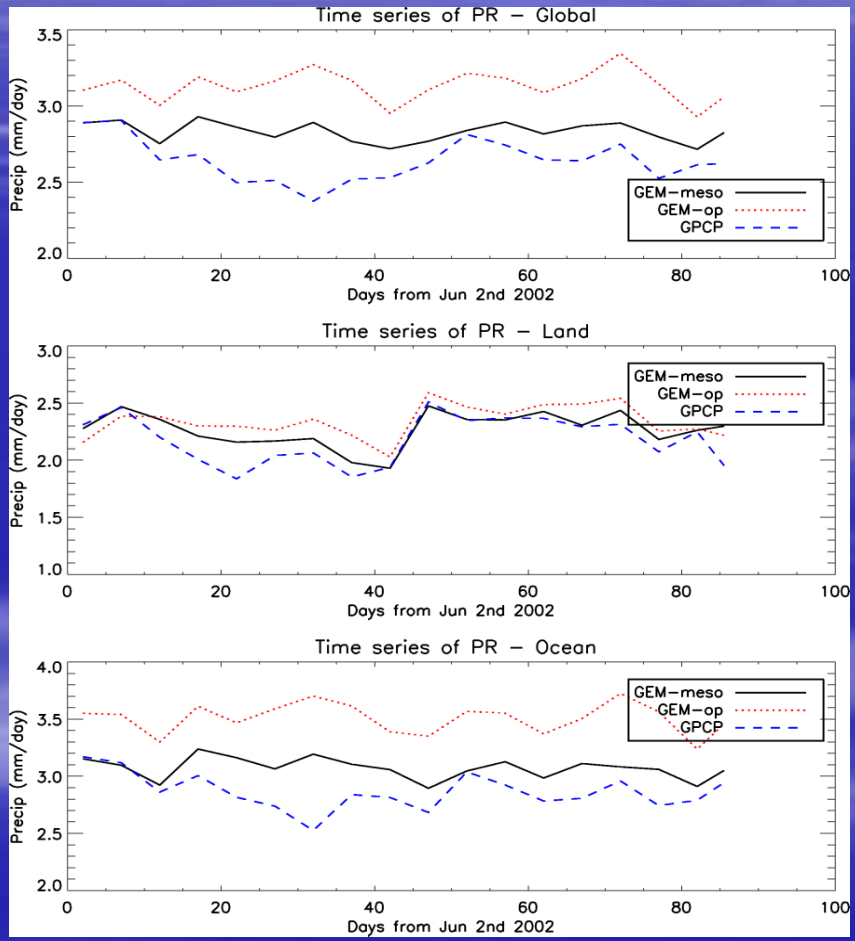
Domain averages



Seasonal zonal average



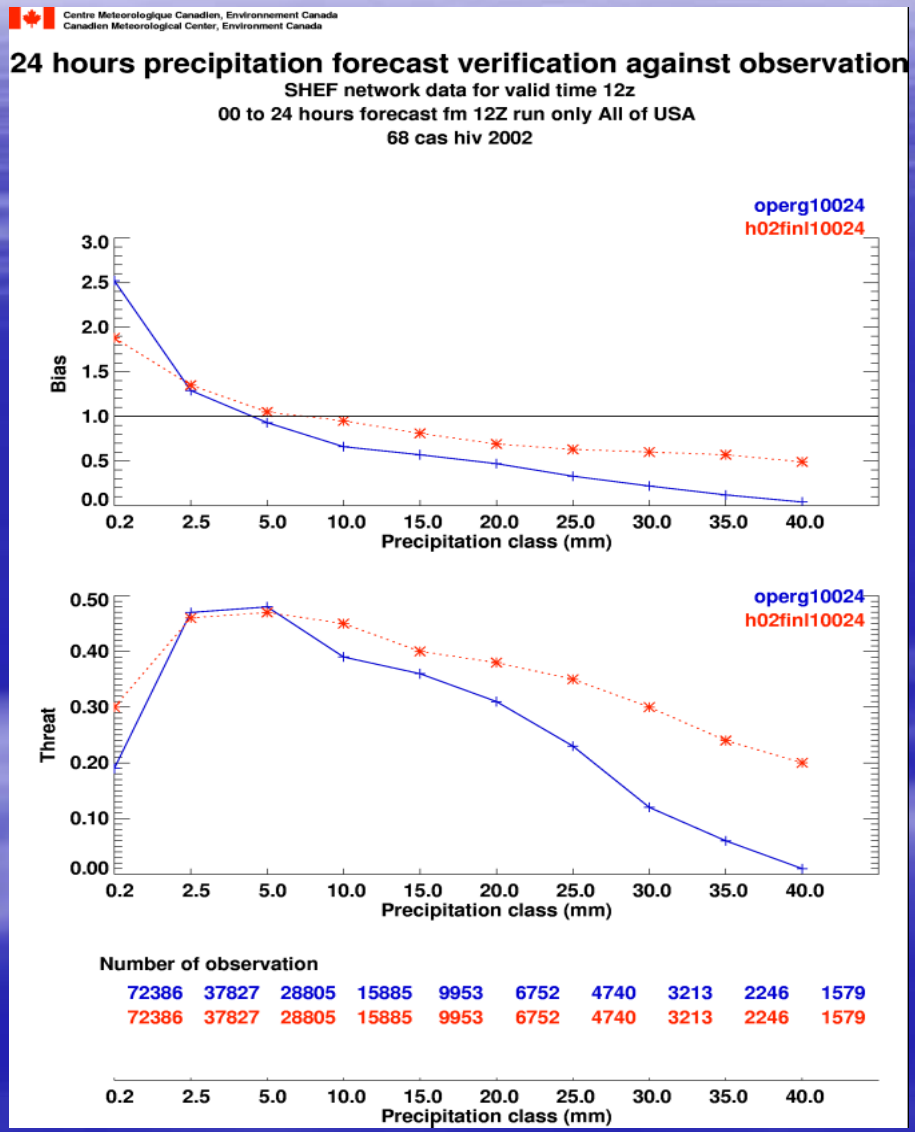
Domain averages



Précipitation(2)

- Dans un deuxième temps, nous utilisons les données des stations de surface
- La comparaison est faite avec une série de 137 intégrations de 48 heures (hiver 2001-2002) du Global-meso initialisé avec sa propre “analyse” (background check des données sat)

SHEF – U.S.


Centre Meteorologique Canadien, Environnement Canada
Canadien Meteorological Center, Environment Canada
24 hours precipitation forecast verification against observation
SHEF network data for valid time 12z
00 to 24 hours forecast fm 12Z run only All of USA
68 cas hiv 2002
operg10024
h02finl10024
Bias
Precipitation class (mm)
operg10024
h02finl10024
Threat
Precipitation class (mm)
Number of observation
72386 37827 28805 15885 9953 6752 4740 3213 2246 1579
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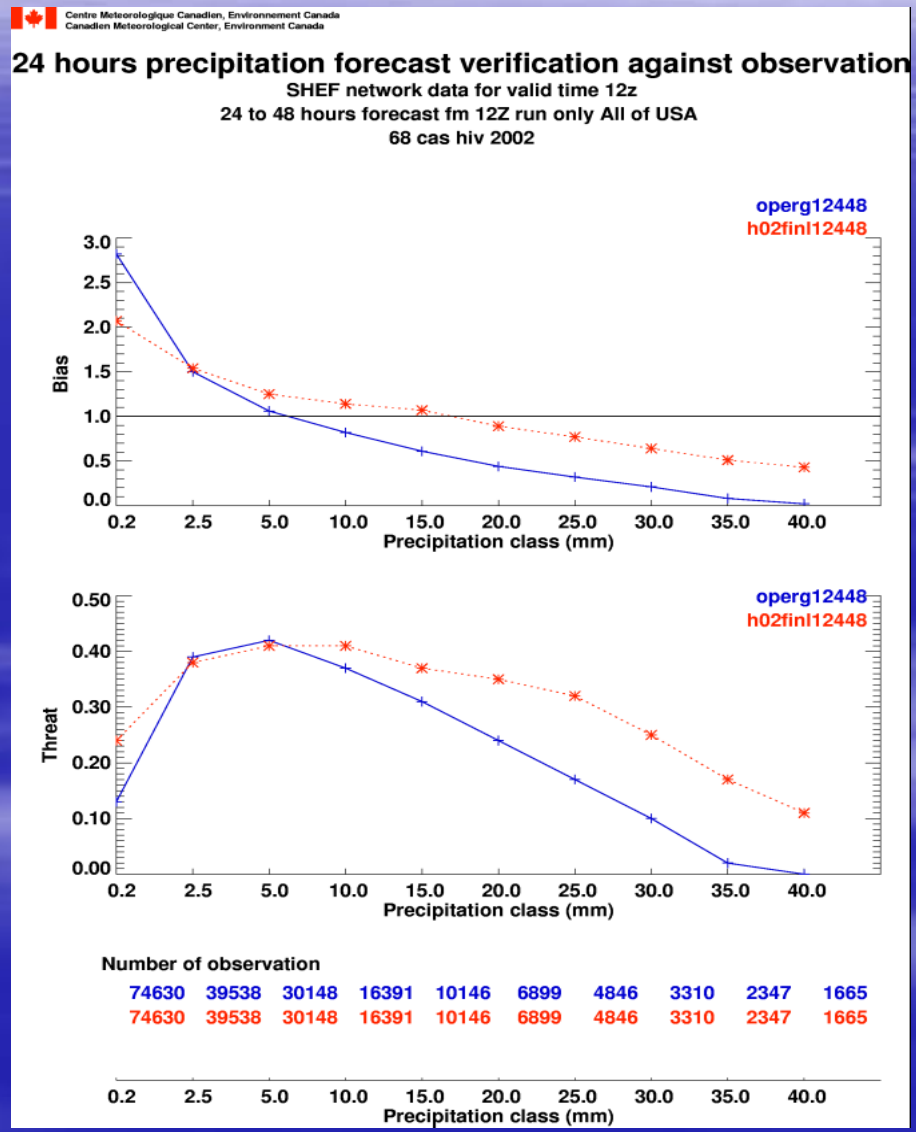
Precipitation class (mm)


Centre Meteorologique Canadien, Environnement Canada
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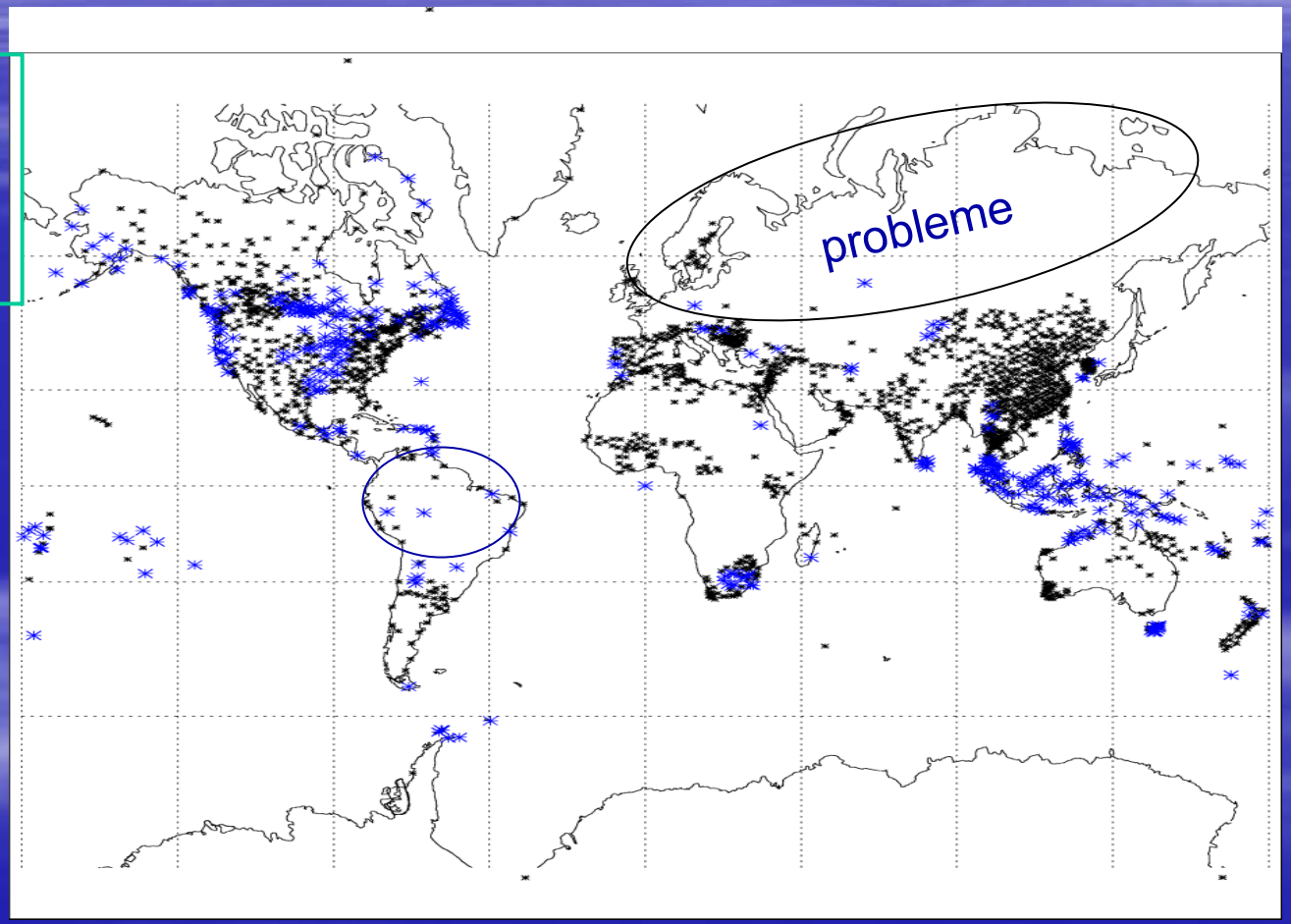
24 hours precipitation forecast verification against observation
SHEF network data for valid time 12z
24 to 48 hours forecast fm 12Z run only All of USA
68 cas hiv 2002
operg12448
h02finl12448
Bias
Precipitation class (mm)
operg12448
h02finl12448
Threat
Precipitation class (mm)
Number of observation
74630 39538 30148 16391 10146 6899 4846 3310 2347 1665
74630 39538 30148 16391 10146 6899 4846 3310 2347 1665
Precipitation class (mm)

QPF: réseau synoptique mondiale

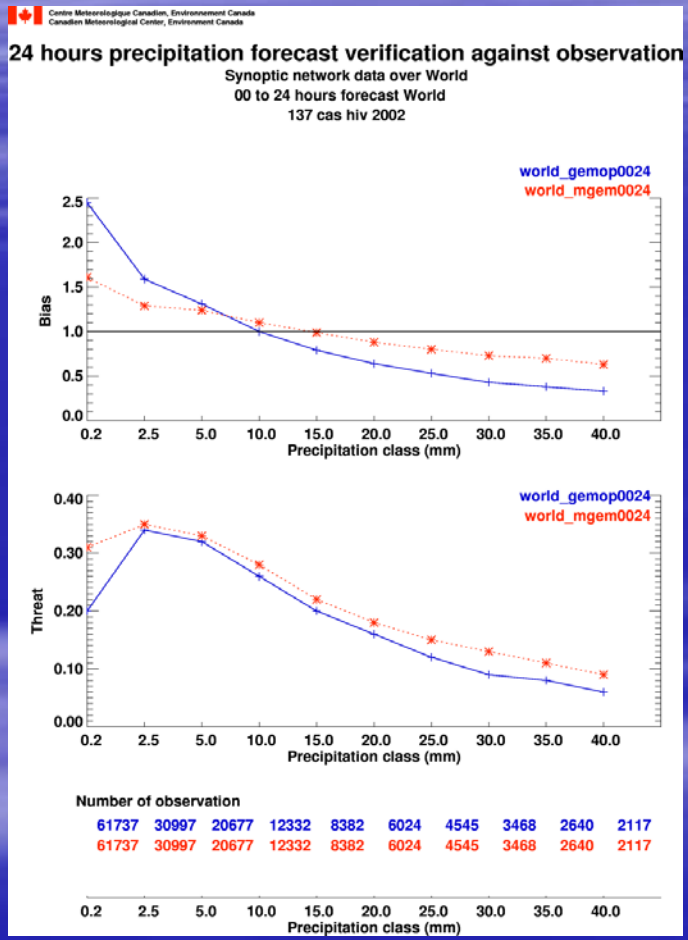
Environ 2000 stations par période de 24 heures

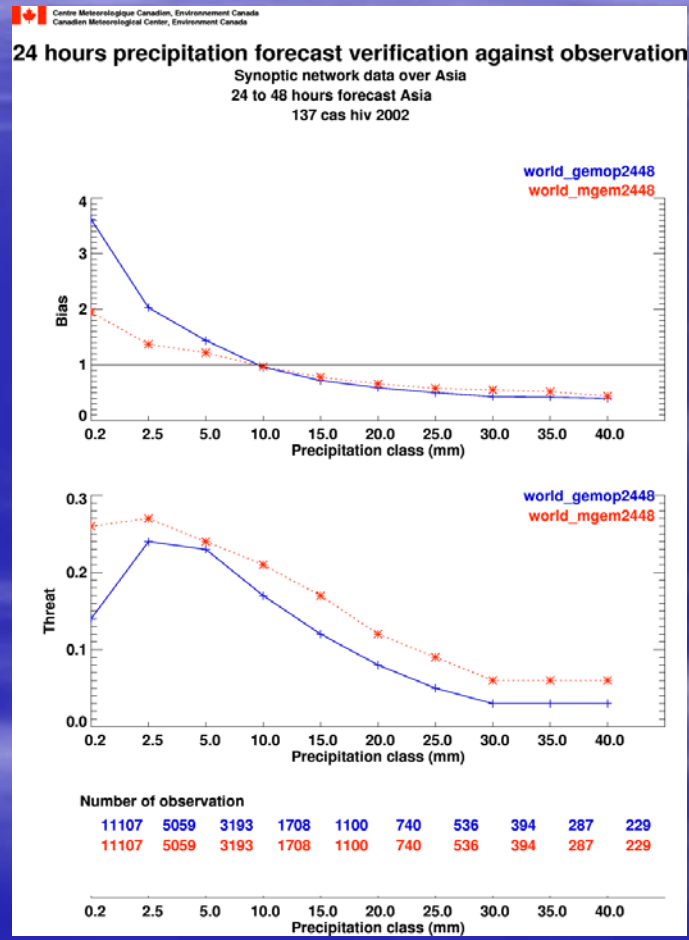
800 000 couplets OBS-PRE



→ Merci à Paul Pestieau et Rochdi Lahlou

QPF: réseau synoptique mondiale

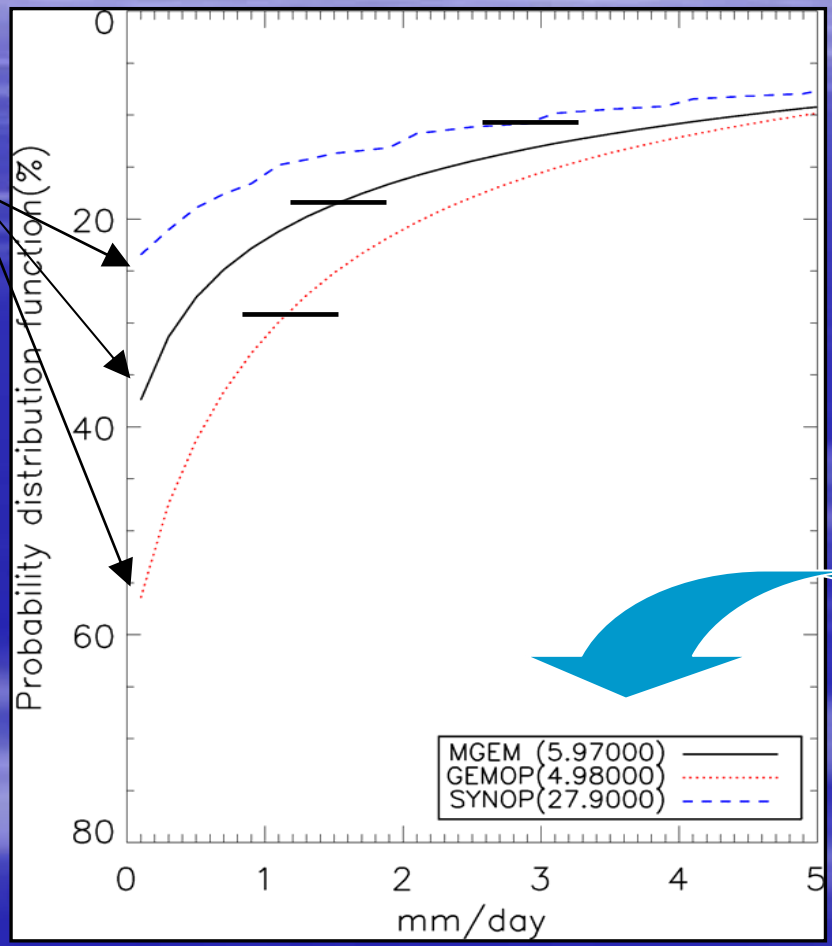




QPF: réseau synoptique mondiale

Probabilité d'un taux de précipation > 0.2 mm/jour

Synop=25%
MGEM=37%
GEMop=56%

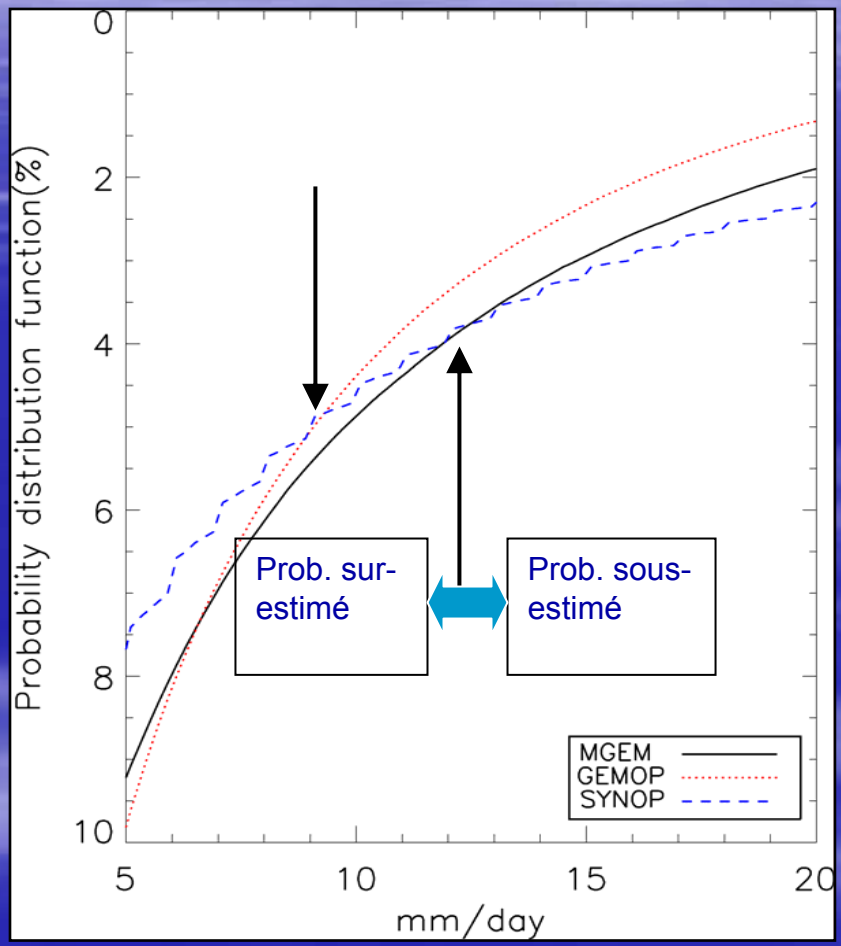


Faible taux

Écart-type

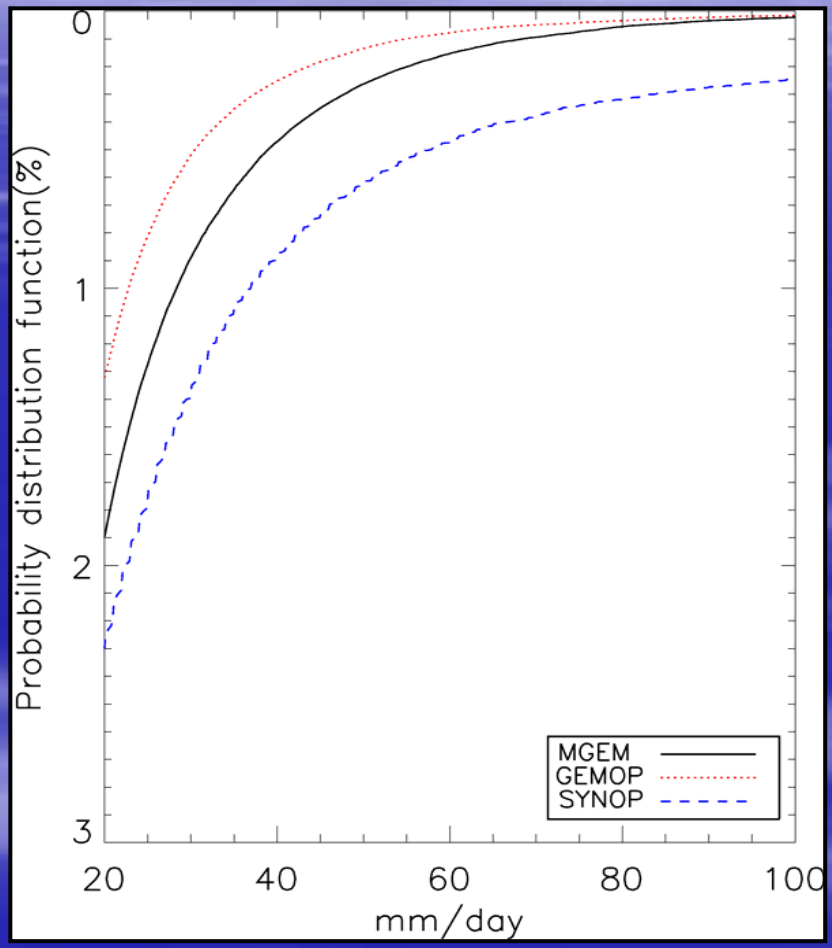
Faible taux de précipitation beaucoup plus probable dans les modèles

QPF: réseau synoptique mondiale



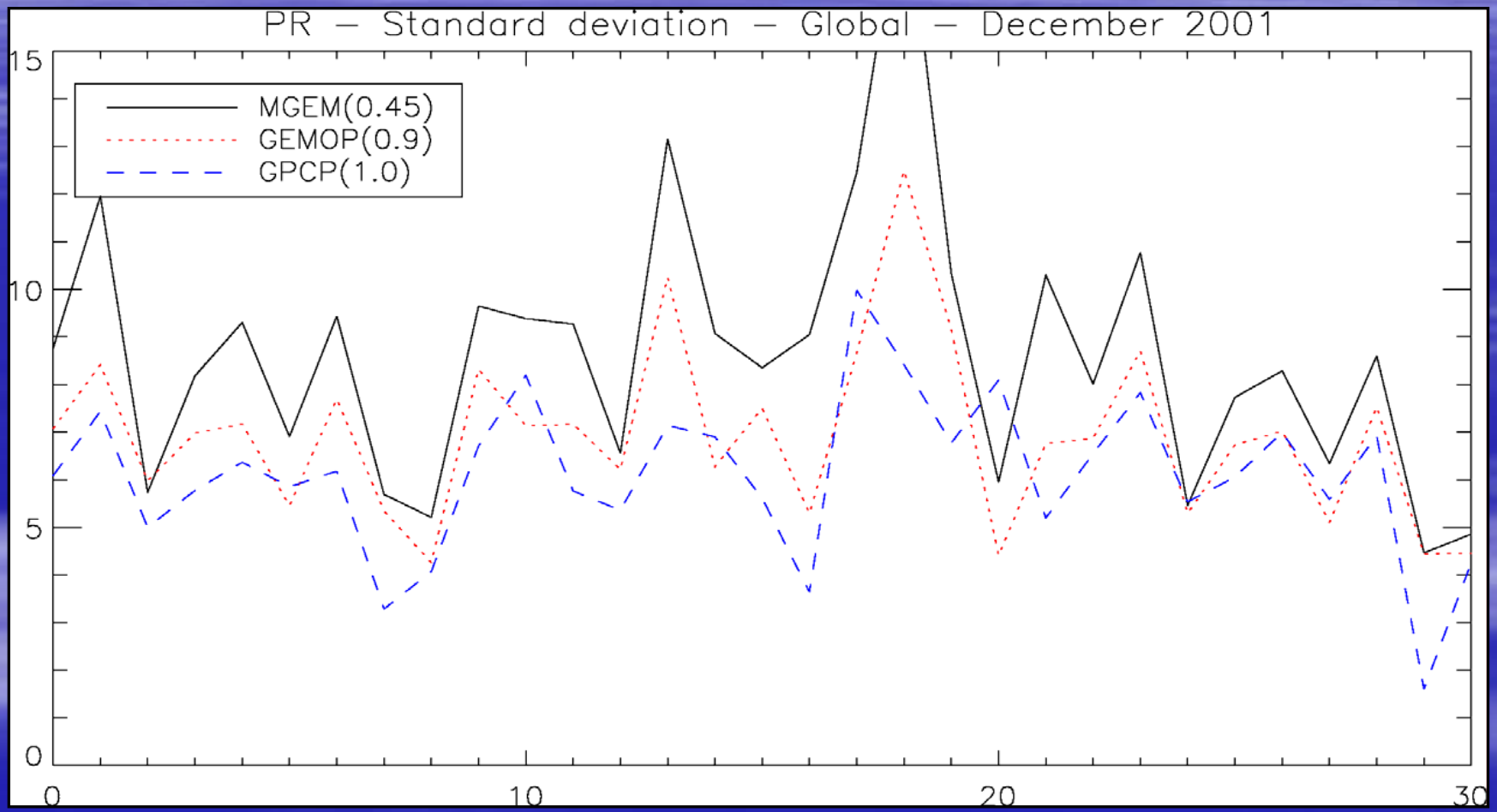
Taux modéré

QPF: réseau synoptique mondiale



Taux élevé

→ Plus haute résolution ameliore quelque peu la PDF de la précip


PR – Standard deviation – Global – December 2001
MGEM(0.45)
GEMOP(0.9)
GPCP(1.0)
15
10
5
0
0
10
20
30

Nuages du Global-meso

- Kain-Fritsch condensé+fraction
- Ktrans condendé+fraction
- Mtke condensé+fraction
- Consun condensé+fraction

TWC
FN

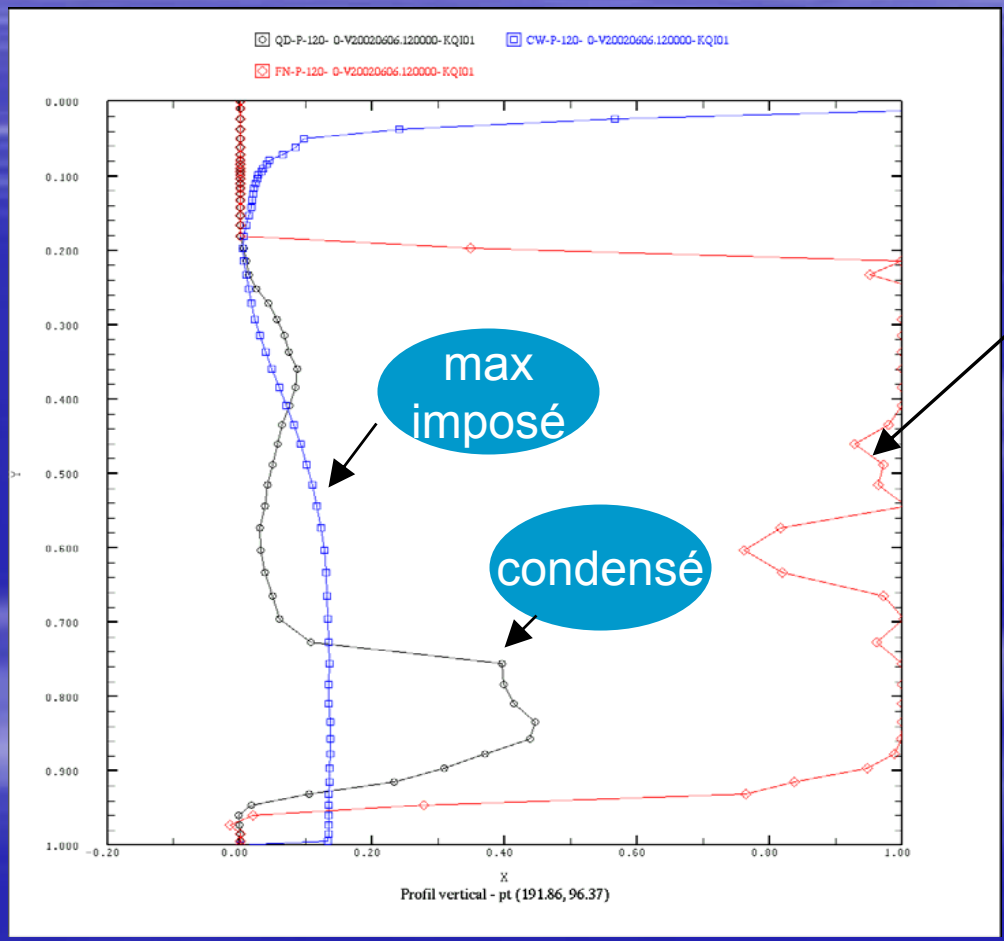
Interface nuages-rayonnement

1. TWC*=[TWC/FN]
2. TWC**=min [TWC*,F(T,P)]
3. FICE=F'(T)
4. Propriétés optiques

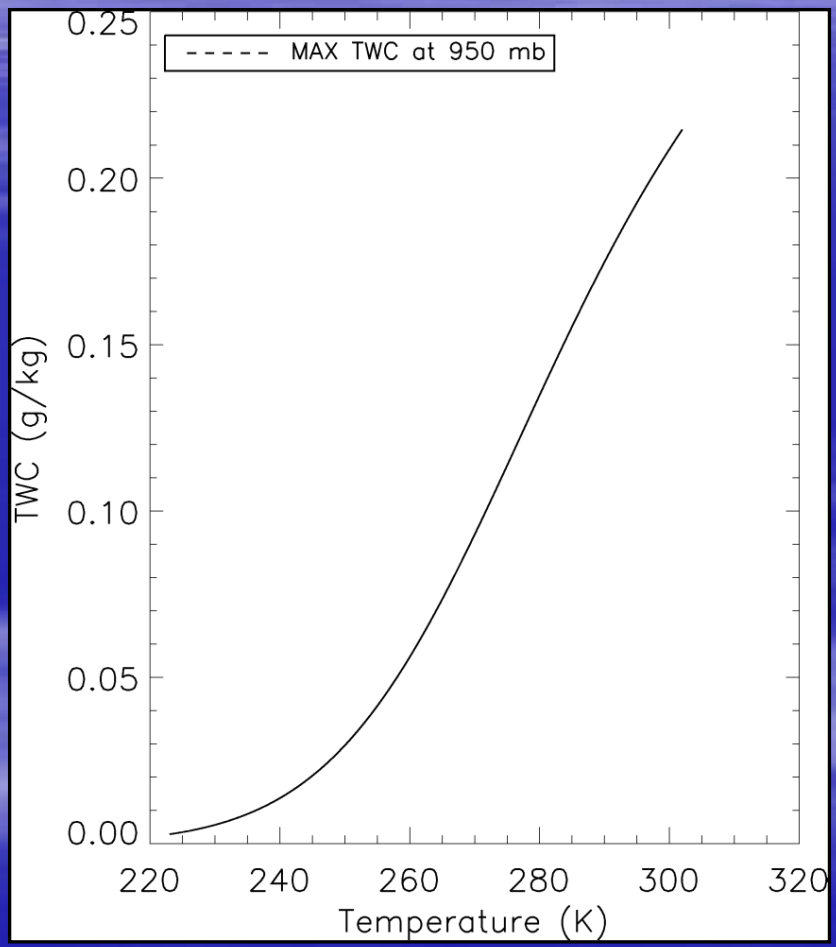
Transfert
radiatif

Interface nuages-rayonnement

Profil vertical
dans une
dépression
de l`hémisphère
sud
2 juin 2002



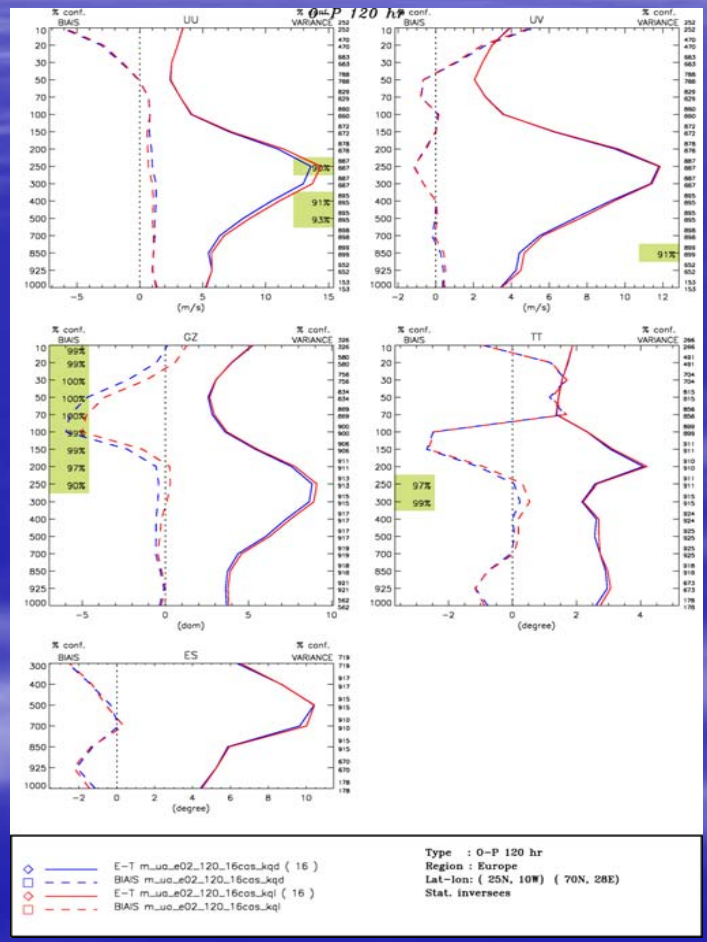
Interface nuages-rayonnement



Condensé maximum imposé (950 mb)

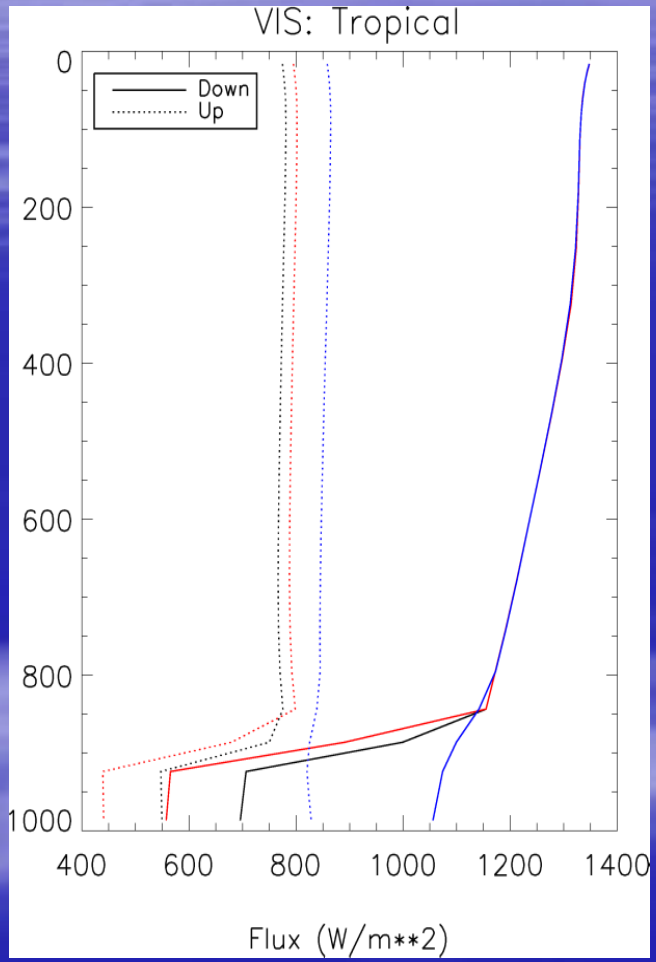
Réponse météorologique

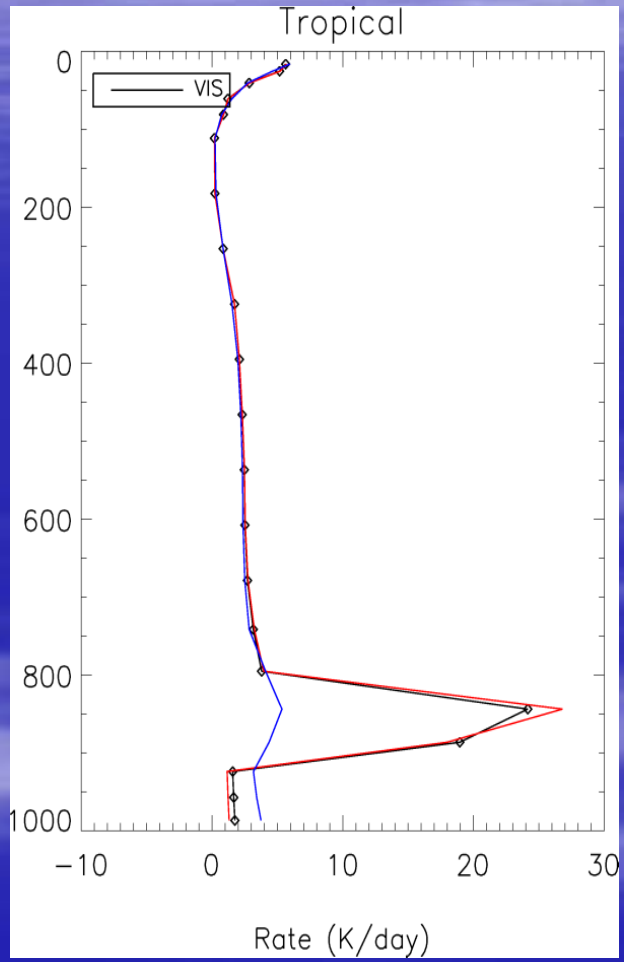
16 simulations
de 120hrs
été 2002



Europe
T=120hr

Radiative response to clouds





Standard tropical atmosphere

Blue: clear sky
Black: 0.2 g/kg cloud over 100mb
Red: 0.4 g/kg cloud over 100mb

→ Modèle colonne de Louis Garand

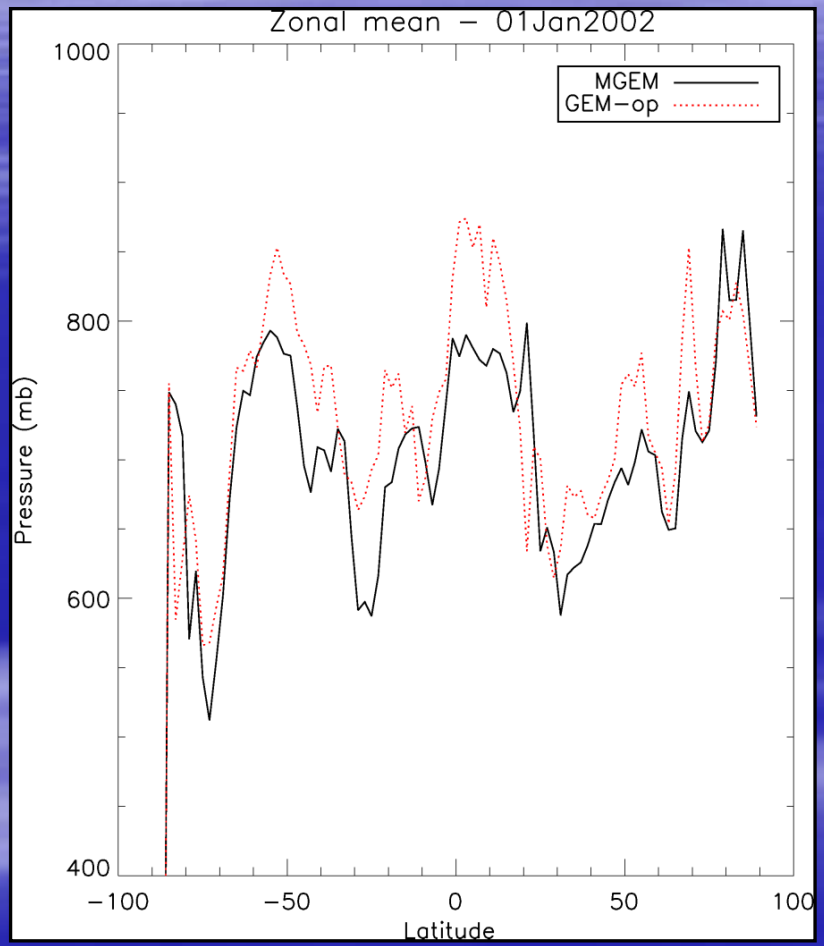
Interface nuages-rayonnement

- Consun et Newsund: nuages produits par les schémas de condensation et convection *sont différents* des nuages vus par le transfert radiatif
- Mixphas et KongYau: nuages produits par ces schémas sont vus par le transfert radiatif

Interface nuages-rayonnement

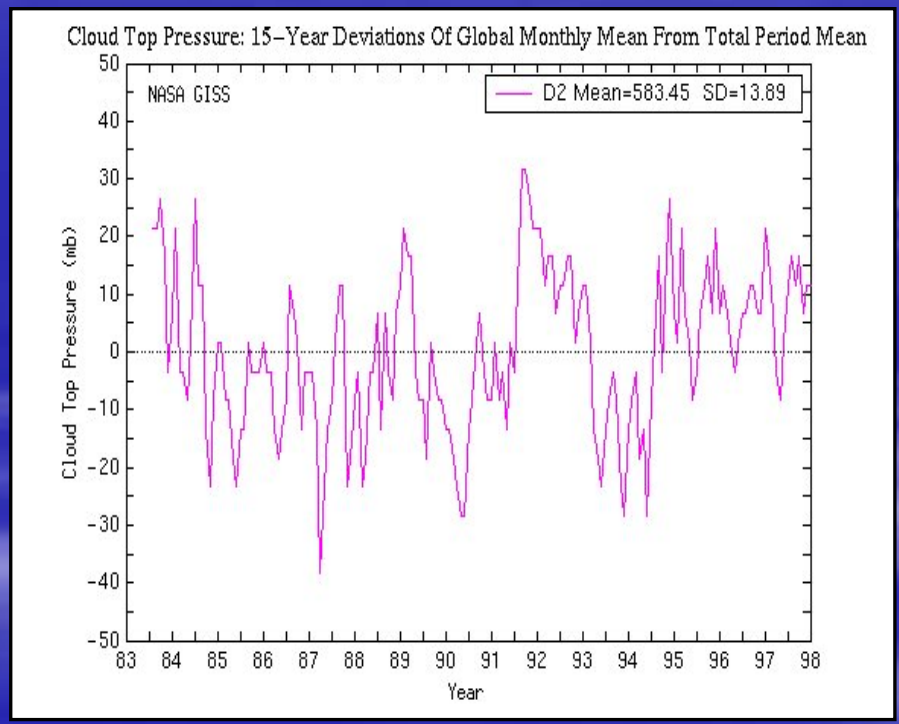
- Attention a l'interprétation de certaines expériences faites avec Mixphas ou KongYau
- Attention a l'interprétation des variables NT (couverture nuageuse),EI (outgoing longwave radiation),BP (pression au sommet des nuages),BE…

Cloud top pressure



ISCCP: International satellite cloud climatology project

15 yr global mean = 583 mb

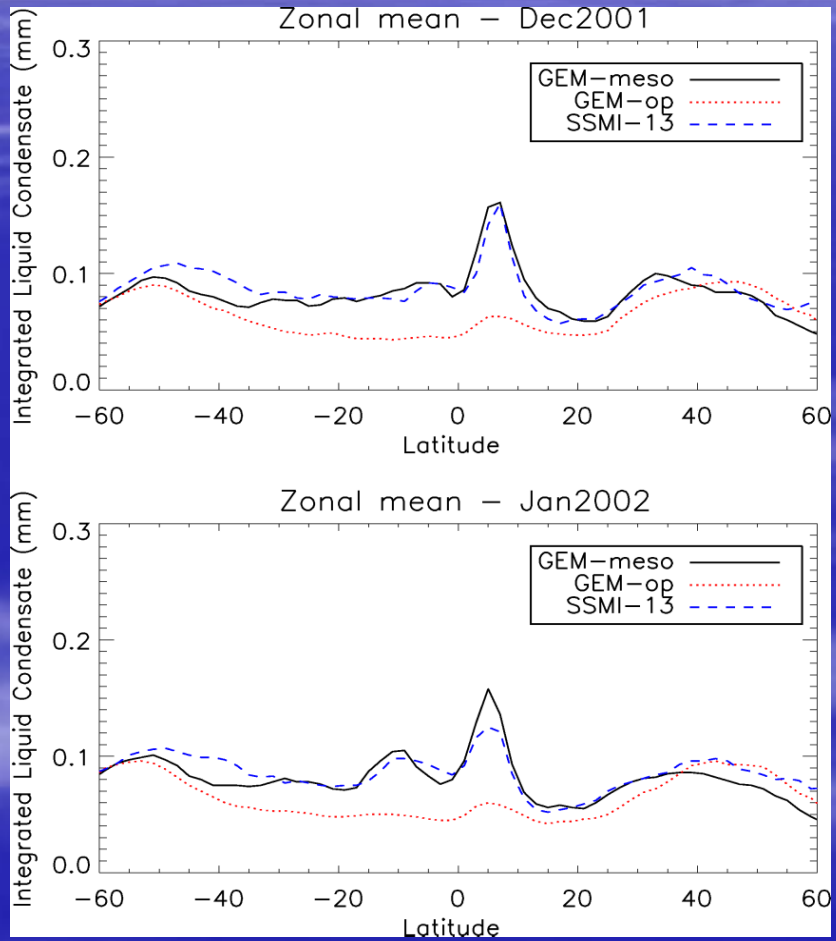


→ Similar conclusion for Outgoing Longwave radiation (EI)

Interface nuages-rayonnement ??

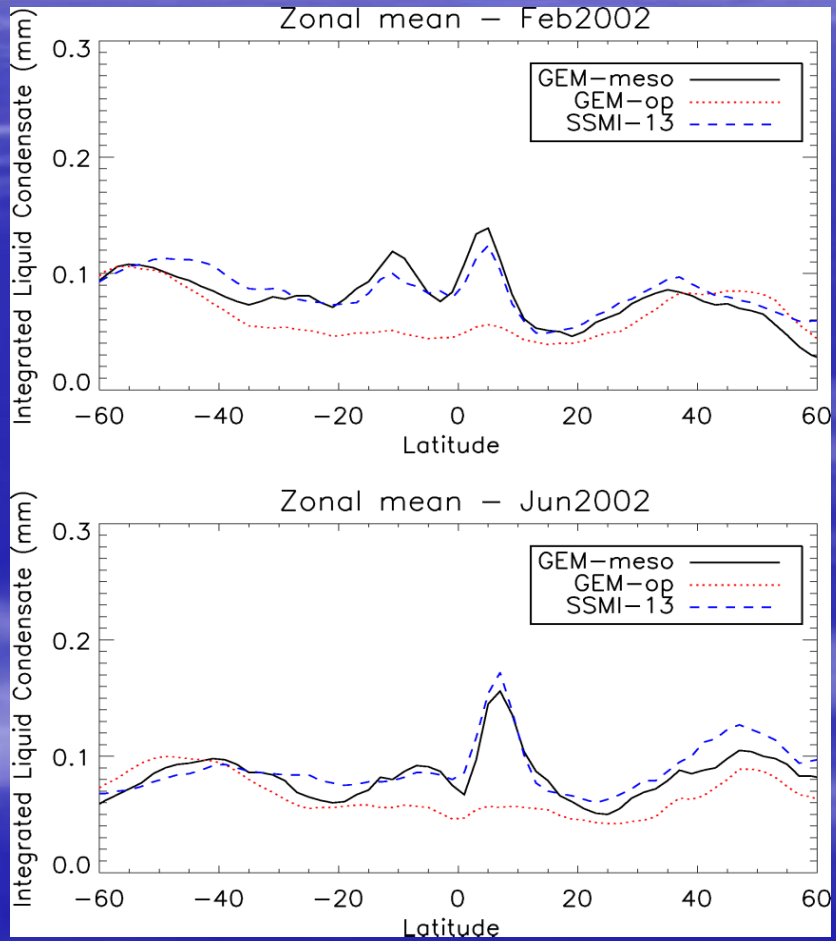
- condensé de nos schémas trop élevé
- sructure verticale
- propriétés optiques
- transfert radiatif

Integrated liquid condensate(IC)

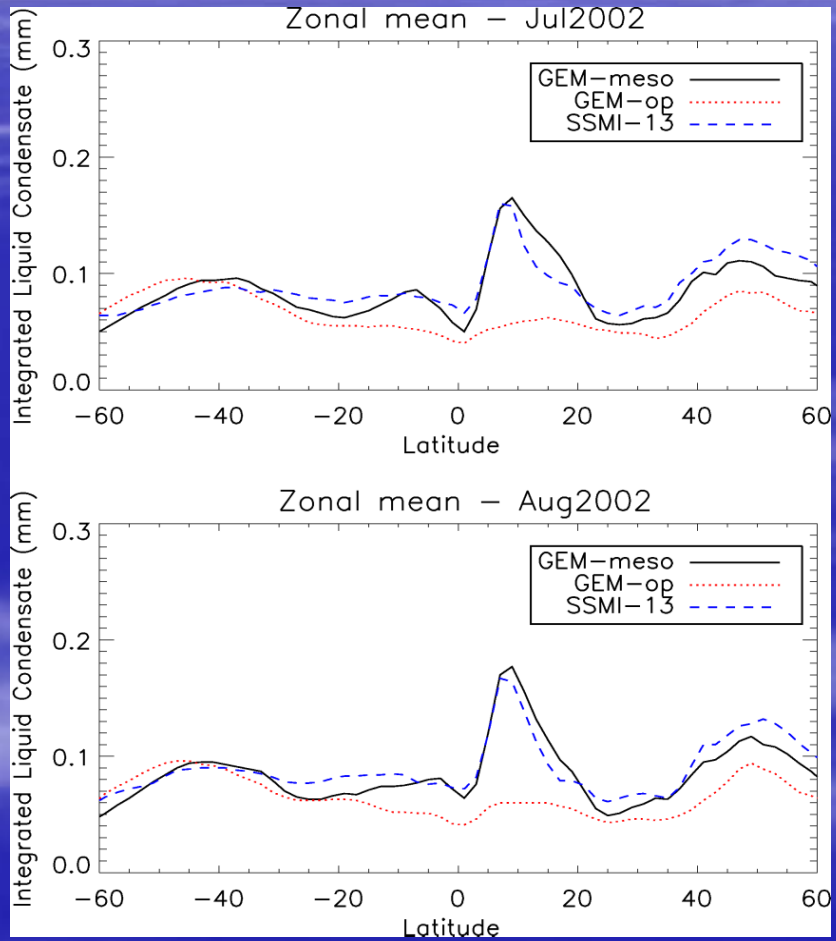


→SSM/I data provided by Remote Sensing Systems

Integrated liquid condensate(IC)



Integrated liquid condensate(IC)



Model: liquid and total condensate