STRATEGIES FOR EVALUATING/IMPROVING CLOUD-RADIATION-TURBULENCE PARAMETERIZATIONS in CLIMATE and NWP MODELS

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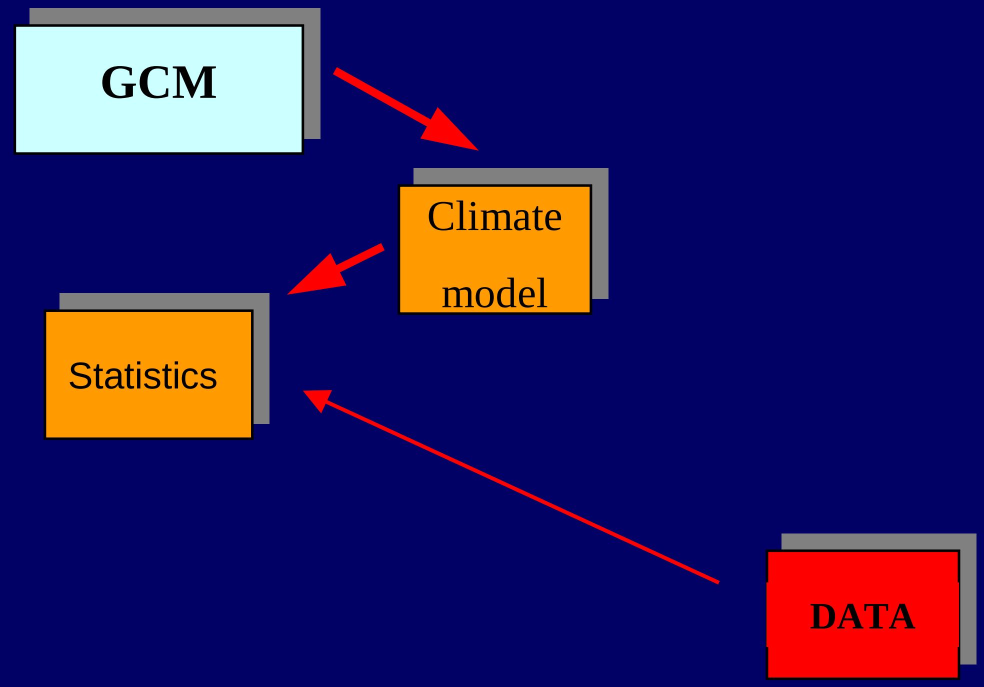
Traditional evaluation

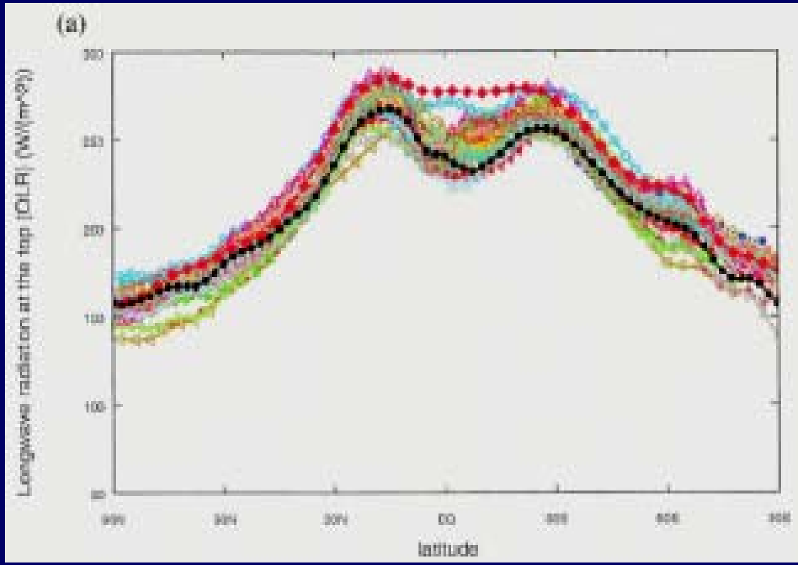
of the global model climate:

- Direct Evaluation of Data versus Model

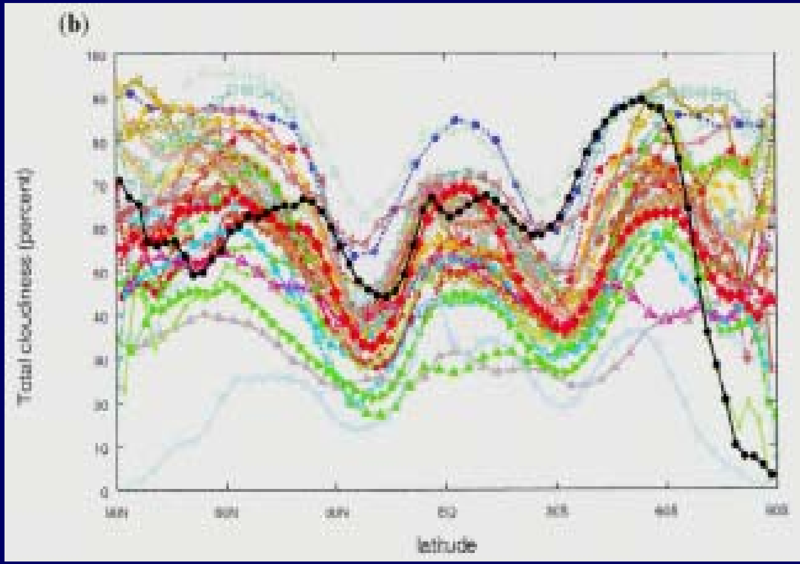

GCM
Climate
model
Statistics
DATA

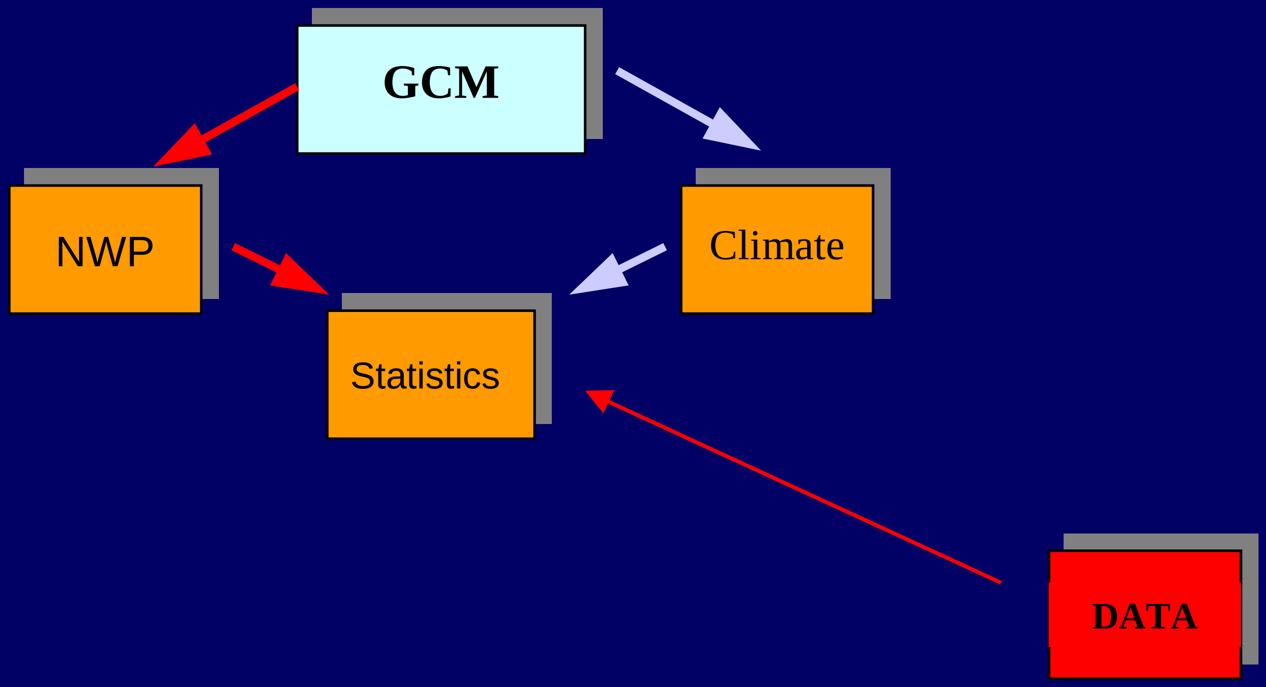
AMIP-intercomparison (10 years)

OLR



Cloud cover

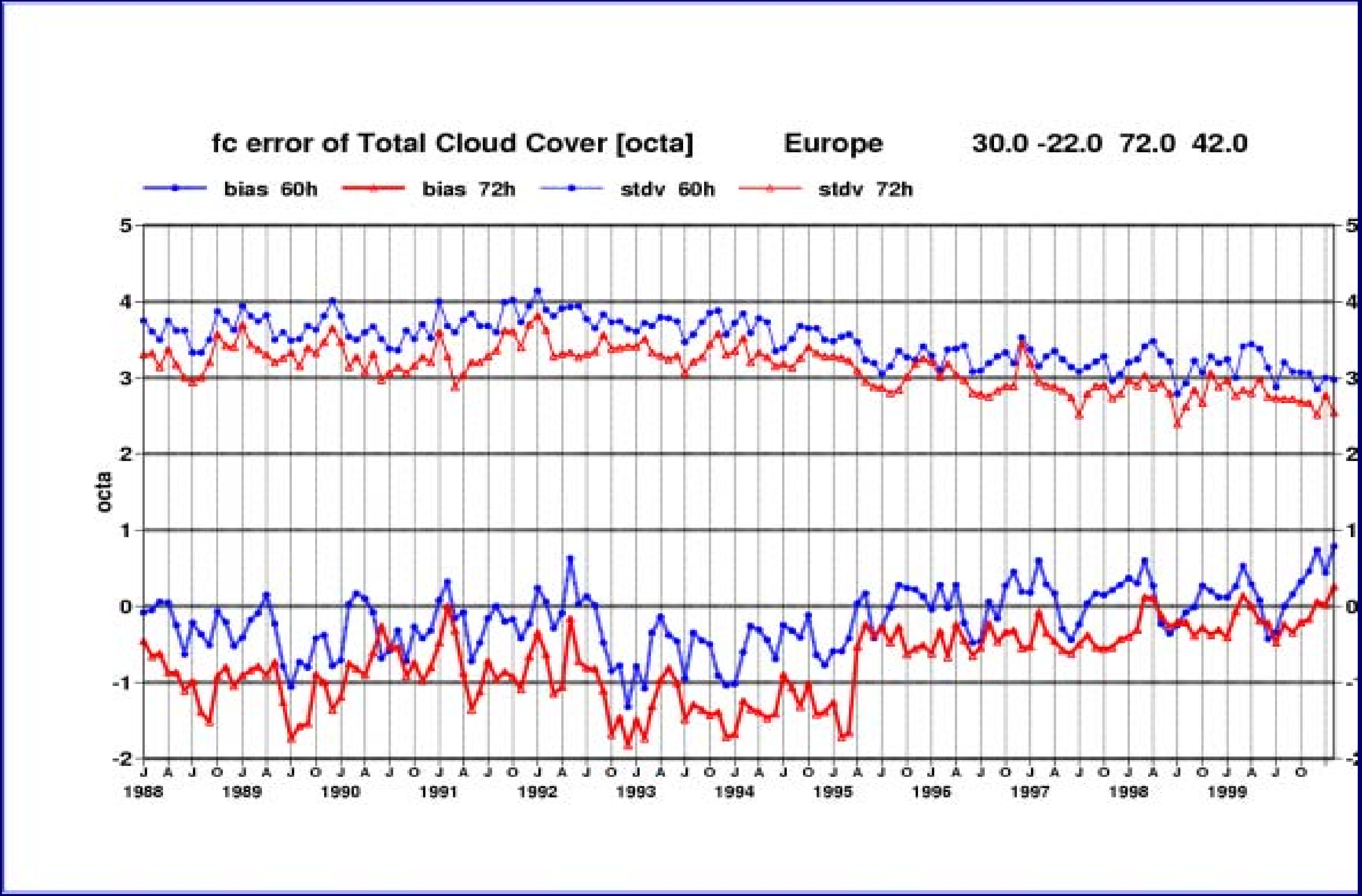




- **Run climate models in a NWP-mode**

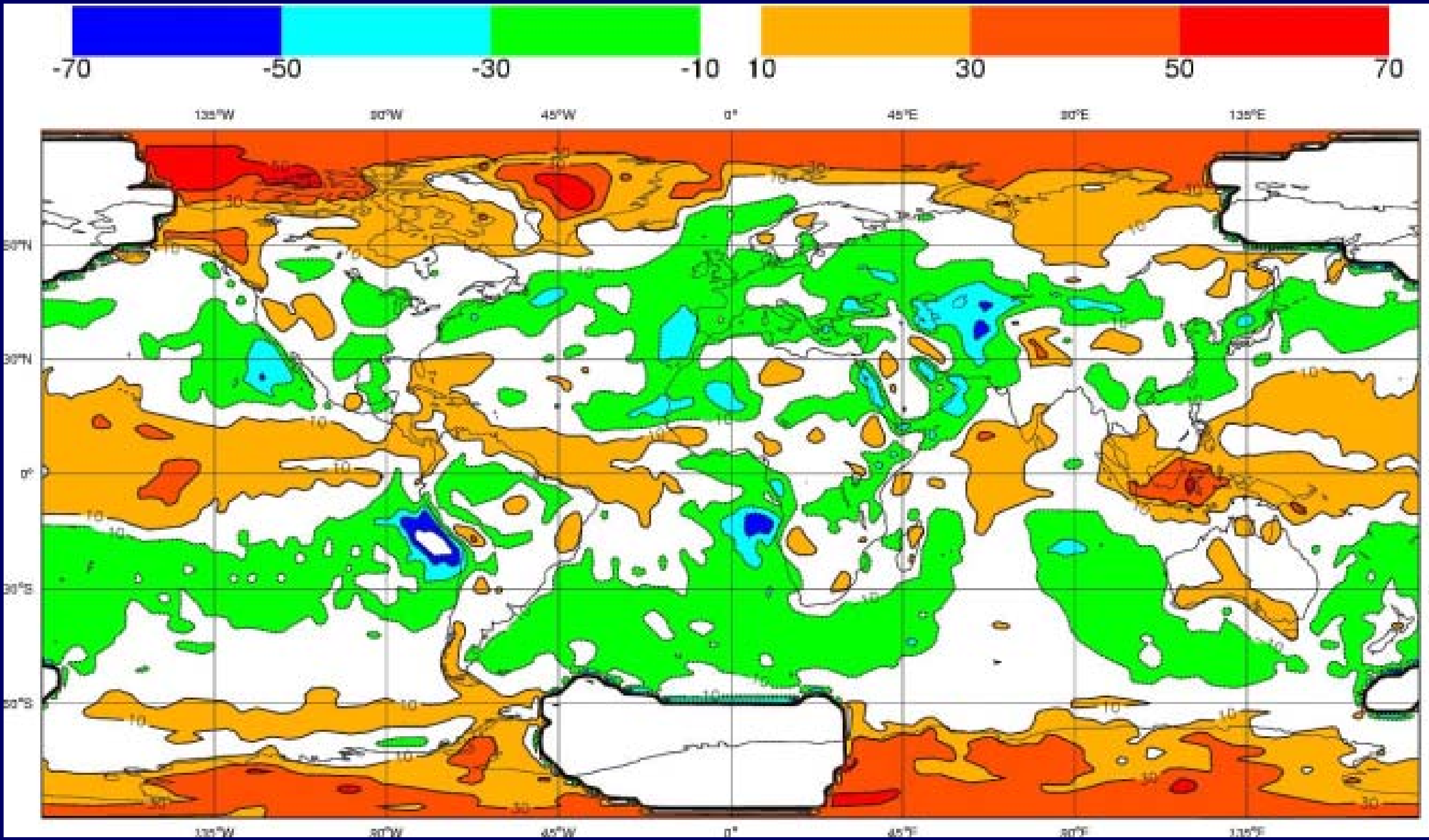
In order to prevent the dynamics from drifting away

Model climate - Short-range NWP Comparison to SYNOPs



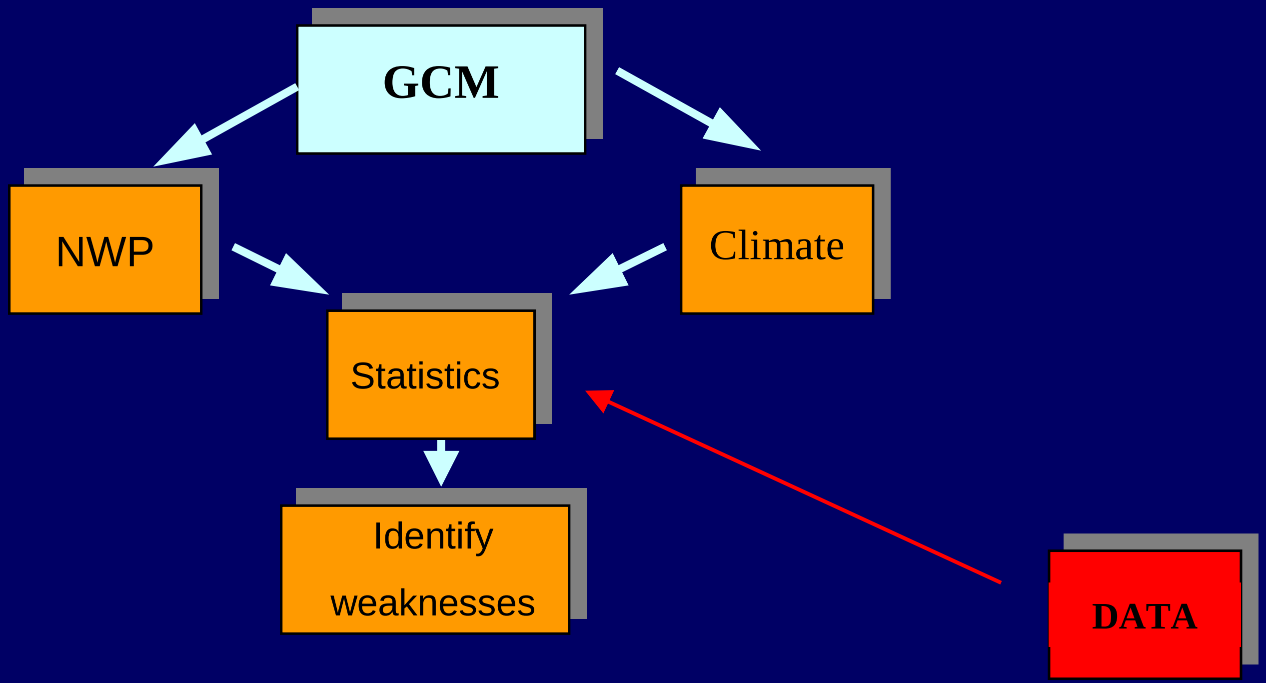
ECMWF-Model climate - Cloud fraction

JJA 1987 T63L31TCC Model - ISCCP



Evaluation of global model climate - Summary

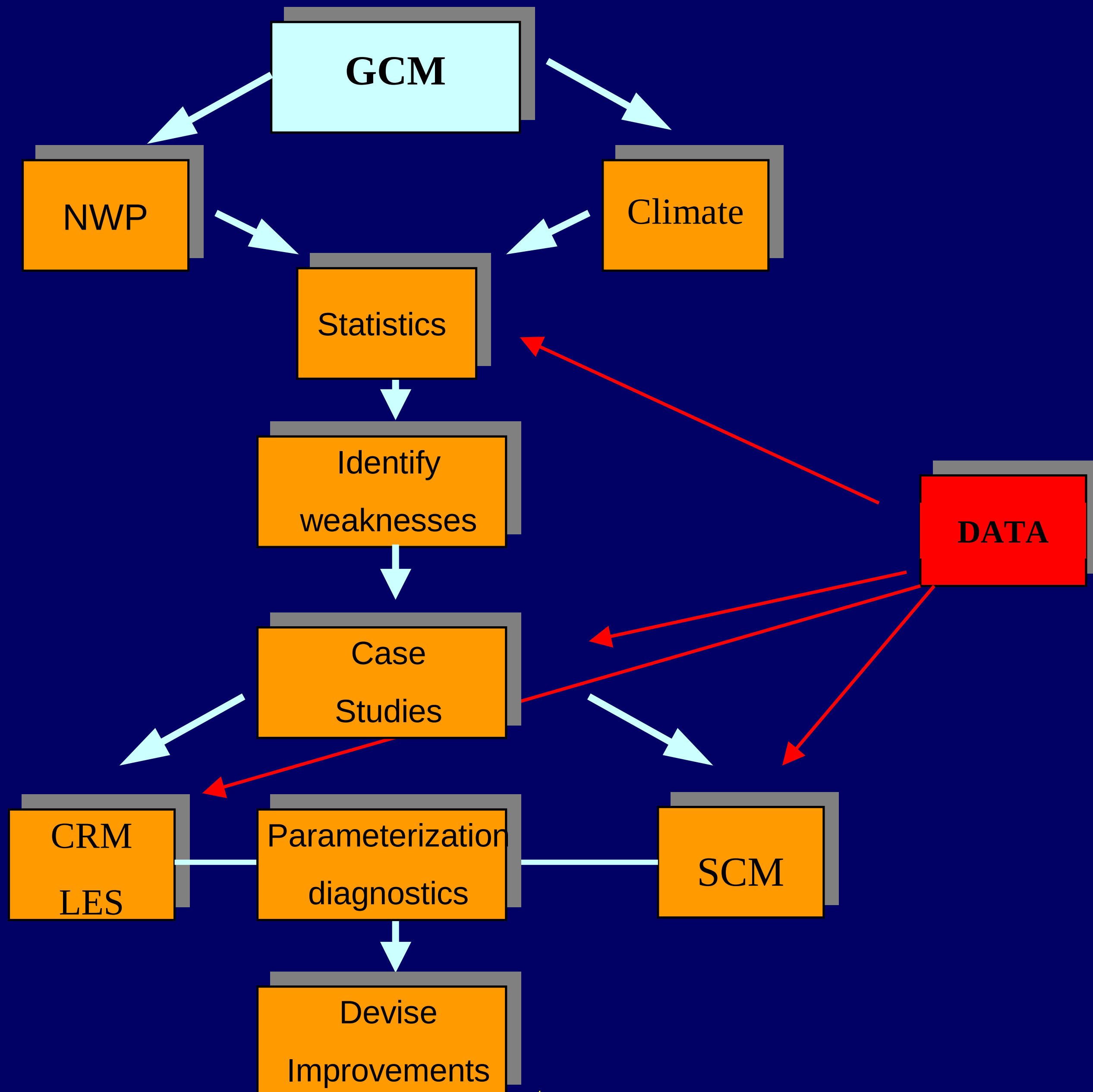
- Evaluating the model climate is a good first step
- Advantages
  - one of the important driving forces of parametrizing clouds is their influence on radiation - comparing radiative fluxes is important
  - it is relatively easy if sufficient data is available
  - major problem areas (in the geographic sense) are exposed
  - regional studies can provide more detailed error characteristics
- Disadvantages
  - errors in clouds/radiation can be caused by errors in the large-scale flow that can evolve through model drift - this can be overcome by the use of short-range forecasts or DA systems to build up the model climate
  - no insight into the actual errors in the model formulation can be gained



- **NEXT Logical Step:**

Detailed Case Studies in Key Areas

- An important simplification in case studies is the use of a single column version of the model physics
- Here the large-scale dynamics are prescribed (mostly from observations)
- This creates a cheap and fairly controlled model environment in which details of the parametrizations can be studied.
- The results can be compared to observations or, as carried out in the GEWEX Cloud System Study and EUROCS, to results of high-resolution Cloud Resolving Models (CRM,LES).
- Important prerequisites:
  - It should be a typical case
  - It should be a locally driven case


GCM
NWP
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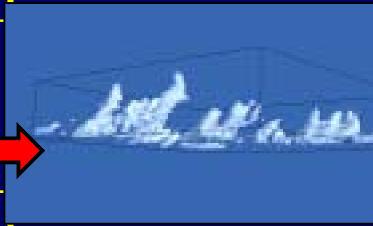
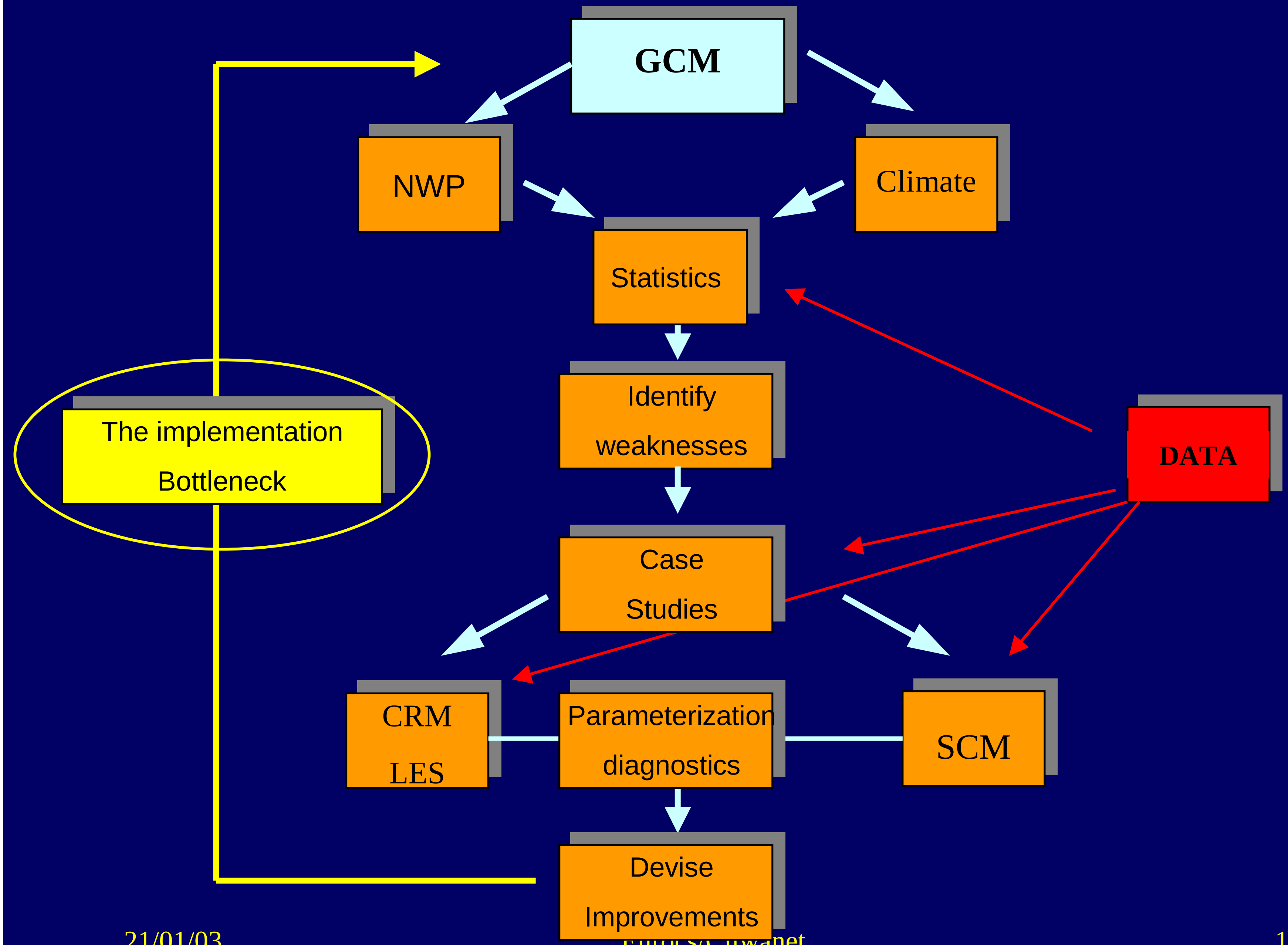
Identify weaknesses
DATA
Case Studies
CRM LES
Parameterization diagnostics
SCM
Devise Improvements

GCSS(WG1)/EUROCS bl-clouds Cases:

Type	Case	Parameterization Issues adressed:
Nocturnal Scu	FIRE (1987)	Top-entrainment
Shallow Cu (steady state)	BOMEX (1969)	Mass flux, cloud cover, lateral entrainment
Shallow Cu topped with Scu	ATEX (1971)	Mass flux, cloud cover, lateral and top entrainment
Shallow Cu (Diurnal Cycle)	ARM (June 21, 1997)	Mass flux, cloud cover, lateral entrainment
Scu (Diurnal Cycle)	FIRE (1987)	Top-entrainment, Radiation



•Despite improved knowledge of the mentioned processes and their parameterizations, progress showing up in improved GCM performances is slow…………..: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The implementation Bottleneck
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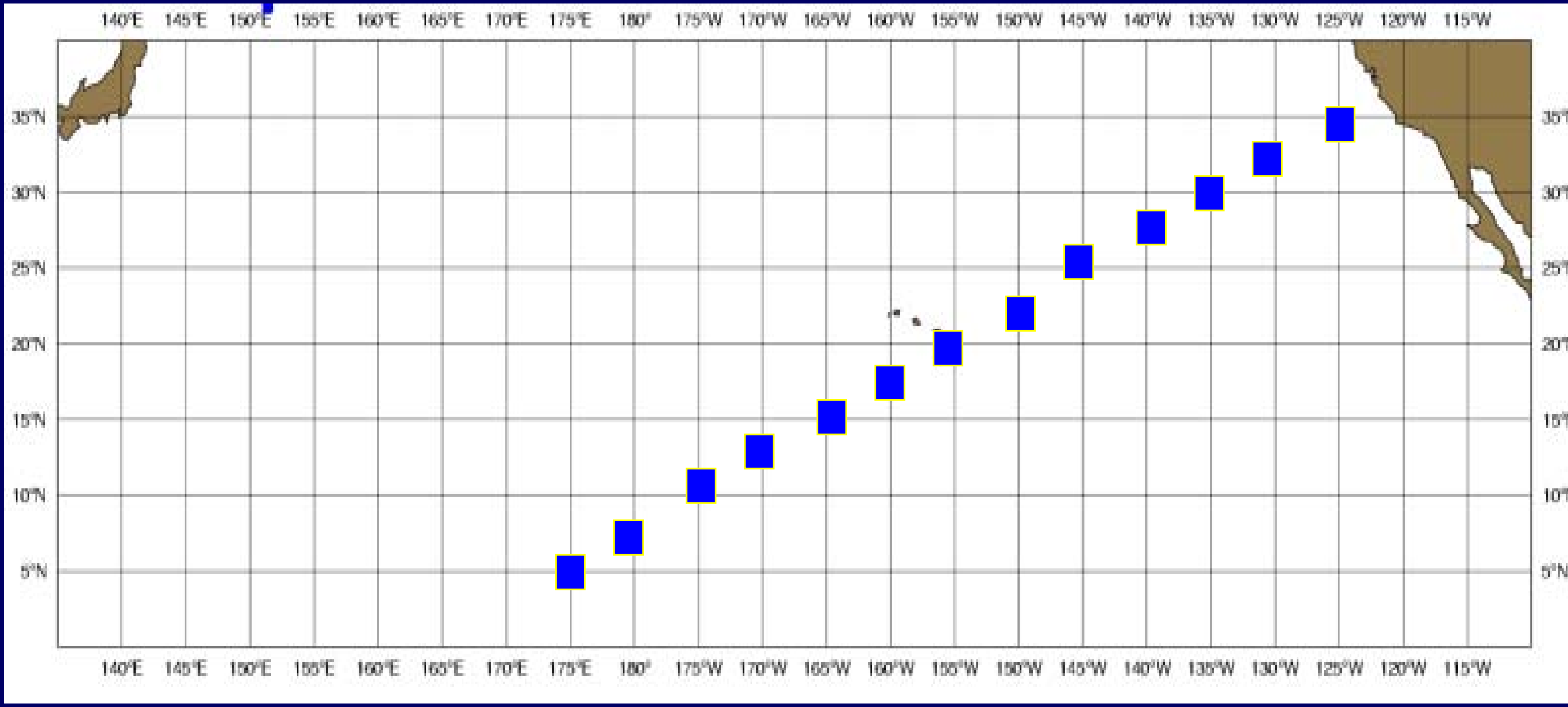
Implementation Bottleneck due to:

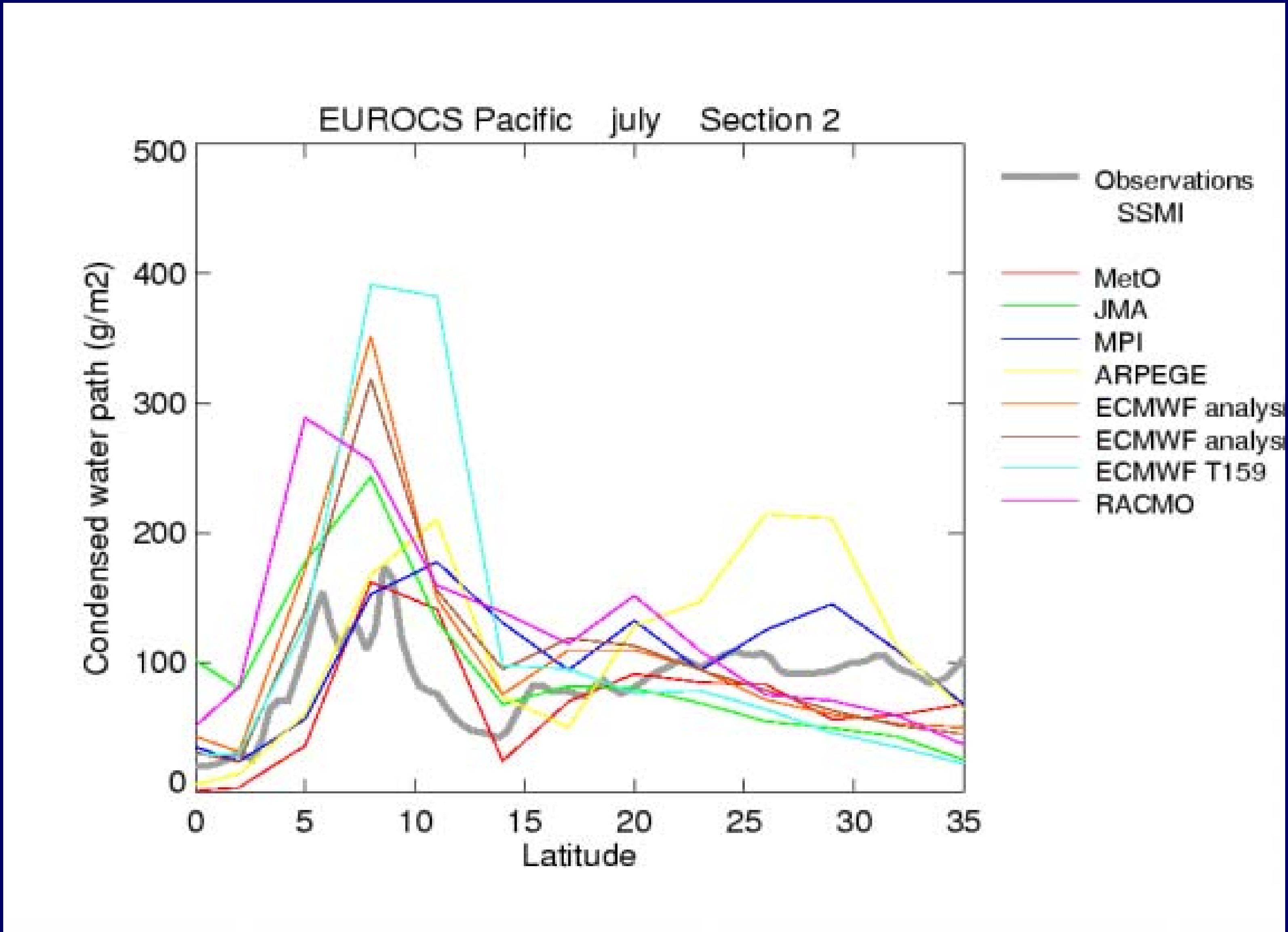
- Cultural Barriers between CRM and GCM community
- Complex interactions between the various parameterizations and the large-scale dynamics that are not always addressed in SCM-CRM context.

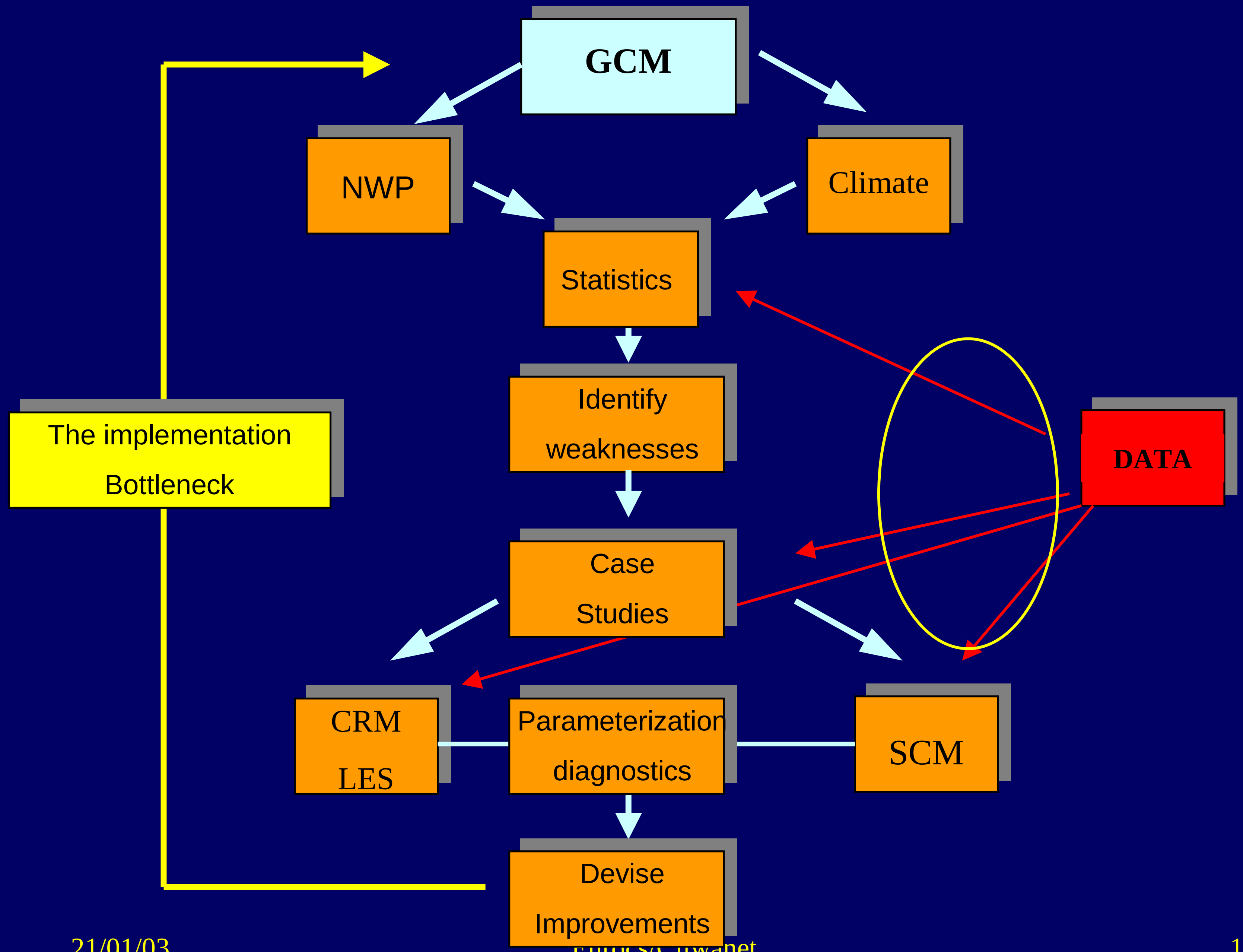
EUROCS-Cure:

- Intimate Collaboration between CRM and GCM community !

The proposed cross section




EUROCS Pacific july Section 2
Condensed water path (g/m2)
500
400
300
200
100
0
0
5
10
15
20
25
30
35
Latitude
Observations SSMI
MetO
JMA
MPI
ARPEGE
ECMWF analys
ECMWF analys
ECMWF T159
RACMO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Use of Observational data

- Useful Case studies in key areas are mostly outside Europe
- However long-term observational data-sets within Europe can be used for evaluation studies (e.g. CLIWANET).
- By making smart composites more effective use of long-term data sets for GCM evaluations is possible.

Main Conclusion

In order to solve the implementation bottleneck it is crucial:

To have close collaboration between:

- **CRM and GCM community**
- **Observational and Model community**
- **NWP and Climate modeling community**