CLIVAR GSOP/GODAE Ocean Reanalyses Intercomparison Workshop ECMWF, 1 - 3 July 2013

1) Santa Fe June 2011

What are areas of robustness in reanalyses?

Ocean Climate Metrics

Intercomparison plans

2) Woods Hole Nov 2012 (www.clivar.org/sites/default/files/ ICPO189_WHOI_fluxes_workshop.pdf)

Joint with Air-Sea flux workshop

First comparison of Reanalysis metrics

3) **This meeting**

Monitor progress – explain/reduce anomalous results

Review working groups

4) GODAE OceanView Symposium Maryland Nov.4-8 (Abstract deadline July 15)

Themes

Theme 1) How to complete the current intercomparison (Deadline: GODAE Symposium).

Which scientific work is missing?
Should it be extended to cover longer period?
How to package the results? publications, presentations, summary paper
Any other short term action?

Theme 2) How to exploit ensemble of ocean reanalyses further?

Which variables can be used for validation of climate models?
Which aspects can be useful for real time monitoring?
Which aspects can be useful for understanding the real world?
Which aspects can be useful for Observing System Assessment?
Which aspects can be use for system development?

Facilitate Data Access

Current status

    Data in a variety of repositories
- EasyInit, APDRC, MyOcean
- Often duplicates, with obsolete data, variety of formats and grids.

    Summary Tables with description in a variety of webpages
- Reanalysis.org, EasyInit, NCAR climate data sets
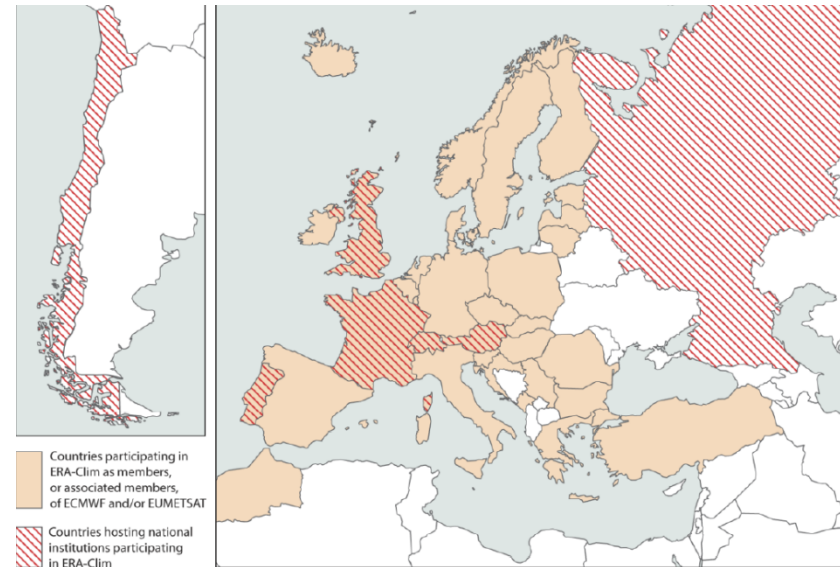- Often duplicates, no consistency or up-to-date ensured

How should we improve (consistency, avoid contradictions, up-to-date)
- Single repository?
- Data distributed in multiple repositories + central web page with links?
- Formats (CF compliant, others?)
- Grids ?

ECMWF Perspective on Integrated Earth System Reanalysis – Dick Dee

ERA-CLIM: EU collaborative research project, 2011-2013, 9 global partners

Goal: Preparing input observations, model data, and data assimilation systems for a global atmospheric reanalysis of the 20th century

Countries participating in ERA-Clim as members, or associated members, of ECMWF and/or EUMETSAT

Countries hosting national institutions participating in ERA-Clim
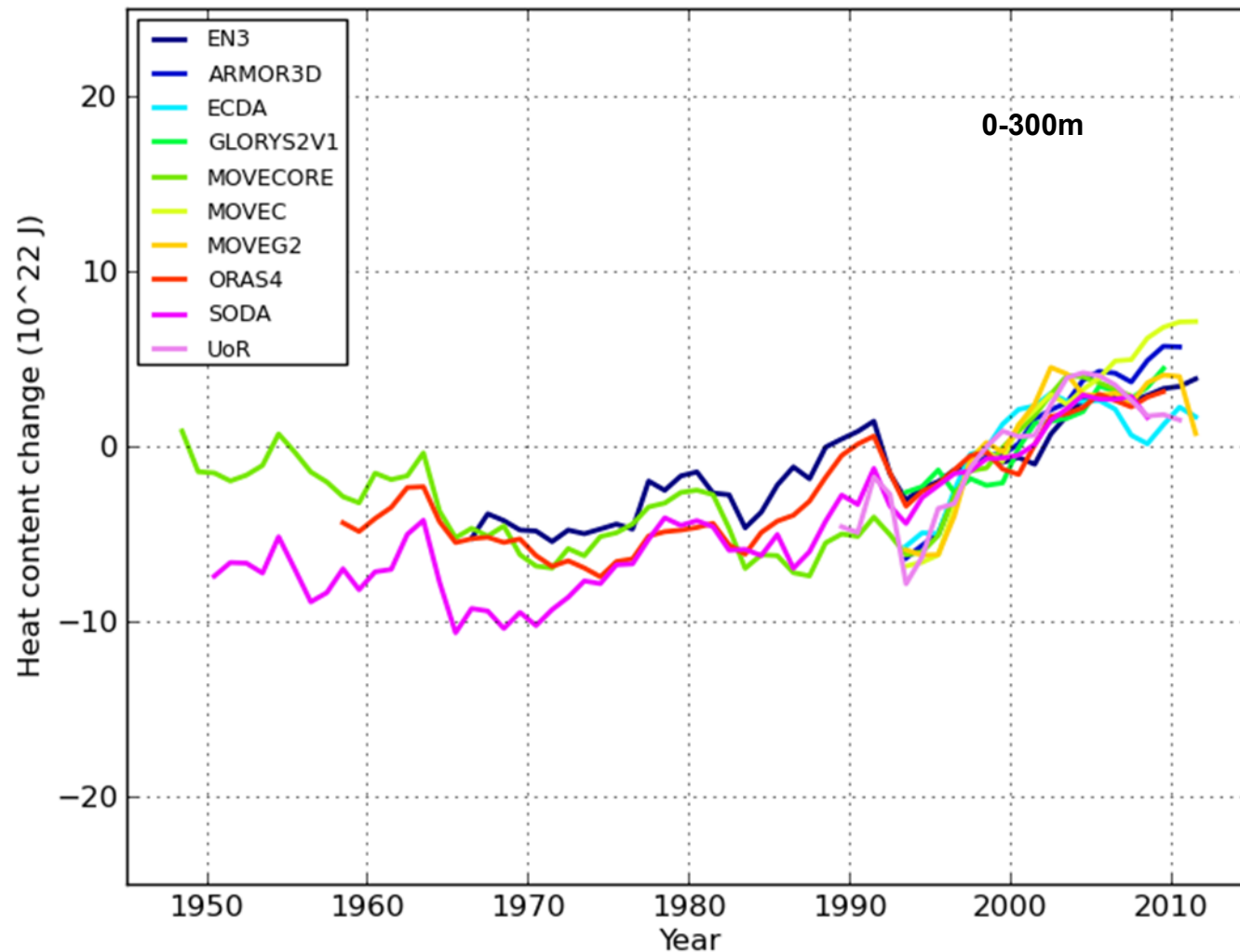
Main components:

1. Data rescue efforts (in-situ upper-air and satellite observations)
2. Incremental development of new reanalysis products
3. Use of reanalysis feedback to improve the data record
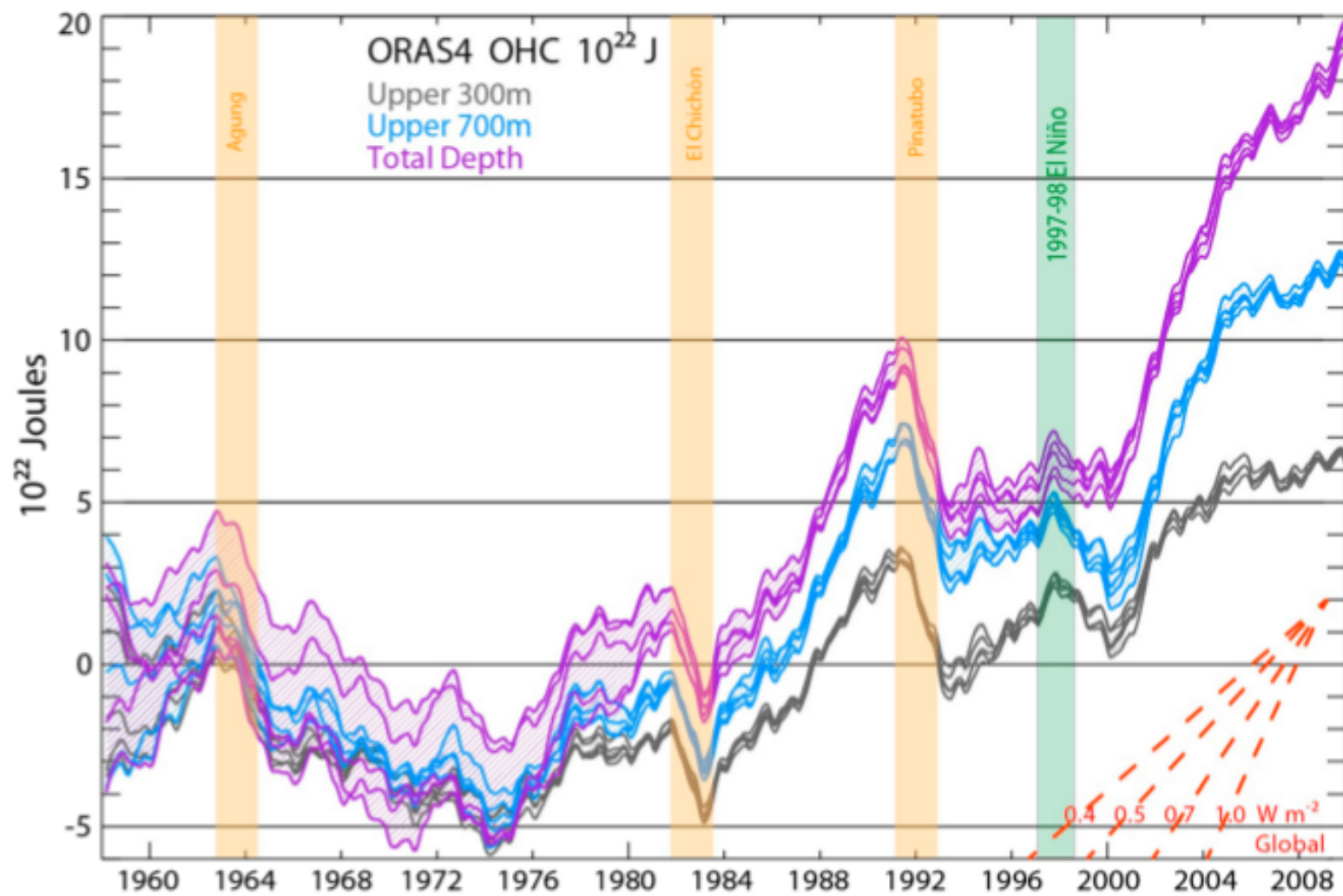4. Access to reanalysis data and observation quality information

ERA-CLIM reanalysis products

ERA-20CM	Ensemble of model integrations, using HadISST2 and CMIP5 forcing	1900-2010 125 km, 60 levels 10 members	Complete
ERA-20C	Ensemble of reanalyses, using surface observations from ICOADS and ISPD	1900-2010 125 km, 60 levels 10 members	In progress, available end 2013
ERA-20C/ Land	Global land surface, meteorological forcing from ERA-20C	1900-2010 40 km 10 members	Available end 2013
ERA-SAT	New reanalysis of the satellite era *(to replace ERA-Interim)*	1979 onward 40 km, 91 levels	Available 2015

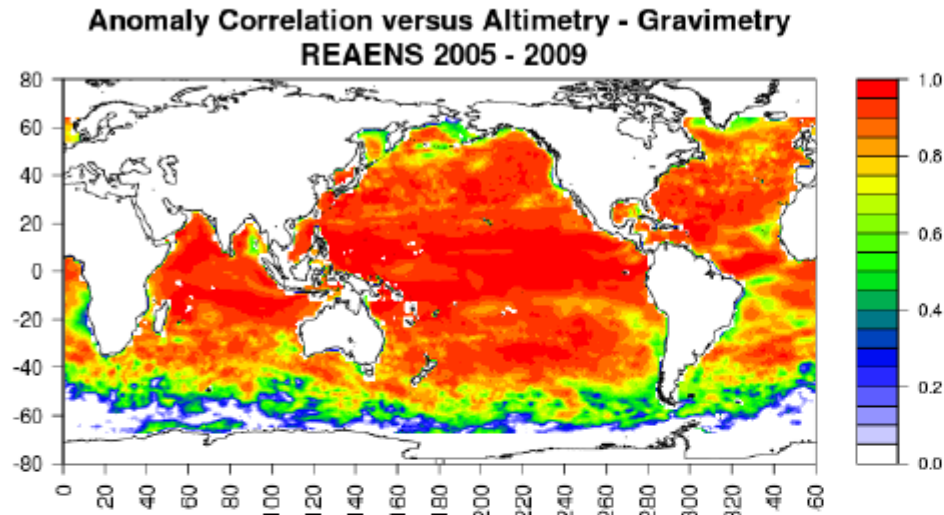# GSOP/GODAE heat content intercomparison
<u>Matt Palmer</u>, Magdalena Balmaseda, et al.

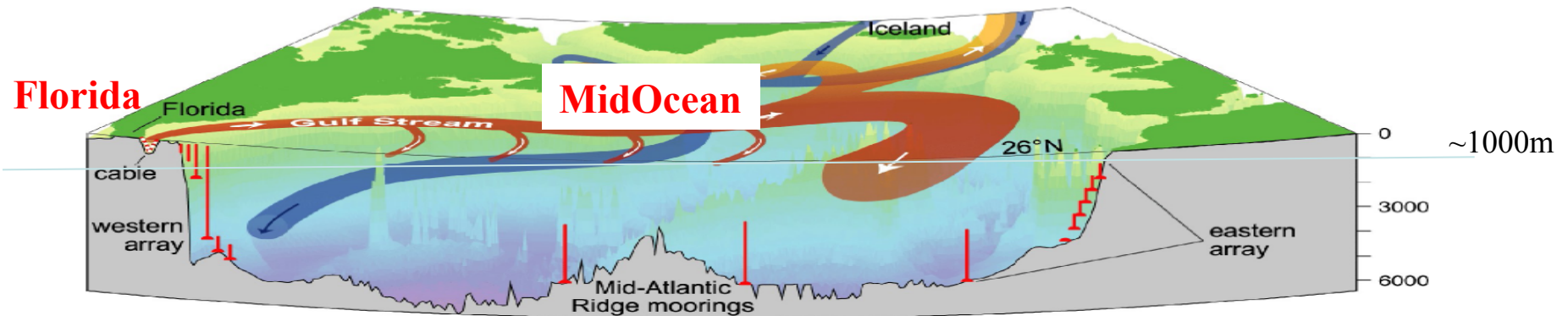Balmaseda et al. [2013]

Validation Period: Regional considerations

Anomaly Correlation versus Altimetry - Gravimetry
REAENS 2005 - 2009

VERY GOOD AGREEMENT
OF THE ENSEMBLE

Anomaly Correlation versus Altimetry - Gravimetry
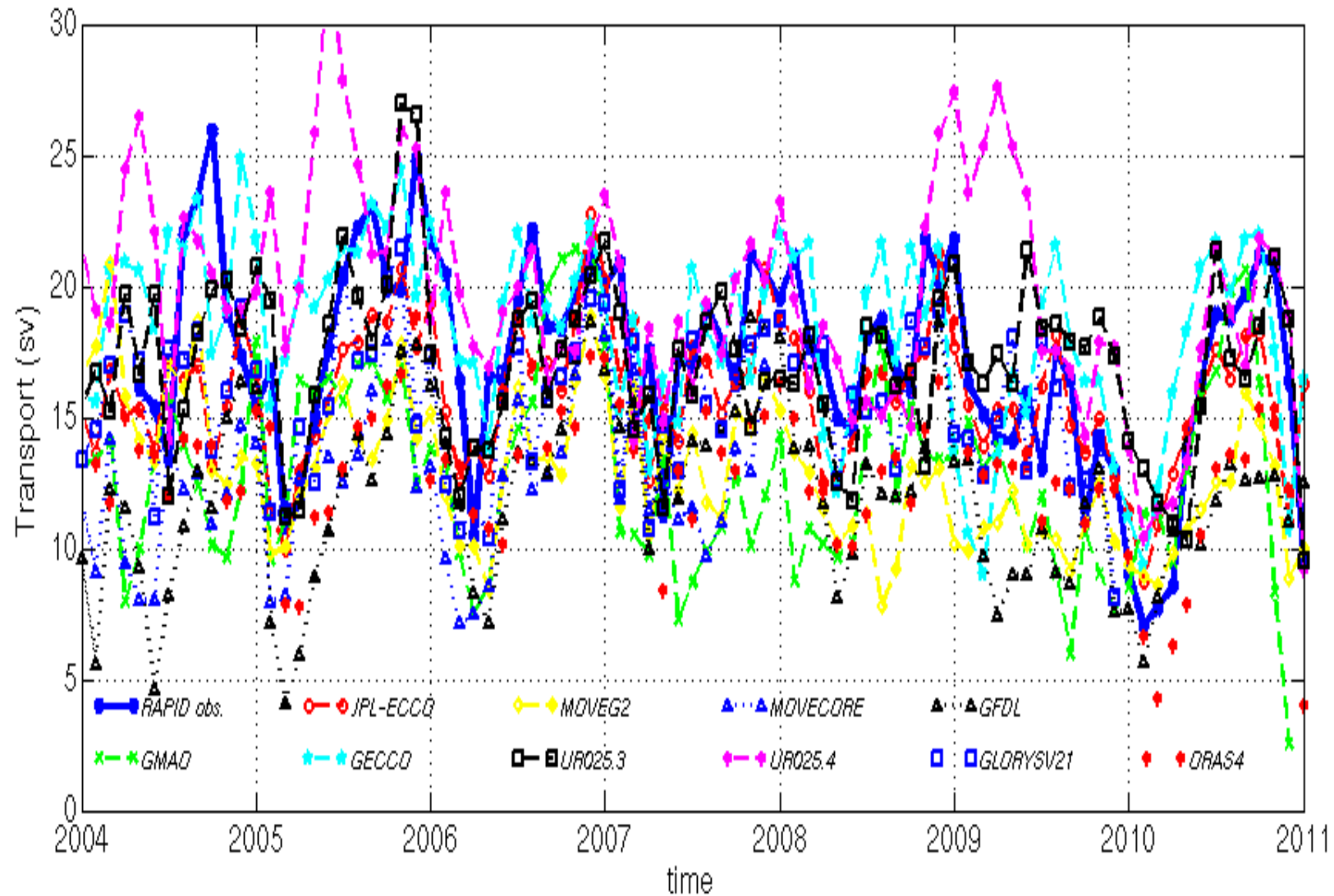Percentage of Products with 99.9% Significant Correlation
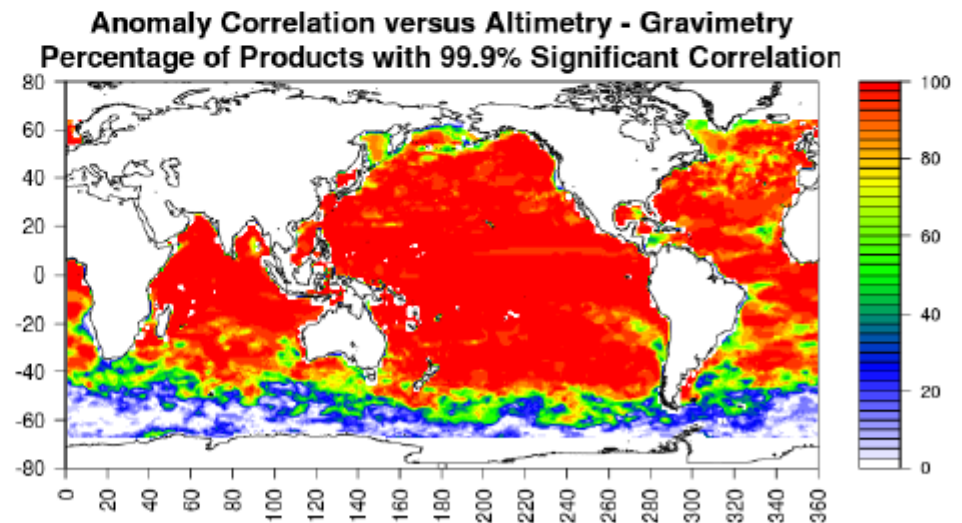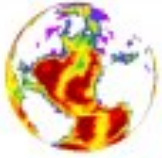
AMOC Definitions

- **Florida** = Flow through Florida straits
- **Ekman** = Wind stress implied transport through MidOcean section
- **MidOcean** = MidOcean flow – Ekman = Geostrophic flow
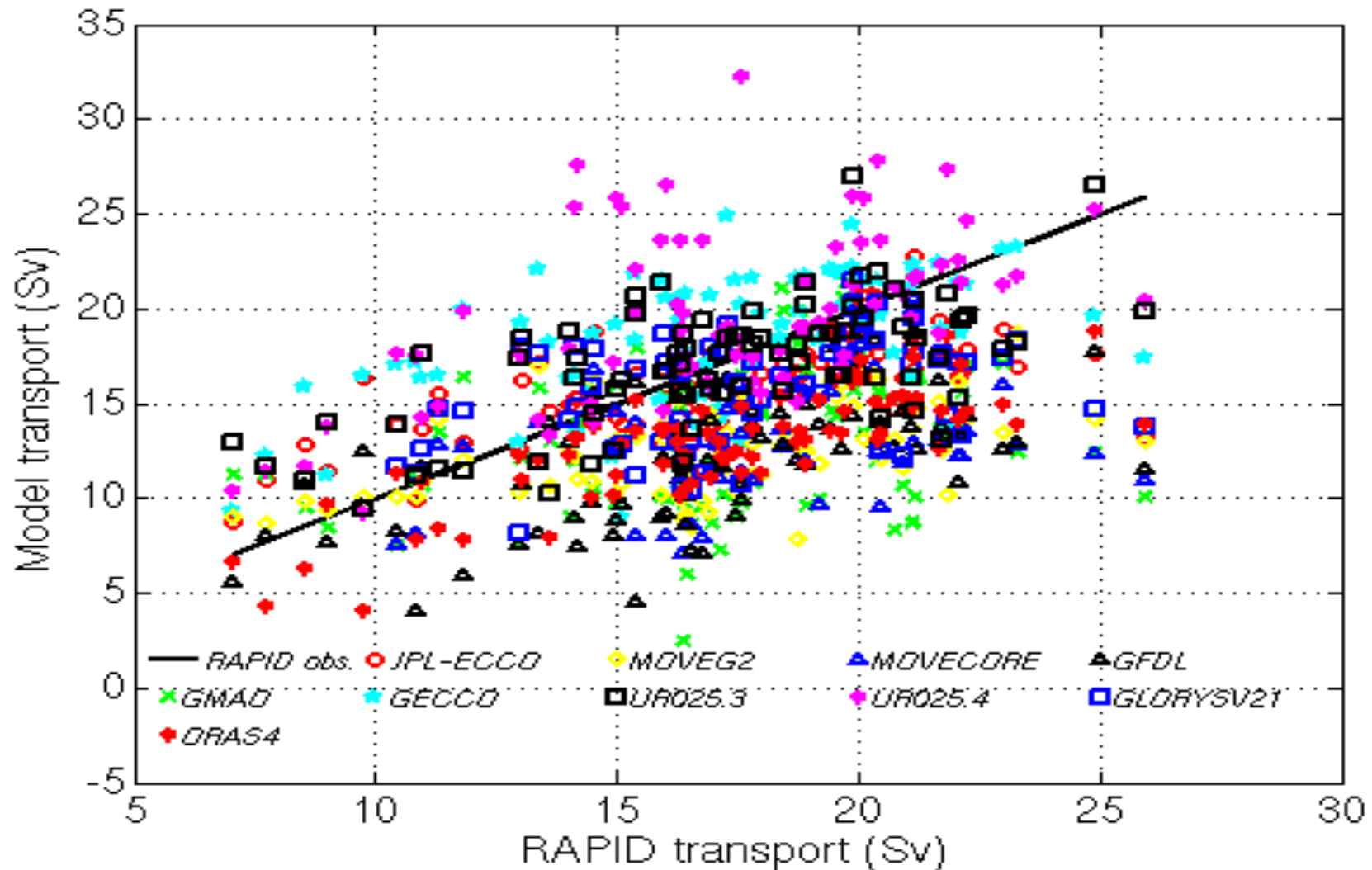- **Throughflow** = Total transport through section (Bering straits + P+R-E)

Monthly MOC for 2004-2010

# Monthly model MOC depending on RAPID MOC

2004-2010 MOC at 26.5N

N	Meridional components (Sv)	Florida Current	Ekman	Midocean	Max MOC*	Total throughflow
1	RAPID (Apr04-Mar11)	31.6	3.2	-34.8	17.6	0.0
2	JMA: MOVEG2	13.0	2.9	-17.0	12.7	-1.1
3	JMA: MOVECORE(04-07)	16.6	3.7	-21.9	12.6	-1.6
4	JPL_ECCO	25.5	3.1	-28.7	15.9	0.0
5	GFDL/NOAA	31.6	3.8	-36.6	12.2	-1.2
6	GMAO/NASA	28.6	2.7	-32.9	12.9	-1.7
7	GECCO2	41.2	2.3	-44.5	18.3	-1.0
8	Mercator/GLORYSv21	24.3	3.1	-28.9	15.6	-1.7
9	GloSea5/METO (2004-2009)	25.1	3.1	-29.7	16.3	-1.5
10	ECMWF	18.8	3.0	-22.9	12.9	-1.2
11	UR025.3	32.1	2.9	-36.6	15.6	-1.6
12	UR025.4	29.3	2.9	-33.6	17.9	-1.4

*- MOC integrated from surface
-1Sv throughflow ~ -0.2Sv of MOC
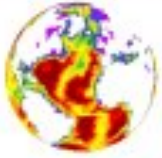
Points for Discussion

- Florida strait v MidOcean transports

- Why are model heat transports lower than Observed?

- Depth structure of AMOC transports?

- AMOC at other Atlantic latitudes

- Role of temporal eddies in transports

- Does current Assimilation increase/improve mean AMOC?

- Should we be looking to assimilate RAPID AMOC measurements?

- Ensemble estimates of AMOC transports?

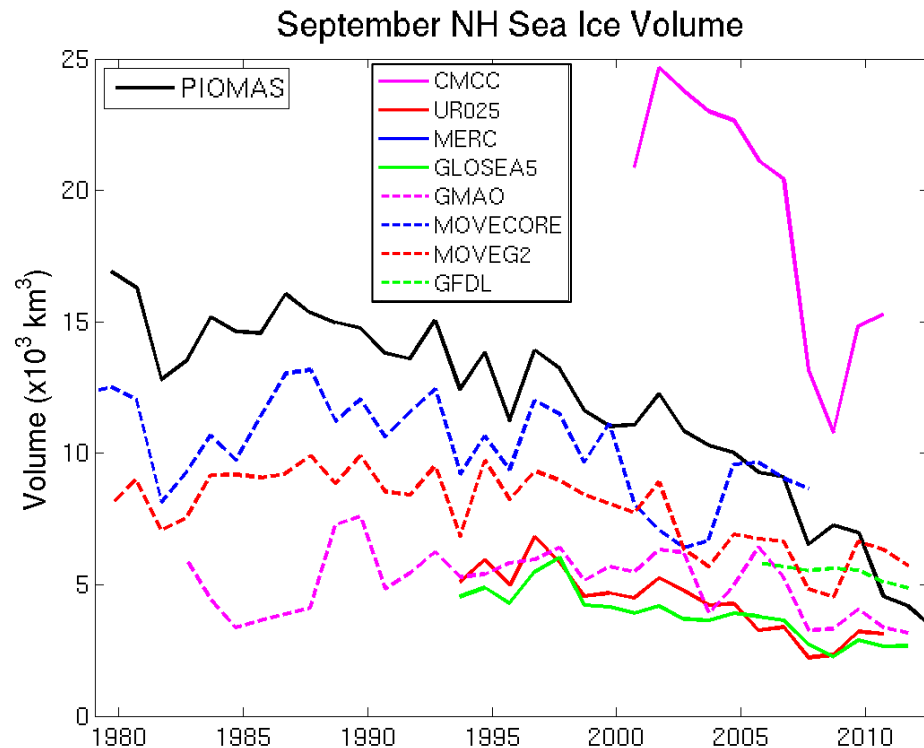# Sea Ice Intercomparison

Greg Smith, Jean-François Lemieux and Frederic Dupont

Mean March Sea Ice Thickness: 2007
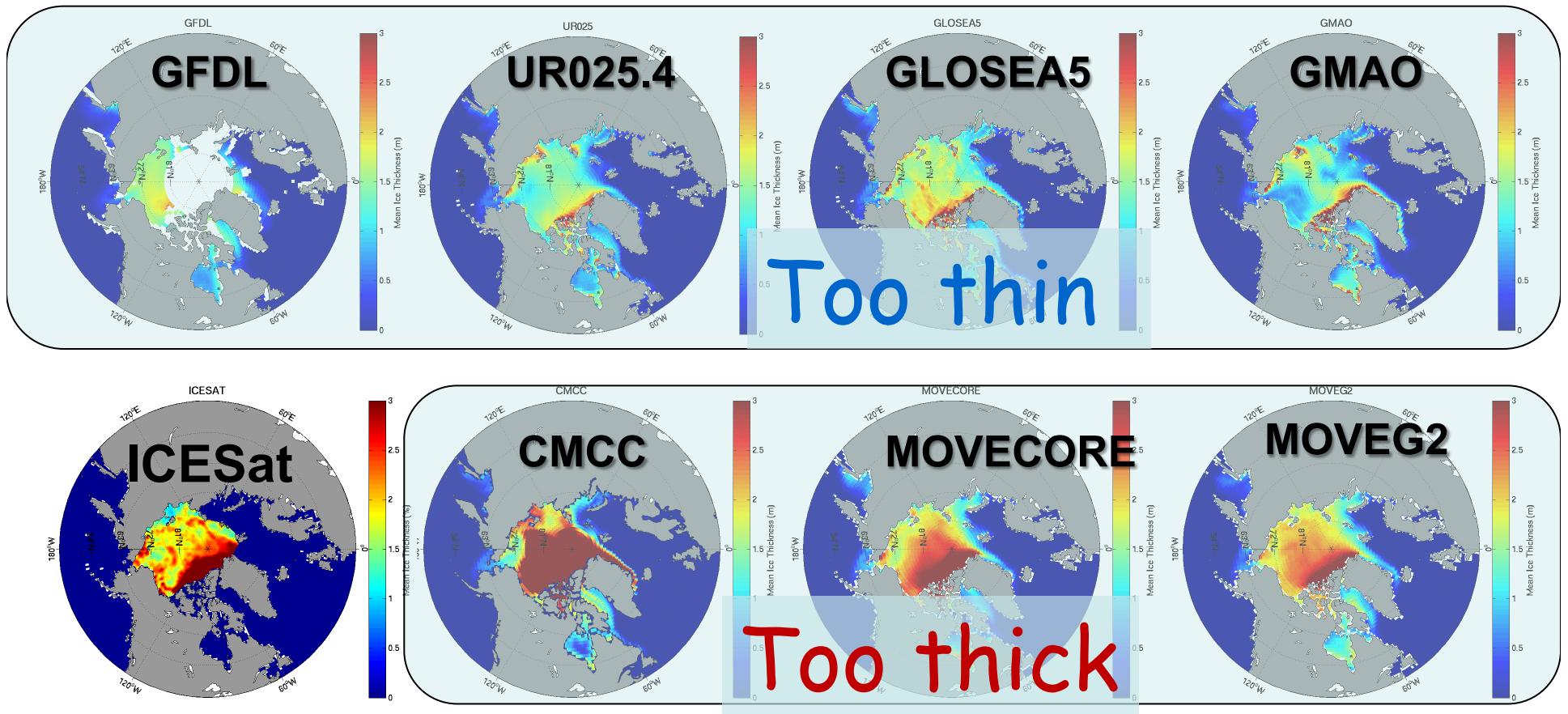
Timeseries of ice volume for September

- Large uncertainty in volume as compared to extent.

- Some agreement in downward trend from 1995 onwards

- PIOMAS is a well validated reference model run

- Surprisingly, most models have overly thin ice.

September NH Sea Ice Volume

How to complete the current intercomparison

- Proposed a list of action items to prepare for the GODAER OceanView Symposium by completing/enhancing the analysis for various parameters (e.g., including SSS, deep ocean changes), including submitting abstracts to the symposium.
- Proposed a few action items for "Best Practices" (data format, naming convention of different synthesis products; metadata such as depth info; references; co-author lists).
- Suggested enhancing scientific/diagnostic analysis of certain variables (e.g., potential change of S in the deep ocean; the spatial pattern of the deep ocean changes of T & S).
- Disseminate results through CLIVAR Exchange (summary of intercomaprison efforts), Ocean Sci., Ocean Dyn. Or Clim. Dyn. (a collection of papers for analysis/comparison of different variables), BAMS to highlight a topic of broad interest (e.g., deep ocean changes).

Current Inter-comparison (THEME I)

1. ACTION Complete data submission. Deadline mid September.
   1. Salinity (SSS (0-10m average) and additional products Li Shi to send request)
   2. Steric Height (possibly new reanalysis. Andrea)
   3. Sea Ice (new reanalysis. Greg)
   4. Heat Content (Matt)
   5. Sea Level (Fabrice, request complete time record)
   6. MLD (Takahiro, complete time record)
2. ACTION: Minimum common period to 1993-2009.
3. ACTION: Heat and Salt content on similar format (Matt Palmer and Li Shi to request)
4. ACTION: request vertical resolution details (bottom depth of each layer (Fabrice)
5. ACTION: Consistent naming of reanalysis products among variables (Fabrice)
6. ACTION: Submit abstracts to GODAE . Deadline 15th of July (everyone)
7. ACTION: CLIVAR Exchanges. (NICO) A description of project and short article showing at least one highligt per product (everybody)
8. ACTION: Contact Editor Ocean Science (Ocean Dynamic and Climate Dynamics) to request special issue
9. ACTION:: Submit papers to Ocean Science
10. ACTION: Contact producers informing on plans on GODAE/CLIVAR /others preference on anonymity (Magdalena).

How to exploit ensemble of ocean synthesis products further?

- Which variables can be used for validation of climate models?
- Which aspects can be useful for real time monitoring?
- Which aspects can be useful for understanding the real world (process studies)?
- Which aspects of the intercomparison can be useful for Observing System Assessment?
- Which aspects can be use for system development?

The following factors affect the answers to many of the questions above:

- "Signal-to-spread" ratio;
- Change of spread in space and time;
- Dependence on the parameter/quantity.

Recommendations for "How to exploit ensemble of ocean synthesis products further"

- Provide and archive ensemble mean and spread of each intercomaprison quantity to
  - evaluate impact of observing system (in space and time)
  - System improvement
  - Robustness of synthesis products as a whole for interring variability in the real world

- Enhance interactions with other community:
  - Promote the utility of ocean synthesis by other communities (e.g., initializing decadal prediction; evaluation of climate models).
    - Central Data portal with uniform format (preferably CF compliant): EasyInit; work with ESG/CMIP/obs4MIP
    - Complete and update metadata info in reanalysis.org and EasyInit.
  - Interaction with the Working Group for Ocean Model Development (WGCMD)
    - Provide a common framework for intercomparison (e.g., a subset of the GSOP/ GODAE OceanView metrics and WGOMD metric).

- Work with the obs community to
  - gain better estimate of obs uncertainty (e.g., provide feedback to data developers about the consistency among data products).
  - Consistent dataset for assimilation (QC procedure, uncertainty)

Value-added aspects of synthesis products beyond observations

- Complete space-time (including hi-frequency) distribution of MLD, D20, etc.

- Inferred/derived quantities: transports, esp. in regions where no direct obs are available (e.g., AMOC at 48N), steric height distribution in space.

Issues identified

- Strategy for the use of certain type of data (e.g., RAPID):
    - Withhold for independent validation or assimilate?
    - How to assimilate? Raw profile or derived quantities? Assimilate integral quantities?

• Automatic procedure to compute ocean climate indices; portal (OOPC, ICDC/ Hamburg, GODAE OceanView)

Recommendation

DATA ARCHIVE of ENSEMBLE MEAN AND SPREAD (EasyInit for Instance)

- Useful information for system development

- Needed to assess progress (each vintage of reanalysis needs to be better than previous)

- Needed to faciliate definition of indices

- Needed to faciliate process studies

- Need a name for the product and a version number (EA)v1

- Need format (CF compliant, homogenize variables names) and variable names.