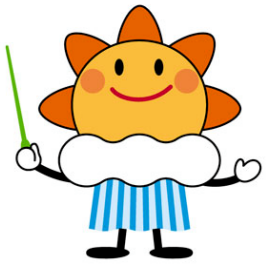
Observational Data Screening Technique Using Transport Model and Inverse Model in Estimating CO2 Flux History

Takashi MAKI, Kazumi KAMIDE and Yukitomo TSUTSUMI

Japan Meteorological Agency



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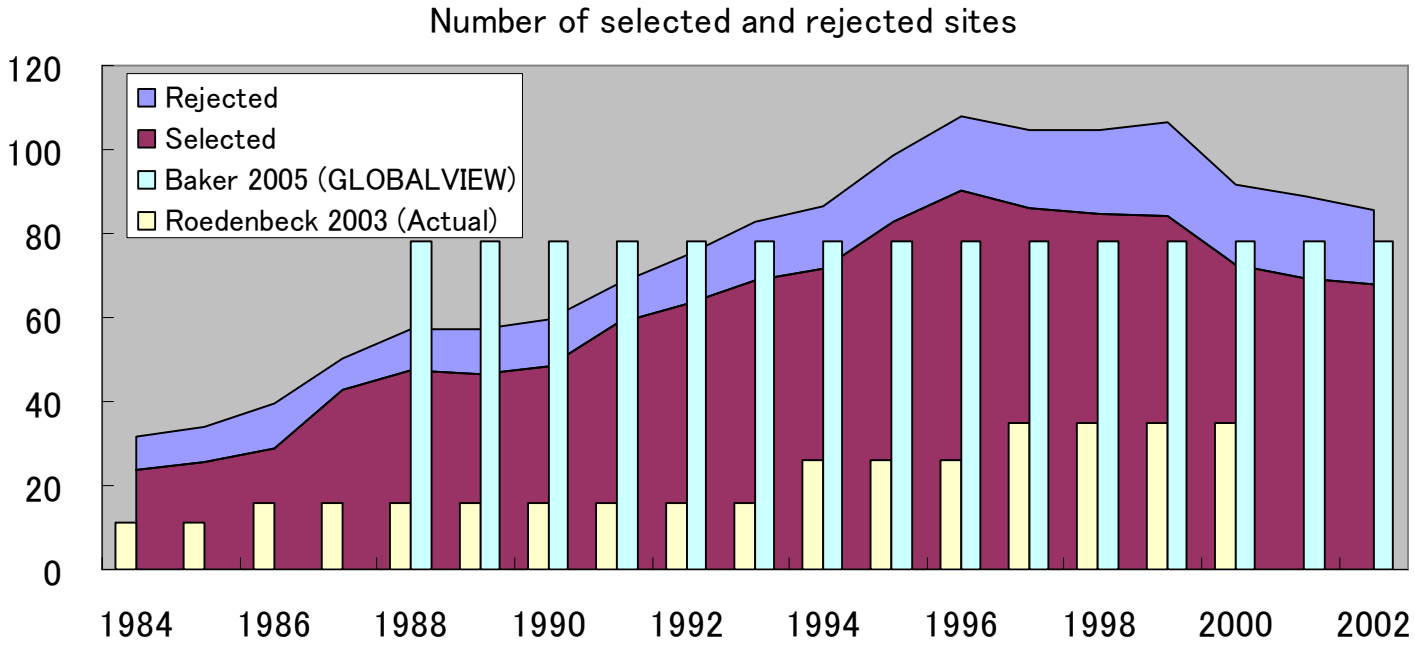
Purposes

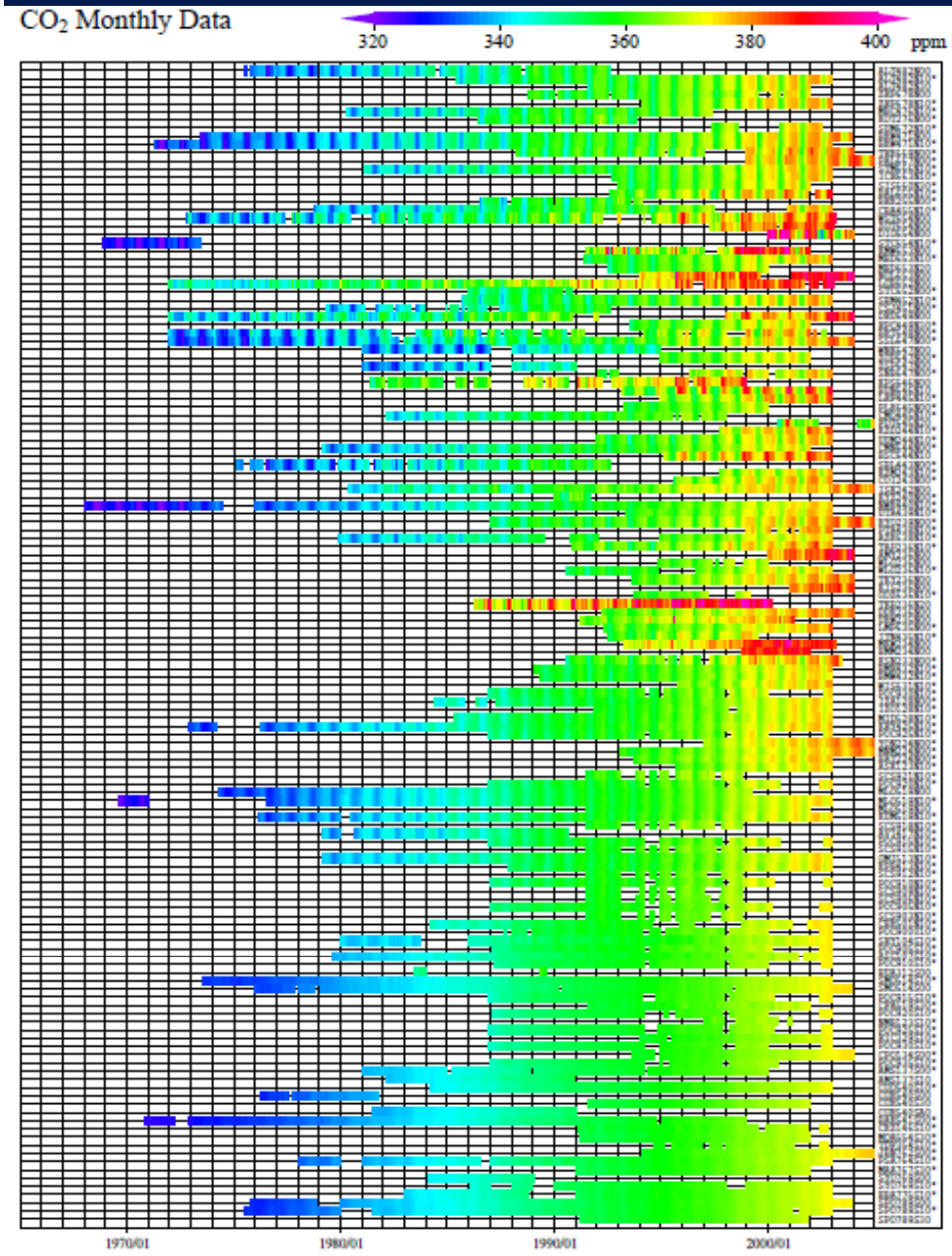
To use actual observational data (in situ, mobile platform) in inter-annual inversion (IAI) for estimating CO2 flux history.

To use as many actual observational data as possible consistently in IAI.



Results of our and other researches

Problems in direct use of actual data



1. Nonuniformity (lack of data, etc)
2. Representative (affected by local sources, etc)

Actual monthly mean CO2 concentration reported to World Data Centre for Greenhouse Gases (WDCGG) from 1968 - 2004, 124sites.

How to resolve these problems

Produce dummy data (give large uncertainties and reject from analysis) by smoothing, interpolating and extrapolating.

Determine data uncertainty (representative) from the difference between actual data and smoothed data (as in TC3L2).

In addition, select each observational data (not site) by inverse model.

*TC3 = TransCom 3, L2 = Level 2

Inversion setup

Transport model	JMACDTM, as in TC3L2
Meteorological field	JMA analysis (1997), as in TC3L2
Observational data	WDCGG monthly mean (1983-2004), 133 sites (surface + JAL)
Data uncertainty	Standard deviation of difference between actual and smoothed data
Backgroud Flux	Fossil fuel (1990,1995), CASA, Takahashi, as in TC3L2*
Prior flux	As in TC3L3(Houweling et al)
Prior flux uncertainty	As in TC3L3(Houweling et al)
Inversion code	As in TC3L2(Rayner et al)
Data selection	Using inversion (next slide)

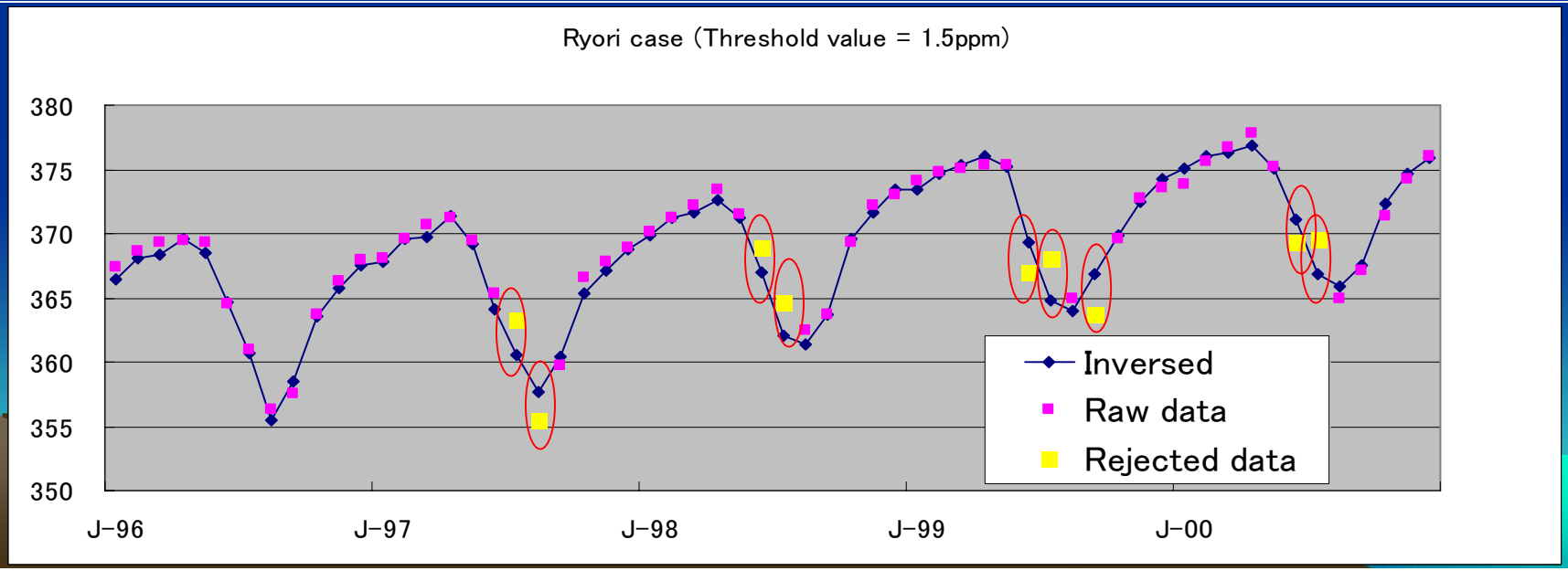
Data selection procedure

-1- to use all actual observational data in IAI.

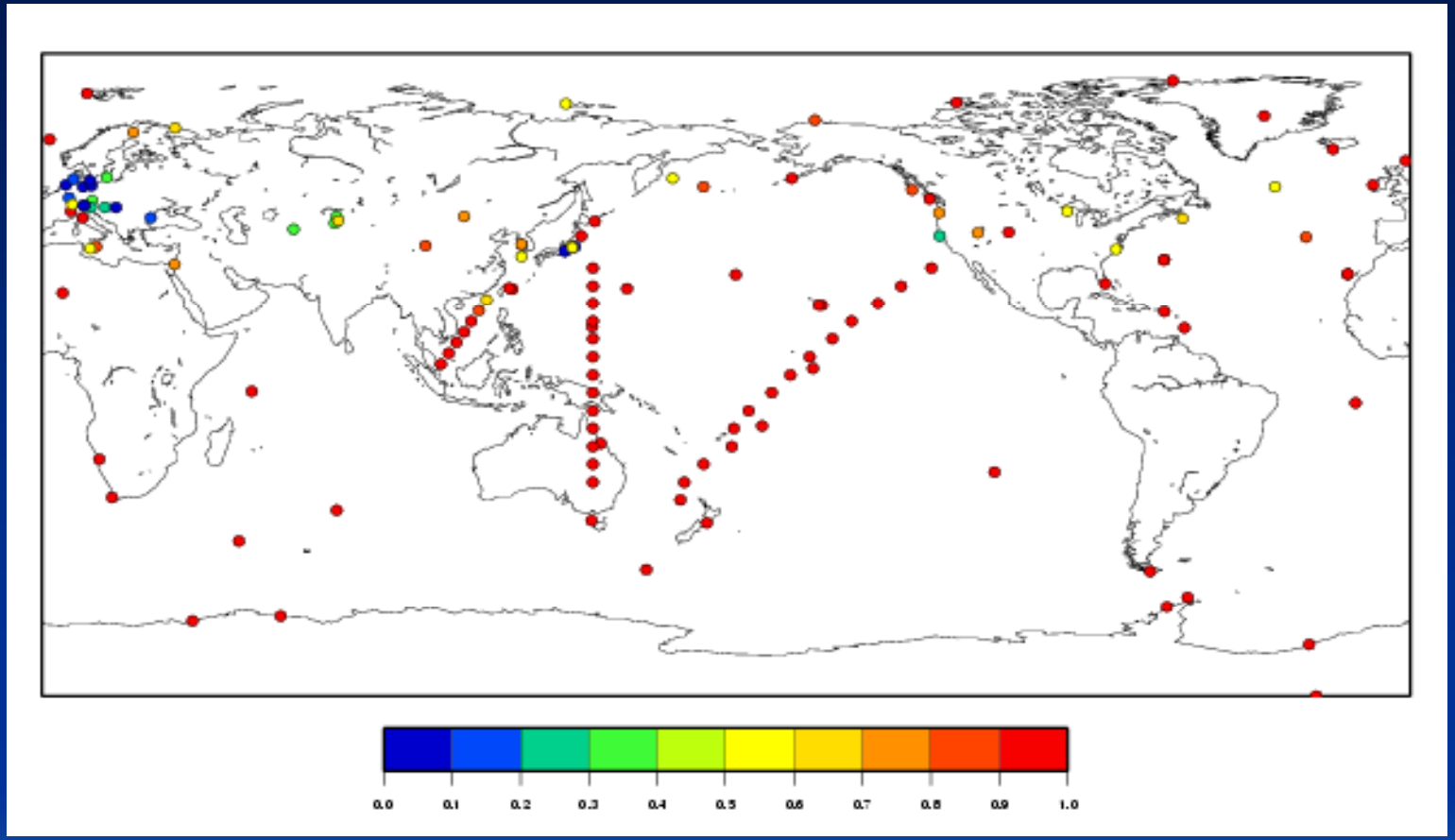
-2- to reject observational data when the data mismatch is larger than the threshold value.

-3- to use only selected observational data in inversion with same condition.

-4- to repeat process -2- and -3- until we have no rejected data.



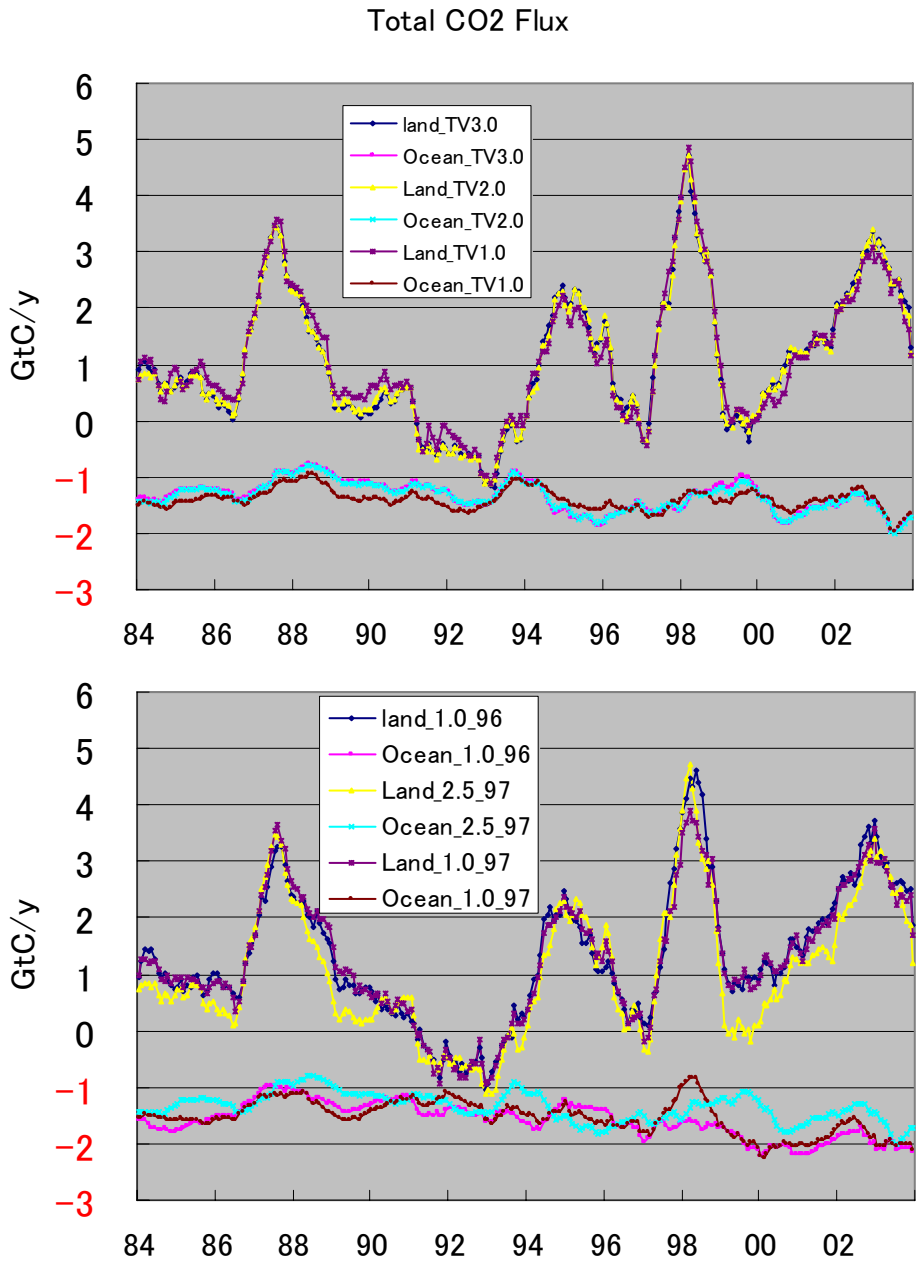
Data selection rate (1984-2003)



Remote sites show better selection rate than continental sites.

*Data selection rate = selected data / input actual data

Sensitivity Tests

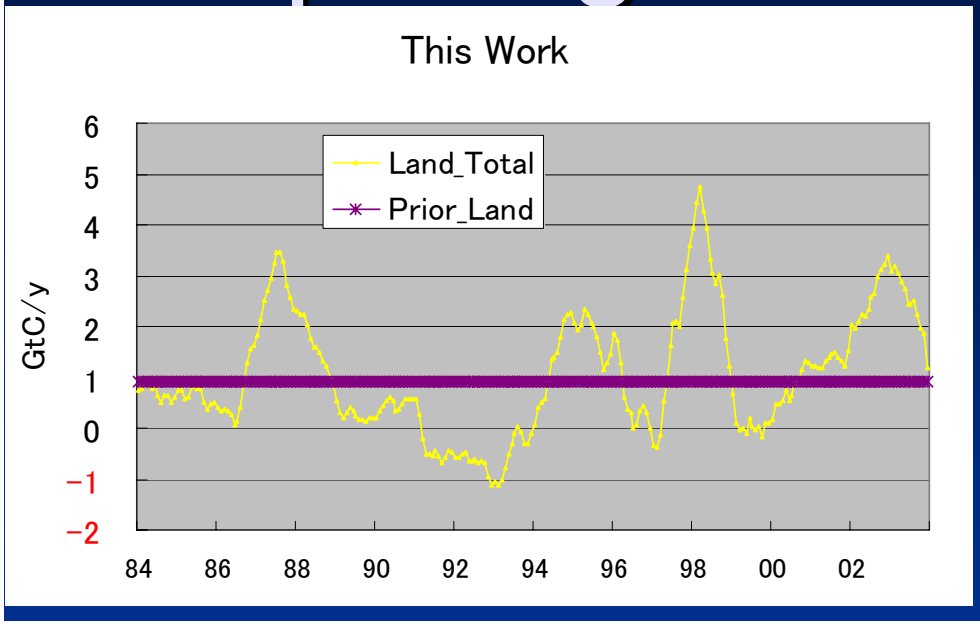


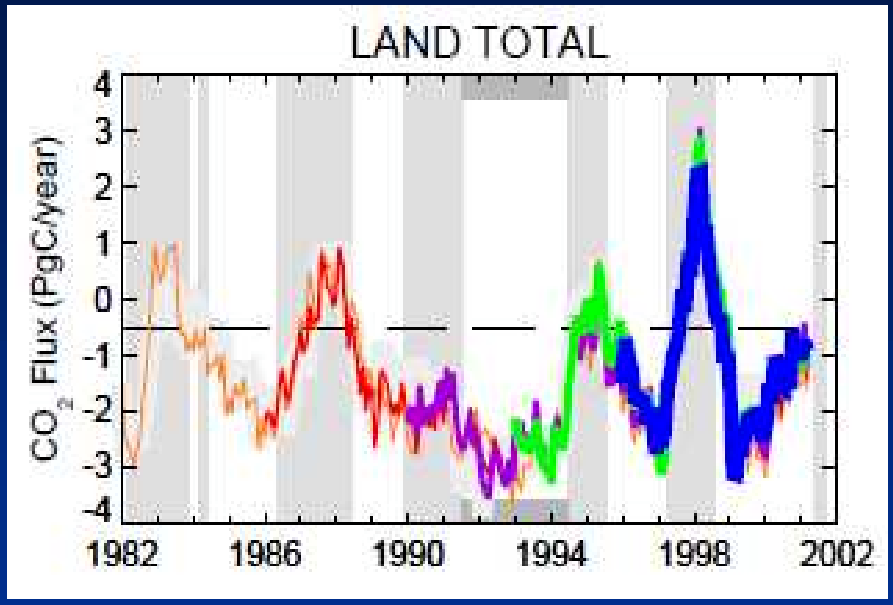
Each TV result shows good agreement with each other.

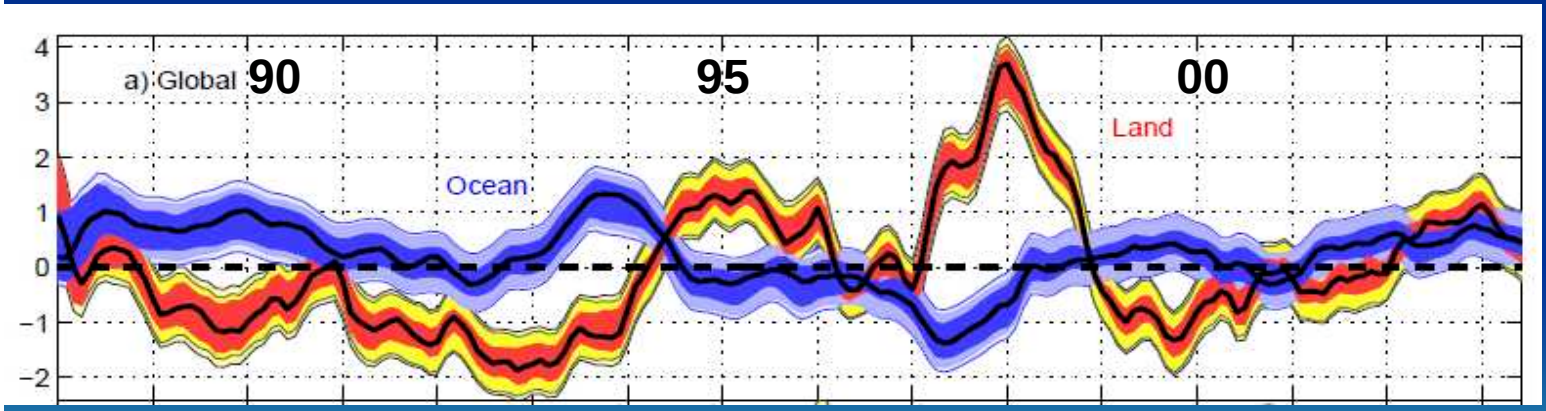
*TV = Threshold value (ppm)

Model resolution (2.5 deg., 1.0 deg.) is more effective to the flux analysis than meteorological field (1996, 1997).

Comparing with other researches







Roedenbeck 2003

Baker 2005

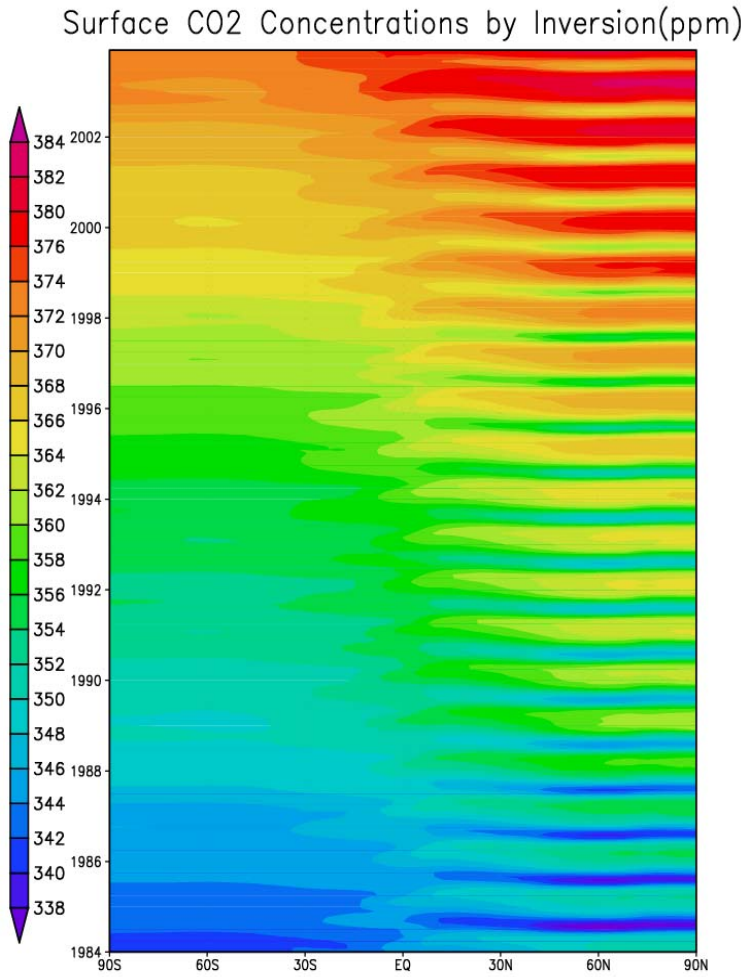
Phase and amplitude of total land flux show good agreement with each research.

Advantages of this method

- To be able to use several kind of observational data (surface, upper air and column data) even if we could treat the data in inversion.
- Not to need huge computational resources (we need only a few iteration of inversion).
- To be able to estimate CO2 flux history consistently especially long analysis period in accordance with the change of observational network.

Future plan, sample product

- Upgrade transport model from Off-line model to On-line model
- Increase number of geophysical regions
- Use real meteorological field in forward run
- Calculate model monthly mean CO2 concentration at a site from exactly observational time
- Use as many data as possible



Acknowledgement and References

Acknowledgement

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We thank to WDCGG data contributors especially NOAA/CMDL. (http://gaw.kishou.go.jp:/wdcgg/pdf_contributors.php).

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