

# Routing Comparison --TRIP and GCM--

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# In CCSR/GCM

- Route generator (*rivdst*, etc.) and routing scheme (*rivstp*, etc) are prepared (both in *pgriv.F*), **but not properly working.**
  - 5.6 and 5.7b are basically the same.
- Is it different from TRIP?

# GCM's Route Generator

- **Too Simple!**

- Flow to the nearest ocean

- Flow direction priority:

- E → W → N → S → NE → SE → SW → NW

- No elevation.

8	3	5
2		1
7	4	6

Direction Priority

# GCM's Routing Scheme

- Similar to “storage function (貯留関数)”

$$S_{t+1} = (S_t + I * dt) * (1 - dc * dt)$$

$$O = (S_t + I * dt) * dc$$

$$dc = v / l$$

- **Explicit function.**
- Calculation order is on a “i-j basis”, not on a “flow direction basis”. It is due to parallelization matter.

# TRIP's Routing Scheme

$$S_{t+1} = S_t * e^{-dc*dt} + (1 - e^{-dc*dt}) * I / dc$$

$$O = (S_{t+1} - S_t) / dt + I$$

$$dc = v / l$$

- Numerically better, due to derived from an analytical solution of a differentiate function.

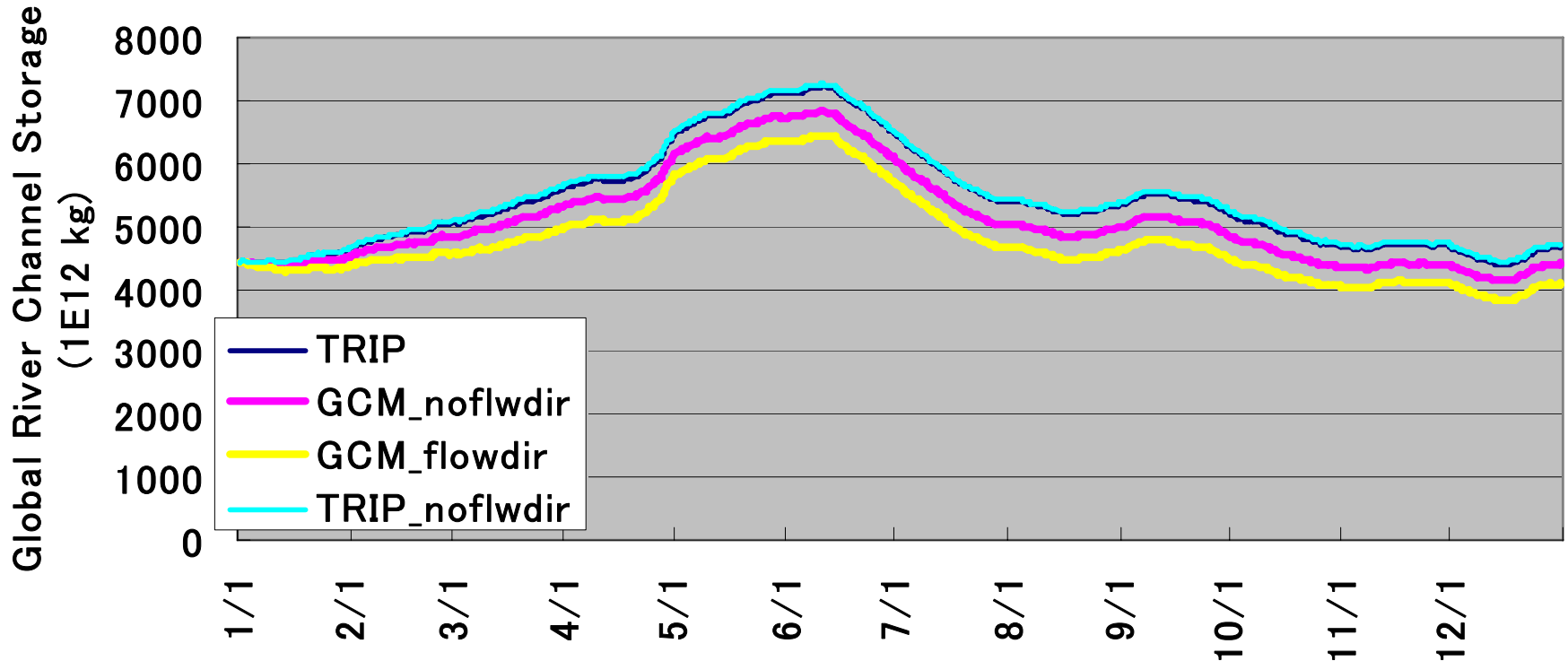
# Difference b/w TRIP and GCM's

$$\begin{aligned} S_{TRIP} - S_{GCM} &= \\ & S * \left( 1 - e^{-dc * dt} - dc * dt \right) + \\ & I * dt * \left( 1 - \frac{1}{dc * dt} + \frac{1}{dc * dt} e^{-dc * dt} - dc * dt \right) \\ & > 0 \quad (\because dc * dt < 1) \end{aligned}$$

- GCM's always underestimates.

# Global Accumulation simulated by TRIP's framework

ERA15+IsoMAT, 19791/1-12/31



**TRIP ≡ TRIP\_noflwdir > GCM\_noflwdir > GCM\_flowdir**

**➔ Calculation in the order of upstream to downstream is not so necessary.**

# Updates to TRIP and GCM

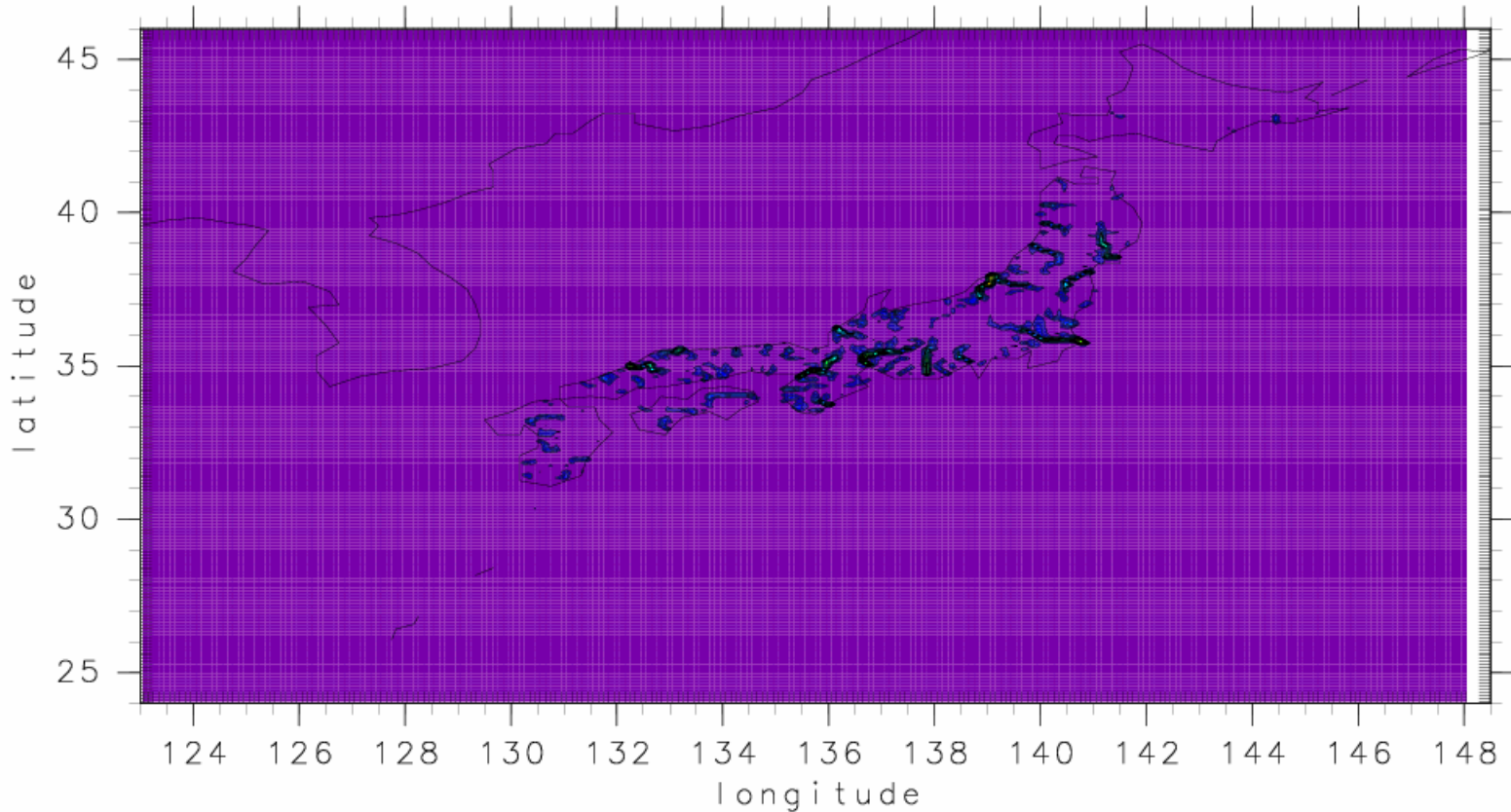
- TRIP
  - Option to the storage function.
  - Option to calculation in the order of I-J coordination.
- GCM (CCSR 5.6, convertible to 5.7b)
  - TRIP option (-DOPT\_TRIP)
  - Parallelizable.
  - `/export/raid27/kei/agcm5.6/src/physics/pgriv.F`



# Example 1

river flow  
kg/s  
RFLOW av 030120-030130

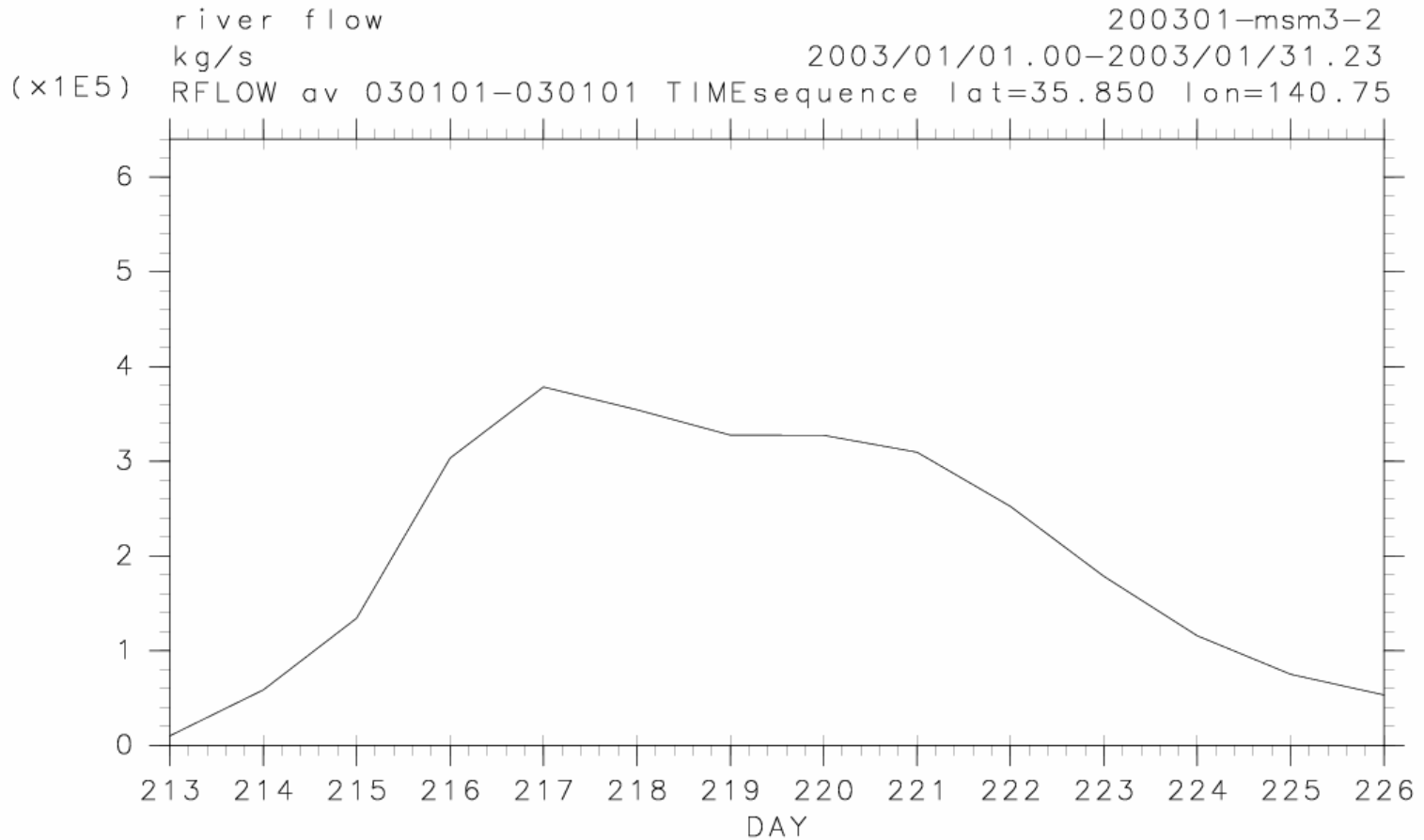
200301-msm3-2  
2003/01/20.23-2003/01/30.23



CONTOUR INTERVAL = 3.000E+04

kg/s

# Example 2 (Tone river)



1/1

— RFLOW

1/31

# Summary

- GCM's Route Generator:
  - Flow direction map should be prepared separately. Current generator in the GCM is too simple.
- GCM's Routing Scheme:
  - Should be updated. Should use TRIP option then.
  - I-J order is fine. Good for parallelization, too.
  - See `/export/raid27/kei/agcm5.6/src/physics/pgriv.F`