Isotopes in LMDZ

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Status

- Versions:
  - Currently isotopes in **LMDZ5A and LMDZ5B, summer 2013 version**
  - Isotopes in vectorial version of ORCHIDEE, 2008 version
  - Unfisnished attempt to put isotopes in LMDZ-ORCHIDEE, Marti's version, in spring 2015
  - Next: isotopes in LMDZ6?

- Isotopes in the trunk?
  - OK in the dynamical part (dyn3dmem), just a bug to solve
 - To do in the physical part

Available simulations

- Simulations:
    - AMIP
    - nudged by NCEP20: 1870-2008
    - nudged by ECMWF: almost real-time
    - zoomed: South America, Tibet, Indonesia, Antarctica, Western US, Greenland...
    - paleo: LGM, THC, MH, LIG, xCO2...
    - different sensitivity tests to model physics

- Outputs
    - extracted for a given spatial domain, time period, frequency, set of variables
    - monthly, daily, 6h, 1h
    - remote-sensing observation simulator for δD: GOSAT, TES, IASI, MIPAS, NDACC, TCCON...

Evaluation for LGM and MH

Last Glacial Maximum
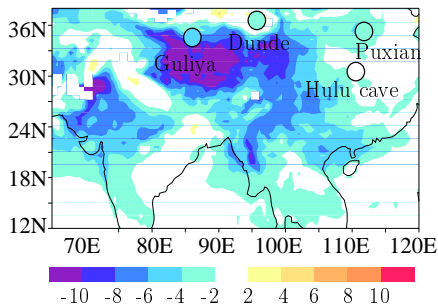
Mid Holocene
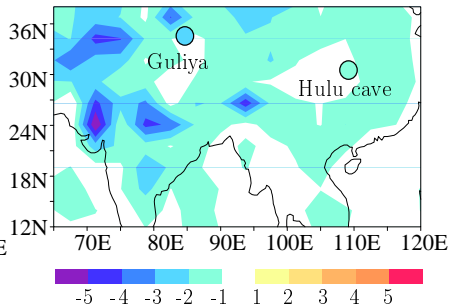
$\Delta\delta^{18}O$ (‰)

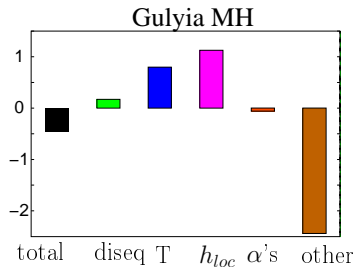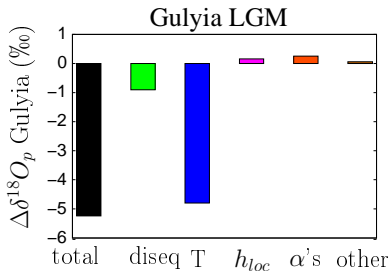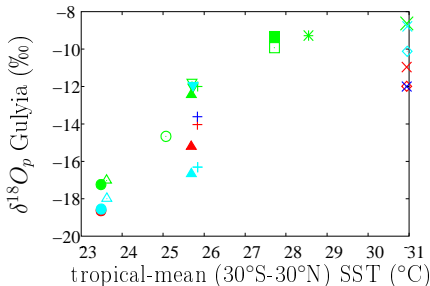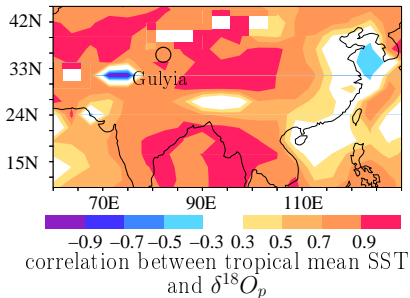(sea water corrected)

LMDZ 50km resolution

$\Delta\delta^{18}O$ (‰)

LMDZ control

Causes of $\delta^{18}O$ changes?

$$R_p = R_v + (R_p - \alpha_{loc} \cdot R_v) + (\alpha_{loc} \cdot R_v - R_v)$$

vap-cond diseq

$$R_v = \frac{R_{oce}/\alpha_i}{\alpha_K \cdot (1-h_i) + h_i} \cdot \left(\frac{h_{loc} \cdot q_s(T_{loc})}{q_s(T_i)} \right)^{\alpha_{loc}-1} + \text{residual}$$

initial vapor   distillation   e.g. upstream convection

Is $\delta^{18}O$ a proxy for temperature?

correlation between tropical mean SST and $\delta^{18}O_p$

Climates:		Model versions
+ present−day	○ LGM climap	● control
× 4xCO2 IPSL	● LGM IPSL	● less diffusion
✳ 2xCO2 IPSL	△ LGM IPSL THCoff	● more detrainment
□ 2xCO2 ECHAM	▲ MH IPSL	● less condensation
■ 2xCO2 MIROChi	▽ Eemien IPSL	● 50 km resolution
	▼ Eemien IPS THC+	

- temperature = significant control at paleo time scales
- robust to model physics

Is $\delta^{18}O$ a proxy for precipitation?
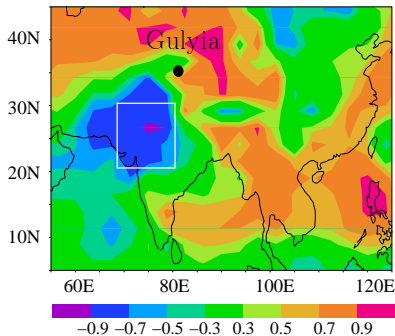
correlation between $\delta^{18}O_p$ at site
and precipitation around

box-averaged precipitation (mm/d)
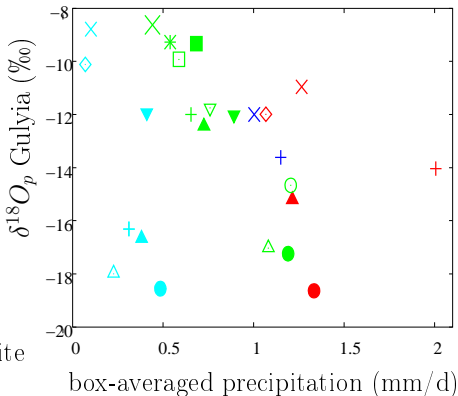
▶ Upstream precipitation plays a role at paleo time scales
▶ Sensitive to the model physics