Cosmogenic nuclide-derived denudation rates in the Amazon basin: A possibility to derive long-term sediment loads

H. Wittmann¹,
F. von Blanckenburg¹, J.L. Guyot²,
L. Maurice³, & P. Kubik⁴

¹GFZ Potsdam, Germany; ²IRD Brasilia, Brazil;
³IRD Toulouse, France; ⁴ETH Zurich, Switzerland
Box-based Model of Dynamic Floodplains

Input from hinterland (cosmogenic & sediment flux) mixed with Floodplain fluxes (calc from Channel depth, Migration rate, Channel belt width)

Sediment storage ~14 kyr (Dosseto et al., 2006)

No nuclide changes occur for $^{10}$Be & $^{26}$Al in Amazon

Denudation signal of sediment source area is preserved
Sampling strategy

Sampling of all sediment-producing areas to the Amazon floodplain
1. Guyana Shield
2. Braz. Shield
3. Andes

(in total > 150 $^{10}$Be analyses)
Beni basin: Denudation Rates

Floodplain denudation rates are consistent with Andean rates.

Decrease in variability -> small-scale processes are averaged out.
Madeira Basin: Summary of Denudation Rates

- Avg. Basin-wide denudation rates
- Integration time: 2.5 kyr
- Resulting sediment flux from Andes: ~80 Mt/yr
- $^{10}$Be-derived flux lower than modern gauging derived flux (~220 Mt/yr)

Possible Causes:
1. Change in Erosion over recent times
2. Anthropogenic effects
3. Methodological differences
4. Sampling frequency from gauging too short to represent all natural variations

Wittmann et al., accepted (Earth & Planetary Science Letters)
Napo basin: Denudation Rates

- Andean denudation rate: ~ 0.5 mm/yr
- Floodplain denudation: ~ 0.9 mm/yr
- Floodplain erosion!
- Modelled burial ages of added floodplain material are: ~ 4 Myr
- Modern, gauging-derived sediment fluxes similar (in Andes)

Floodplain denudation is NOT consistent with Andes

Addition of very old (>4 Myr) sediment to trunk stream
Modern vs. Miocene Reservoirs - Results

Recent "Varzea" sediment:
No burial, Nuclide conc. = Andean sources

Lago Curumucuri:
Old floodplain reservoir, storage duration >5 Myr

Wittmann & von Blanckenburg, 2009 (Geomorphology)