Modeling Nitrogen Leaching and River N Export in the CLM-CN

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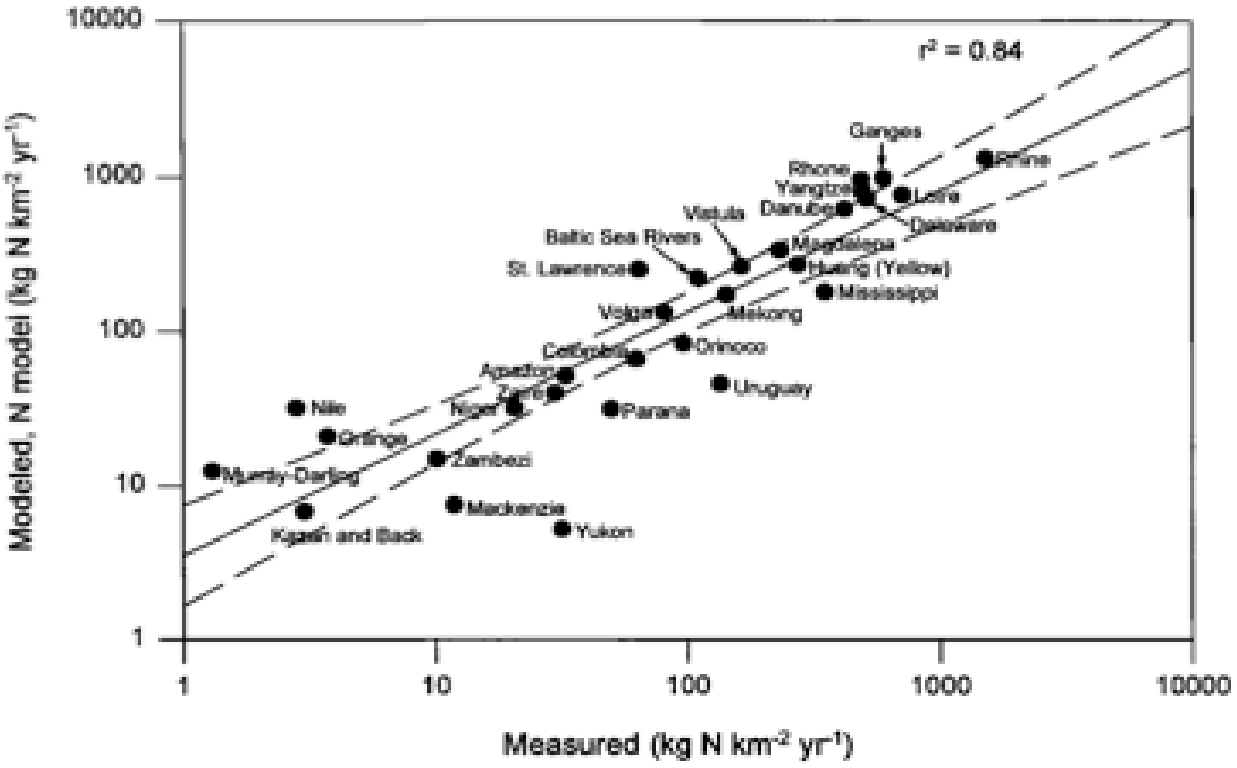
Diagnostic Models of River N Export

$Nexp_{riv} = EC_{riv} * \{N_{sewage} + EC_{ws} * (Diffuse\_Sources)\}$

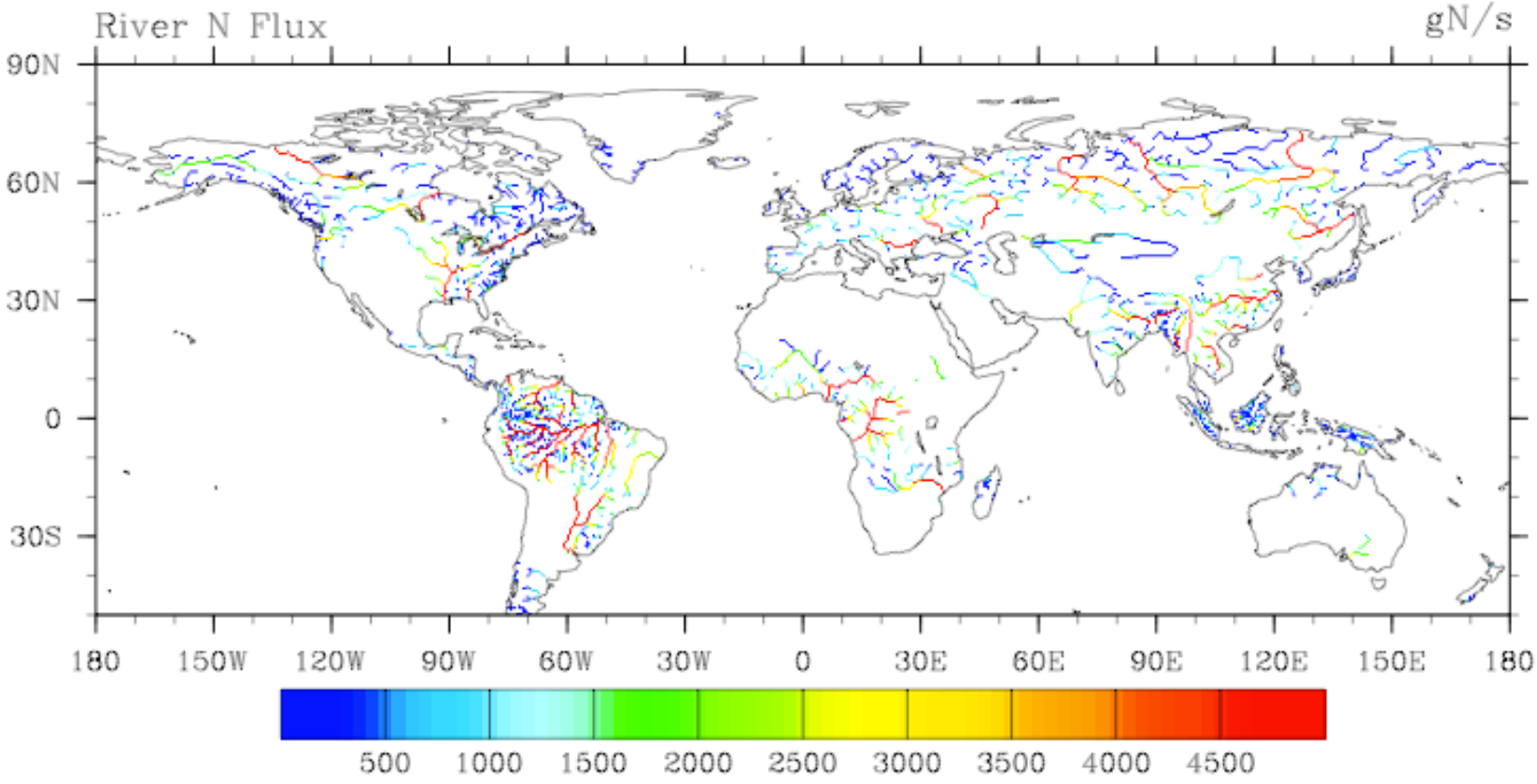
where, EC_{riv} = ~ 0.4 to 0.7 constant or estimated from global river network database

EC_{ws} = ~ 0.15 to 0.45 based on regression of inputs vs. obs river N export

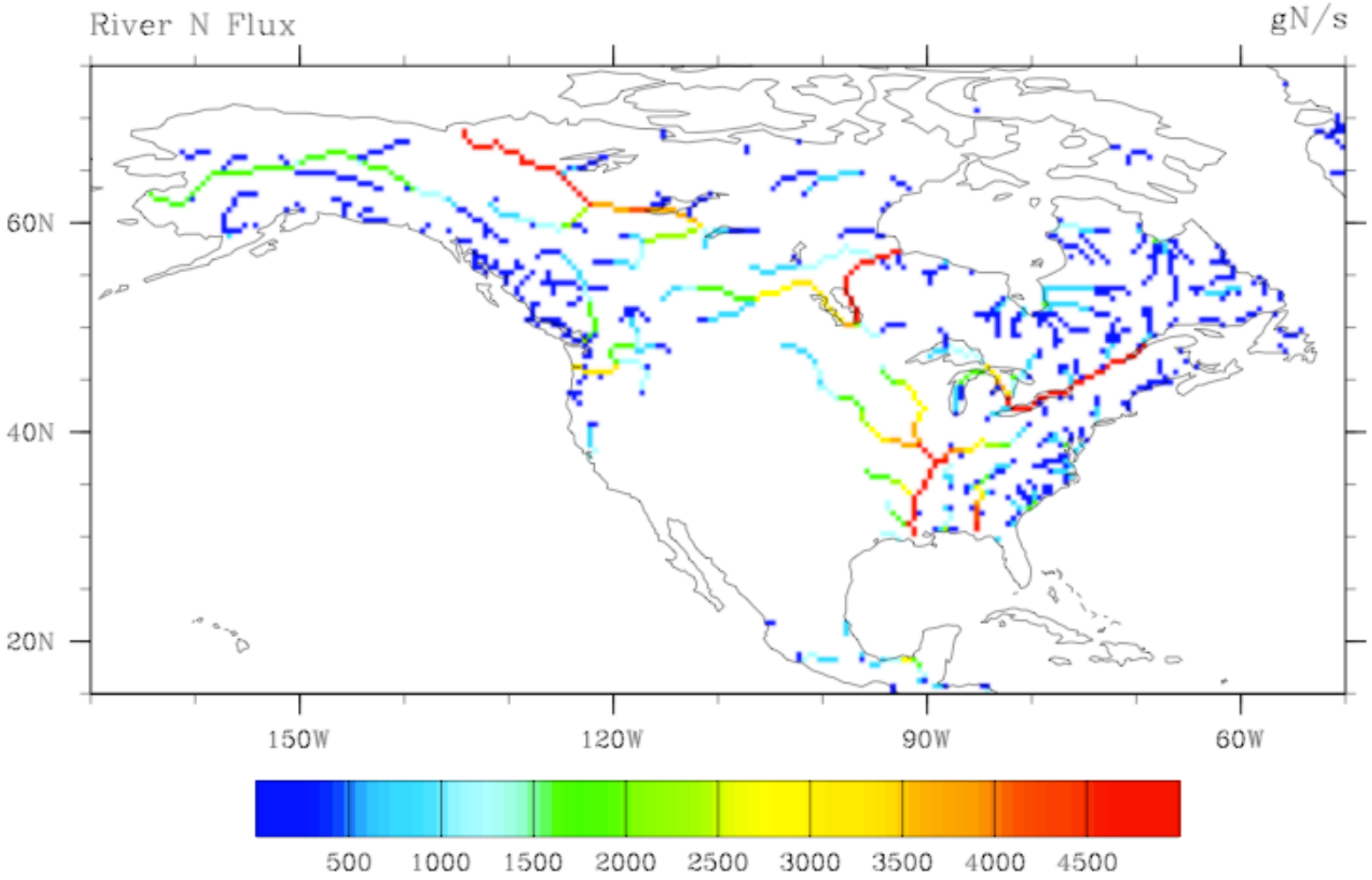


Seitzinger and Kroeze, 1998

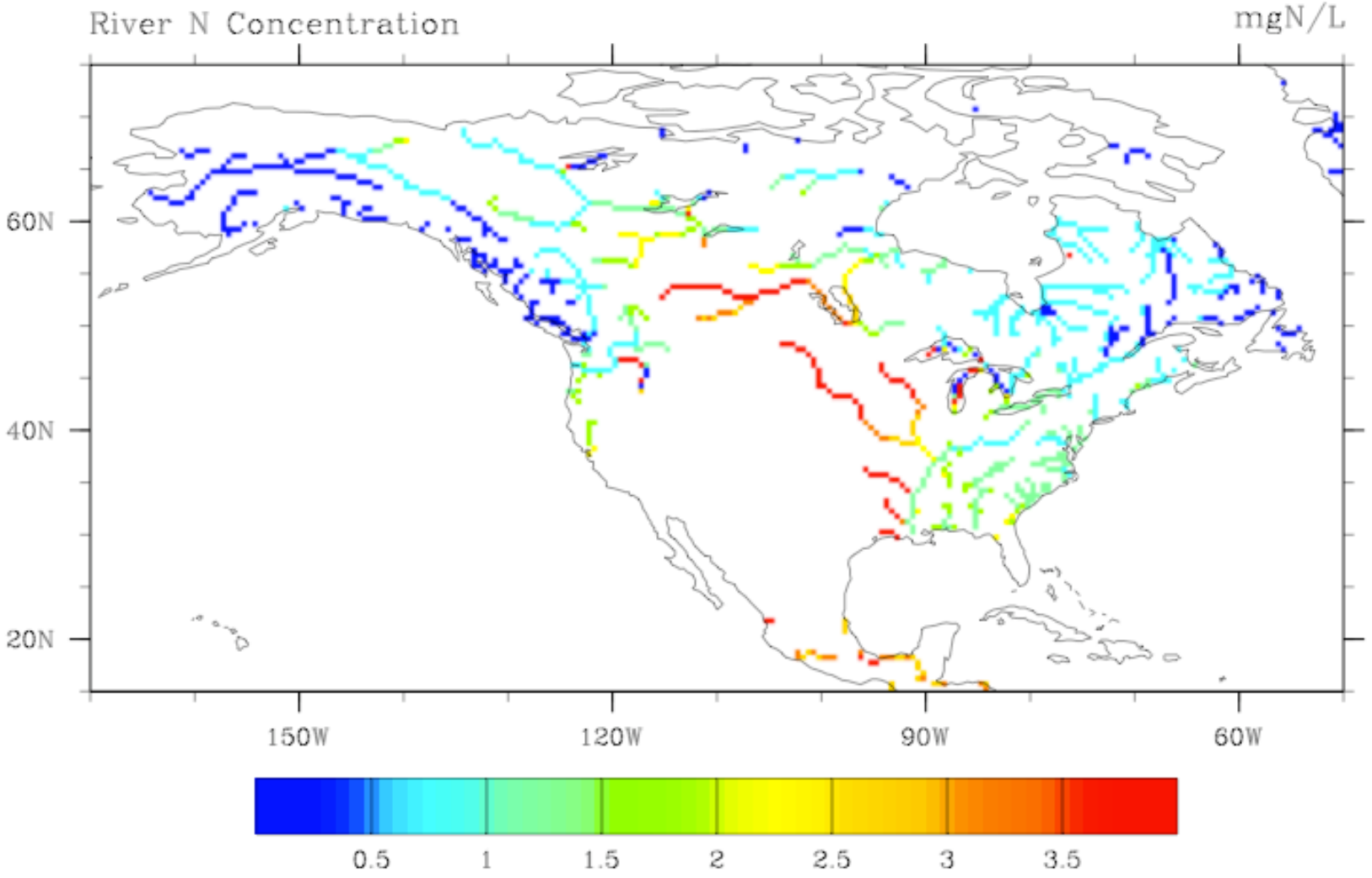
Coupled CLM-CN/RTM Model of River N Export



Coupled CLM-CN/RTM Model of River N Export



River N Concentration



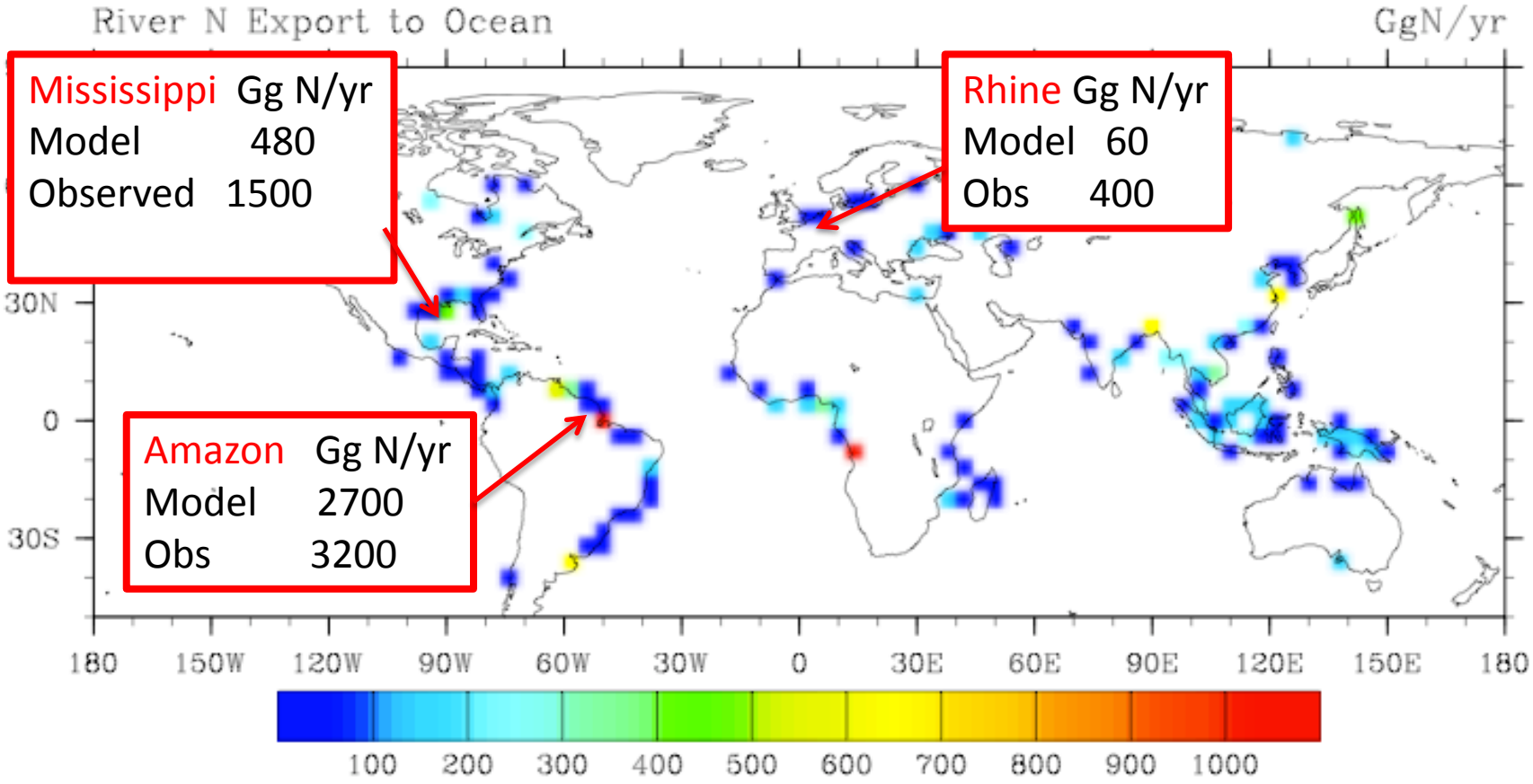
Denitrification in River Sediments

$$NO_3^- + CH_2O \xrightarrow[\text{microbes}]{\text{------->}} N_{2(g)}$$

Denitrification = f(Depth, Residence time, Temperature?)

Depth = f(Flow Rate Q)
Tau is more or less constant in current model

Coupled CLM-CN/RTM Model of River N Export



CLM-CN Results in Year 2000

Nitrogen Pools

POOL	Pg N
Soil Mineral Nitrogen	0.00075
Vegetation	4.1
Soil Organic Matter	66

Soil Mineral N Budget

INPUTS	Tg N yr^{-1}
Biological N2 Fixation	120
Atmospheric Deposition	65
OUTPUTS	
Soil Denitrification	137
Leaching	0
Fire (pyrodenitrification)	28
Storage in SOM, Vegetation	19

Diagnostic Models of River N Export

$f_{denit} : f_{leach}$ ~ 60% : 40% (compared to 100% : 0% for current CLM-CN)

$$f_{leach} = 1 - f_{denit}$$

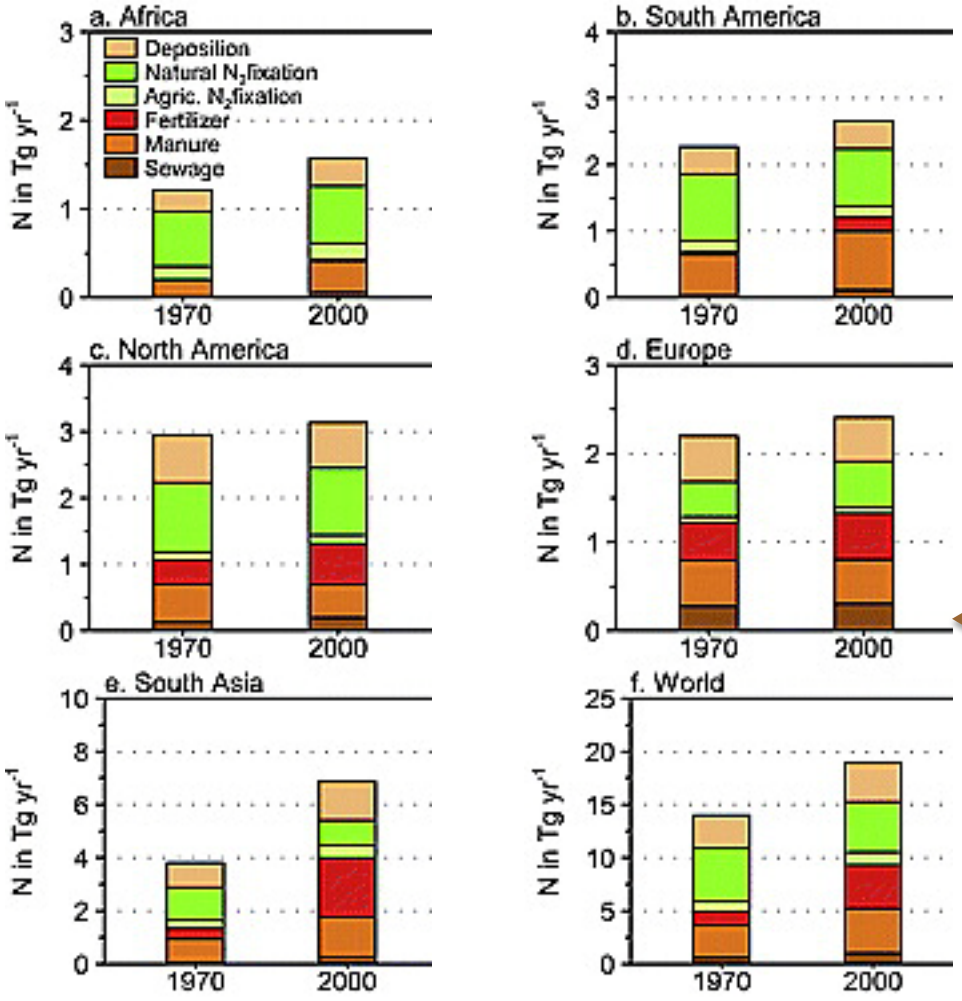
$$f_{denit} = \min(f_{climate} + f_{texture} + f_{drain} + f_{soc} , 1)$$

(e.g., warm Temp, low Precipitation, fine soil texture, poor drainage, high Soil Organic Carbon favor denitrification over leaching)

Van Drecht et al., 2003

Diagnostic Models of River N Export

$$N_{surplus} = N_{dep} + N_{fix} + N_{fert} + N_{manure} - N_{crop\ export} - N_{vol\_NH3}$$



N_{human}

NEWS model
Seitzinger et al., 2010

Conclusions

1) Basic structure for river N transport in place, but current results not very realistic due to:

   - Imbalance between denitrification and leaching losses from soil mineral N pool in CLM-CN.

   - Lack of fertilizer and manure N inputs.

2) River denitrification parameterization also needs refinement –read depth, tau from external river network dataset?