National nitrogen budgets of Japan in 2000s

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Abstract

Nitrogen (N) budget estimation provides fundamental information to grasp N flows among sectors of human activities (e.g., agriculture and industry) and environmental media (e.g., atmosphere and hydrosphere). We have been estimating a national scale of N budgets in Japan in 2000s. We will present the current status of the estimation and discuss methodological generalization for national N budgets estimation.

Keywords: CHANS model, East Asia, Japan, EPNB, National nitrogen budget, Towards INMS

1. Introduction

A vast amount of human nitrogen (N) demand is satisfied with the artificial creation of reactive N known as the Haber–Bosch process. However, most of the created N is lost to the environment due to the low N use efficiency (NUE) of human activities, e.g., approximately 20% of NUE in the full-chain system. The reactive N emitted into the environment induces a variety of impacts such as climate change, air pollution, eutrophication, and ecosystem changes. There is a tradeoff between enhancing benefits of N uses and reducing threats accompanied with reactive N loss to the environment. To tackle with this issue, N budget estimation provides fundamental information to grasp N flows among sectors of human activities (e.g., agriculture and industry) and environmental media (e.g., atmosphere and hydrosphere). According to the Guidance Document on National Nitrogen Budgets in Europe, national N budgets provide the followings; 1, an efficient instrument for visualizing the N cascade and its potential impact and thus help to raise awareness; 2, information to policymakers to identify intervention points and developing efficient emission reduction measures; 3, a tool for monitoring the impact and environmental integrity of implemented policies; 4, an useful indicator for comparisons across countries; and 5, pinpoint knowledge gaps and thus contribute to improving the scientific understanding of the N cascade. The purpose of this study was to estimate Japanese N budgets in 2000s.

2. Materials and methods

Estimation of the Japanese N budgets in 2000s has been conducted referring to the two earlier and on-going studies, one is the Detailed Annexes of the Guidance Document on National Nitrogen Budgets (EPNB 2016) in Europe, and the other is the Coupled Human and Natural Systems (CHANS) N cycling model developed in China (Gu et al. 2015). The case study of Japan is based on the CHANS model with necessary modifications on target pools and subpools (Fig. 1) and accompaniyng N flows to fit the model to Japan.

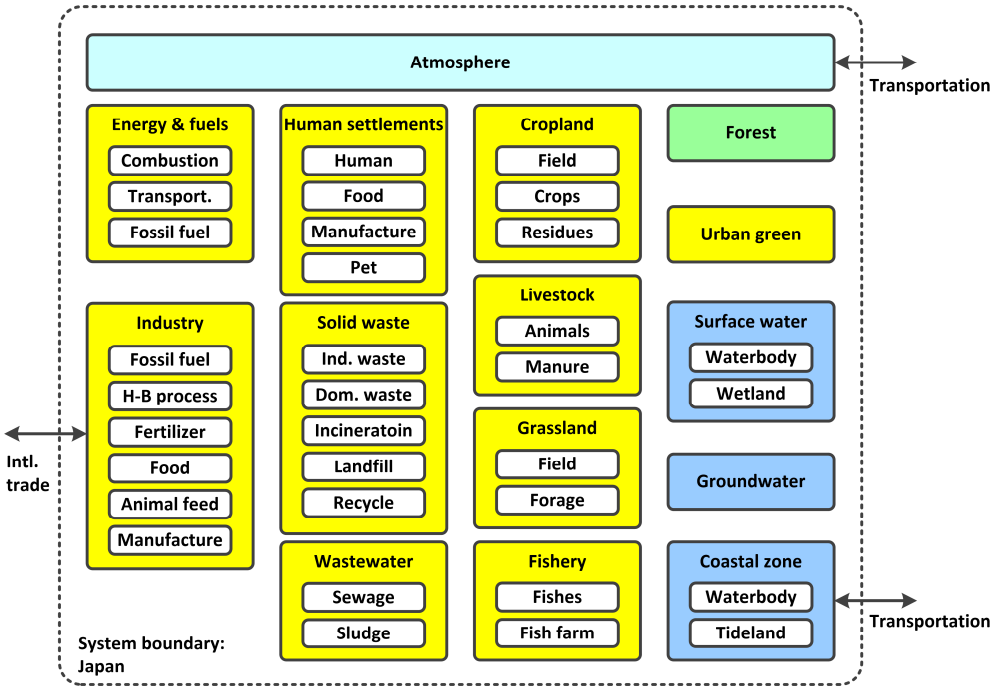

Fig. 1 Pools and subpools to estimate N budgets of Japan

3. Results and discussion

We will present the applicability of the European Guideline to Japan, estimated Japanese N budgets using the default CHANS model, and methodological suggestions to improve N budgets estimation for Japan considering its features in N pools and flows. We will also discuss methodological generalization for national N budgets estimation in addition to the aspect of Japanese case study.

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References

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