# Fire activity in Northern Eurasia from 2002 to 2010 and its contribution to Arctic black carbon

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## Introduction

Northern Eurasia covers 20% of the global land mass and contains 70% of boreal forest. Biomass burning in this region may be a significant source of atmospheric black carbon that would deposit on Arctic ice and accelerate ice melting. We examined the daily fire occurrence in different land cover categories at a 1 km x 1 km resolution from 2002 to 2010 over Northern Eurasia. The results are important in assessing the contribution of fire emissions in this region to the black carbon deposition on Arctic ice. This research is also critical in understanding the impact of climate change on the fire dynamics and emissions in Northern Eurasia.

## Results and Conclusion

Northern Eurasia is divided into seven geographic areas. The fire locations were based on the MODIS active fire products and MODIS MOD12Q1 product was used for the classification of land cover types. Agricultural fires dominated biomass burning in Northern Eurasia during the nine-year period, accounting for about 52% of the MODIS fire detections, followed by grassland fires (17%), forest fires (16%), and shrubland fires (8%). Approximately 61% of the active fire detections in Northern Eurasia occurred in Russia. The remainder of fire activity largely occurred in Central and Western Asia (21%) and in Eastern Europe (8%). In Russia, about 51% of the fire detections were agricultural fires, 24% were forest fires, and 17% were grassland and shrubland fires. Agricultural residues are often burned after harvest in the autumn or before plowing in the spring. In Central and Western Asia, about 58% of the fire detections were grassland fires, and 37% were agricultural fires. The years 2003 and 2008 had 43% and 47%, respectively, more fire detections than the annual mean (303,856) from 2002 to 2010. The unusually high fire activity in 2003 and 2008 was a result of extensive burning on cropland in Russia and Central and Western Russia, and over forest and grassland and shrubland in Russia. There is no apparent trend of fire occurrence in the entire Northern Eurasia, within each geographic area, or within each of the land cover types between 2002 and 2010. We will present the results of the study and discuss its significance on the spatial and temporal extent of black carbon emissions from forest, agricultural, and grassland and shrubland fires in Northern Eurasia.

# Distribution of helium isotope ratio in the central Indian Ocean

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## Introduction

The ocean circulation plays an important role in global biogeochemical cycles. Understanding the dynamics of the deep ocean is essential to study global climate change because the ocean has a great capacity to store and transport heat and material. The $^{3}He/^{4}He$ ratio is one of the most sensitive and conservative tracers in chemical oceanography because of the primordial signature, rapid mobility and chemical inertness of the isotopes. We have collected about 80 samples at 10 stations along or near 70°E from 20°N to 60°S at various depths (200m ~ 5000m) in the central Indian Ocean. Sampling was carried out during the KH-09-5 cruise of a Research Vessel, Hakuho Maru. Helium isotopes in this area have not beeen much investigated yet.[1]

## Analysis

The $^{3}He/^{4}He$ ratios were measured on a conventional noble gas mass spectrometer after extraction, purification and separation using Ti getters and cryogenic charcoal traps.[2] The observed $^{3}He/^{4}He$ ratios were calibrated against atmospheric helium. To estimate the influence of air contamination, the $^{4}He/^{20}Ne$ ratios were measured by an on-line quadrupole mass spectrometer before cryogenic separation of He from Ne.

## Results and Discussion

The $^{3}He/^{4}He$ ratios increased downward, and maximum excess $^{3}He$ of ~17% were observed at mid-depth (2000–3000 m), and then decreased in the bottom water. The distribution revealed a north-south gradient with relatively high anomalies in the northern and equatorial Indian Ocean and low anomaly in the southern Indian Ocean.

The high $^{3}He/^{4}He$ ratios at mid-depth possibly derived from the mid ocean ridge in the Indian Ocean. These results are consistent with counterclockwise deep circulation in the north-west Indian ocean. The north-south gradient might be due to the inflow of deep seawater with the lower $^{3}He/^{4}He$ ratios in Atlantic Ocean or in Antarctic Ocean.

## References

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