

Contents

Chapter 1 Methane is an Important Greenhouse Gas — 1

- 1.1 Methane as an Important Greenhouse Gas — 1
- 1.2 Methane Emission Processes in Wetlands — 2
- 1.3 Wetlands as an Important Source of Methane — 3
- 1.4 Briefly Advances in Studies about Methane Emissions from Wetlands in China — 3
- 1.5 Zoige Alpine Wetlands and Methane Emissions — 5
- 1.6 Three Gorges Reservoir and Methane Emissions — 5
- 1.7 Objectives — 6
- References — 7

Chapter 2 Methane Emissions from Zoige Alpine Wetlands — 13

- 2.1 Diurnal Variation of Methane Emissions from an Alpine Wetland — 13
 - 2.1.1 Introduction — 13
 - 2.1.2 Materials and Methods — 14
 - 2.1.3 Results — 16
 - 2.1.4 Discussion — 18
 - 2.1.5 Conclusions — 21
- 2.2 Determinants Influencing Seasonal Variations of Methane Emissions from Alpine Wetlands in Zoige Plateau and Their Implications — 21
 - 2.2.1 Introduction — 22
 - 2.2.2 Materials and Methods — 23
 - 2.2.3 Results — 24
 - 2.2.4 Discussion — 31
 - 2.2.5 Conclusions — 34
- 2.3 Spatial Variations on Methane Emissions from Zoige Alpine Wetlands — 35
 - 2.3.1 Introduction — 35
 - 2.3.2 Materials and Methods — 36
 - 2.3.3 Results — 37
 - 2.3.4 Discussion — 42
 - 2.3.5 Conclusions — 44

Materials and Methods — 46

Results — 48

Discussion — 53

Methane Fluxes from Alpine Wetlands of Zoige Plateau in Relation
to Water Regime and Vegetation under Two Scales — 55

Introduction — 57

Materials and Methods — 58

Results — 61

Discussion — 68

Conclusions — 71

Inter-annual Variations of Methane Emission from an Open Fen on
Qinghai-Tibetan Plateau: a Three-year Study — 71

Introduction — 72

Materials and Methods — 73

Results — 76

Discussion — 80

References — 83

Chapter 3 Methane Emissions from Three Gorges Reservoir — 93

Methane Emissions from Newly Created Marshes in Drawdown Area
of Three Gorges Reservoir — 93

Introduction — 94

Materials and Methods — 95

Results — 98

Discussion — 101

Methane Emissions from Surface of Three Gorge Dam Reservoir — 104

Introduction — 105

Materials and Methods — 105

Results and Discussions — 106

References — 109

Chapter 4 Methanogens and Methanogenesis in Zoige Wetlands — 115

Methanogenic Communities in Zoige Wetlands — 115

Methanogenic Communities Composition in Zoige Wetlands — 115

New Methanogenic Species in Zoige Wetlands — 116

Influencing Factors of Methanogenic Community Structure in Zoige
Wetlands — 120

Vegetation Type — 120

Temperature — 130

Chapter 5 Methane Emissions from Rice Paddies, Natural Wetlands and Lakes in China — 155

- 5.1 CH₄ Emission Rates from Rice Paddies in China — 156
- 5.1.1 Rice Cultivation in China and Overview of Its CH₄ Emission Estimates — 156
- 5.1.2 CH₄ Emissions from Rice Paddies in China — 159
- 5.2 CH₄ Emission Rates from Natural Wetlands in China — 164
- 5.2.1 Natural Wetlands in China and Overview of Their CH₄ Emission Estimates — 164
- 5.2.2 CH₄ Emissions from Natural Wetlands in China — 166
- 5.3 CH₄ Emission Rates from Lakes and Reservoirs in China — 169
- 5.3.1 Lakes and Reservoirs in China and Overview of Their CH₄ Emission Estimates — 169
- 5.3.2 CH₄ Emission Rates from Lakes and Reservoirs in China — 170
- 5.4 CH₄ Emission Rate Estimation — 172
- 5.4.1 CH₄ Emission Rate Estimation from Rice Paddies in China — 172
- 5.4.2 CH₄ Emission Estimation from Natural Wetlands in China — 175
- 5.4.3 CH₄ Emission Estimates from Lakes and Reservoirs in China — 178
- 5.4.4 Total CH₄ Emissions from Rice Paddies, Wetlands and Lakes in China — 181
- 5.5 Limitations, Uncertainties and Future Directions — 183
- References — 184

Chapter 6 Modelling Methane Emissions of Wetlands in China — 195

- 6.1 Overview of Methane Emission Modelling — 195
- 6.2 Wetland Methane Emission Model Construction — 197
- 6.2.1 Integrated Biosphere Simulator and Water Table Modelling — 197
- 6.2.2 Methane Module — 199
- 6.3 Wetland Methane Emission Model Validation and Sensitivity Analysis — 203
- 6.3.1 Sensitivity Index for Initial Sensitivity Analysis — 203
- 6.3.2 Initial Sensitivity Analysis — 204
- 6.3.3 Model Performance in China — 205
- References — 208

Index — 213