研究报告

陈衍婷,杜文娇,陈进生,徐玲玲.厦门地区大气降水氢氧同位素组成特征及水汽来源探讨[J].环境科学学报,2016,36(2):667-674

厦门地区大气降水氢氧同位素组成特征及水汽来源探讨

Composition of hydrogen and oxygen isotopic of precipitation and source apportionment of water vapor in Xiamen Area

关键词：大气降水 氢氧同位素 水汽来源 局地降水线方程

基金项目：中国科学院知识创新工程青年人才领域前沿项目(No.IUEZD201403)

作 者 单位

陈衍婷 中国科学院城市环境研究所, 城市环境与健康重点实验室, 厦门 361021

杜文娇 1. 中国科学院城市环境研究所, 城市环境与健康重点实验室, 厦门 361021;2. 中国科学院大学, 北京 100049

陈进生 中国科学院城市环境研究所, 城市环境与健康重点实验室, 厦门 361021

徐玲玲 中国科学院城市环境研究所, 城市环境与健康重点实验室, 厦门 361021

摘要：采集厦门地区6个站位春、夏和冬季的大气降水样品,并用稳定同位素质谱仪分析降水样品中的氢氧同位素值(δD和$\delta^{18}O$).结果表明:厦门地区大气降水中δD和$\delta^{18}O$值春季最高(-7.86‰±8.07‰和-2.18‰±0.80‰),夏季最低(-61.17‰±4.85‰和-8.42‰±0.62‰).本文同时利用HYSPLIT模型对不同季节厦门地区水汽来源及输送路径进行追踪,发现厦门地区夏季降水主要受到来自南海及西太平洋气团的影响,期间降水量大,δD和$\delta^{18}O$值较低.厦门地区大气降水线方程为$\delta D=8.35\delta^{18}O+12.52$($R^2$=0.906),与全球降水线方程($\delta D=8.17\delta^{18}O+10.56$)相比,截距及斜率略有偏高.厦门地区氘剩余值(*d*值)波动范围较大(-5.13‰~32.25‰),说明厦门地区降水的水汽来源较为多样,降雨条件较为复杂.厦门地区降水中*d*值表现为冬季高,春季次之,夏季低的季节性变化特征.年尺度下,厦门地区氢氧同位素与降水量在呈显著的负相关关系(*r*分别为-0.477和-0.369,$p<0.01$).

Abstract: Precipitation samples were collected during winter, spring and summer in six sites in Xiamen area, and the values of hydrogen and oxygen isotopic were determined by the stable isotope mass spectrometer. The results showed that the values of δD and $\delta^{18}O$ in precipitation were highest in spring with -7.86‰±8.07‰ and -2.18‰±0.80‰, and lowest in summer with -61.17‰±4.85‰ and -8.42‰±0.62‰, respectively. HYSPLIT model was employed to track the water vapor trajectory in different seasons in Xiamen area. The model results indicated that precipitation in summer was mainly influenced by the South China Sea water vapor and Western Pacific water vapor, with significant amount of rainfall as well as the low δD and $\delta^{18}O$ values. The equation of local meteoric water line (LMWL) was $\delta D=8.35\delta^{18}O+12.52$($R^2$=0.906), and the slope and intercept were slightly higher than that of the global meteoric water line ($\delta D=8.17^{18}O+10.56$). The value of *d*(-5.13‰~32.25‰)for precipitation fluctuated widely, which might implied various sources of water vapor and complicated precipitation conditions. The value of *d* for precipitation had a rank with winter>spring>summer. During the sampling period, the negative correlation between δD and $\delta^{18}O$ with precipitation was discovered, with *r*=-0.477 and -0.369 ($p<0.01$), respectively.

Key words: precipitation hydrogen and oxygen isotopic source apportionment of water vapor local meteoric water line