

LONG RANGE TRANSPORT OF RADIOACTIVITY FROM FUKUSHIMA - MODELLING OF AIR MASS TRAJECTORIES



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HV air Sampler (Staplex TFIA-2)

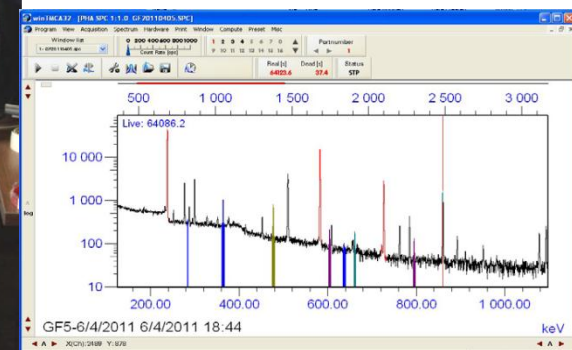


Flow rate: 1.6-1.7 m³/min (60cfm)
Sampling duration: 23 h
Total Volume: 2400-2700 m³
Air Volume Uncertainty (2σ): 30-50 m³

Glass Fiber Filters TFA GF810



Very high retention of fine particles. 99.98% retention efficiency of 0.3 micron particles.



Activity concentrations of ^{131}I , ^{137}Cs and ^{134}Cs in air over Milan

Date of sampling	Fallout isotopes in surface air				
	^{131}I $\mu\text{Bq m}^{-3}$	^{137}Cs $\mu\text{Bq m}^{-3}$	^{134}Cs $\mu\text{Bq m}^{-3}$	ratio $^{134}\text{Cs}/^{137}\text{Cs}$	ratio $^{131}\text{I}/^{137}\text{Cs}$
31/03/11	322±35	< 29 ^a	< 26 ^a	-	-
02/04/11	335±89	59±42	56±37	0.95	5.7
03/04/11	467±25	40±9	37±8	0.92	11.7
05/04/11	323±16	25±9	27±9	1.09	12.9
07/04/11	438±28	26±17	25±15	0.98	16.8
09/09/11	209±33	56±30	54±24	0.97	3.7
10/04/11	229±55	63±30	61±22	0.97	3.6
11/04/11	285±43	^b 27±18	^b 23±14	0.90	10.6
12/04/11	333±73	60±38	56±30	0.94	5.6
14/04/11	343±48	57±26	54±23	0.95	6.0
15/04/11	220±58	47±27	42±20	0.89	4.7
16/04/11	161±34	39±10	^b 13±7	0.33	4.1
17/04/11	118±27	44±17	31±13	0.69	2.7
19/04/11	107±30	29±16	40±14	1.38	3.7
20/04/11	107±38	38±16	23±12	0.62	2.8
21/04/11	128±33	^b 17±16	27±14	1.59	7.5
22/04/11	94±46	35±16	< 11 ^a	-	2.7
28/04/11	^b 60±35	^b 23±16	< 12 ^a	-	2.6
29/04/11	< 41 ^a	< 11	33±14	-	-
30/04/11	< 19 ^a	< 16 ^a	< 12 ^a	-	-
3/05/11	< 9 ^a	17±16	22±14	1.34	-

^a MDA

^b Critical Level

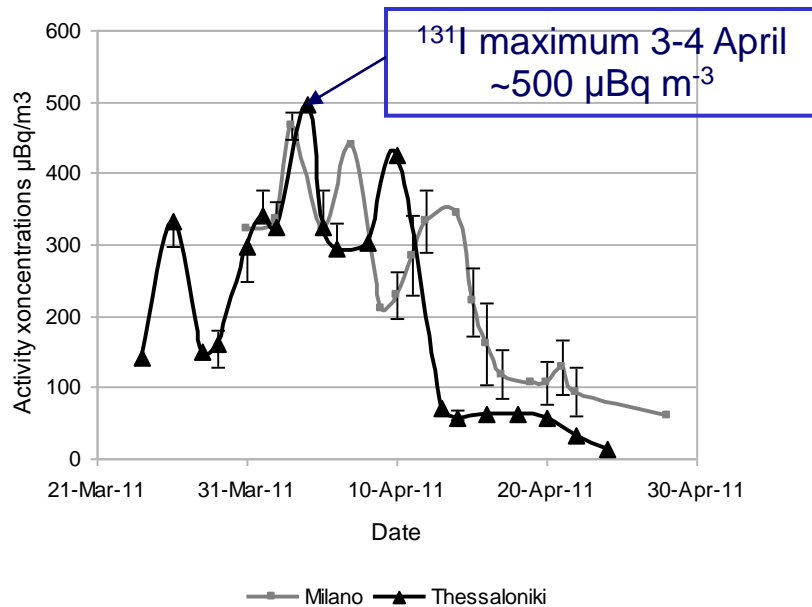
$$^{134}\text{Cs}/^{137}\text{Cs} = 1$$

Related to the burn-up history of the nuclear fuel of the destroyed nuclear reactor

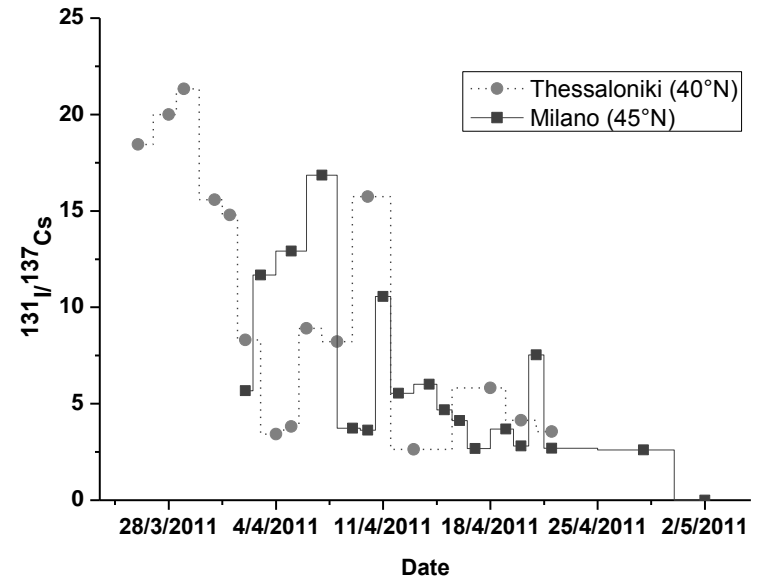
$$^{131}\text{I} < 500 \mu\text{Bq m}^{-3}$$

^{131}I atmospheric concentrations

I-131 in Milano and Thessaloniki



$^{131}\text{I}/^{137}\text{Cs}$ activity ratio in Milan (45°) and Thessaloniki (40°)



$^{131}\text{I}/^{137}\text{Cs}$ decrease with time

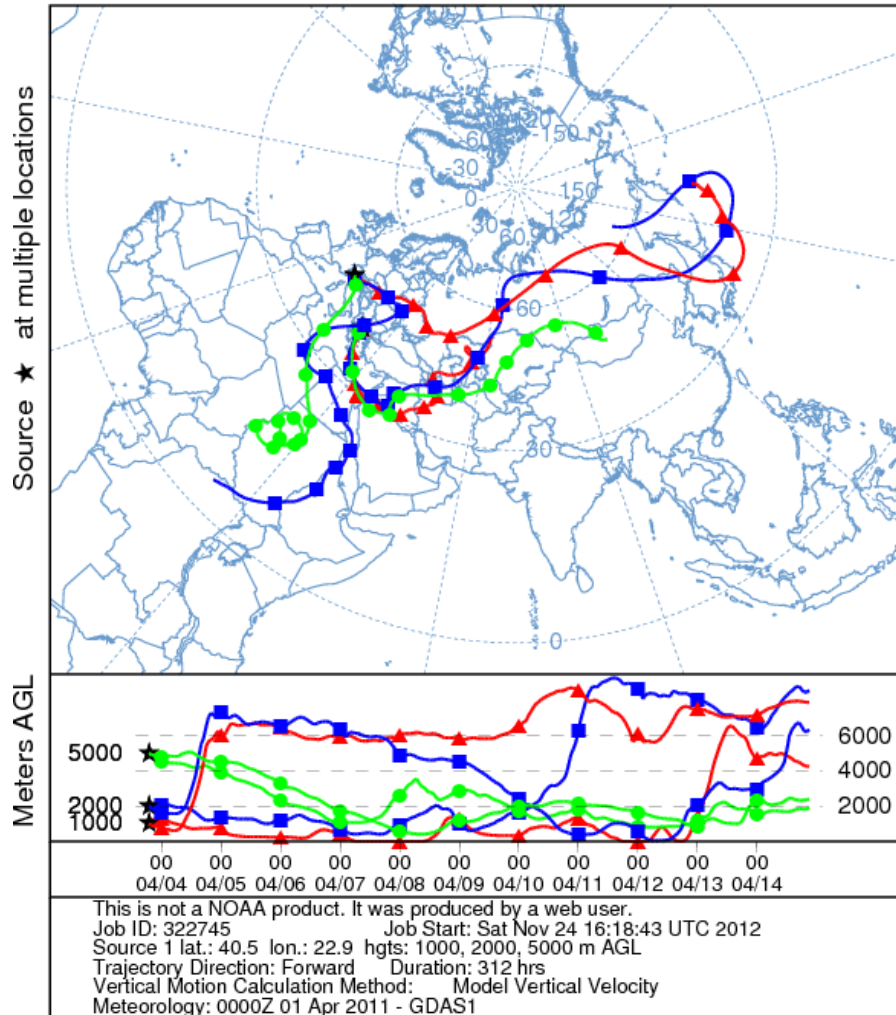
Reflects the different volatility, attachment and removal of the two isotopes during transportation due to their different physico-chemical properties.

Back trajectories analysis

NOAA HYSPLIT MODEL

Forward trajectories starting at 1900 UTC 03 Apr 11

GDAS Meteorological Data



On April 3, 2011 at 19:00 UTC the back-trajectory analysis indicates the transport of air masses from Japan both in Italy and in Greece but at different arrival heights. As Fig. 8 shows the air masses started above Japan at around 2 km. In Italy the air mass moved down, travelled near the ground and arrived above Italy at height of 1 km. On the other hand, the air mass after being near the ground for almost 2 days rose to arrive at height of 2 km above Thessaloniki. Both transport pathways can explain the maximum concentrations that were observed at the regions of study.

CONCLUSIONS

- The Fukushima plume was detected all over Europe
- The presence of more than one peaks of ^{131}I and $^{137,134}\text{Cs}$ is an index that air masses continuously transferred from Fukushima, Japan till the end of April, 2011.
- HYSPLIT backward trajectories interpreted the measured atmospheric concentrations
- ^{131}I and $^{137,134}\text{Cs}$ isotopes were found above their detection limits in all environmental samples but very far below levels of concern