

Article

High Resolution Chemistry Transport Modeling with the on-line CHIMERE-WRF Model over the French Alps - Analysis of a Feedback of Surface Particulate Matter concentrations on Mountain Meteorology

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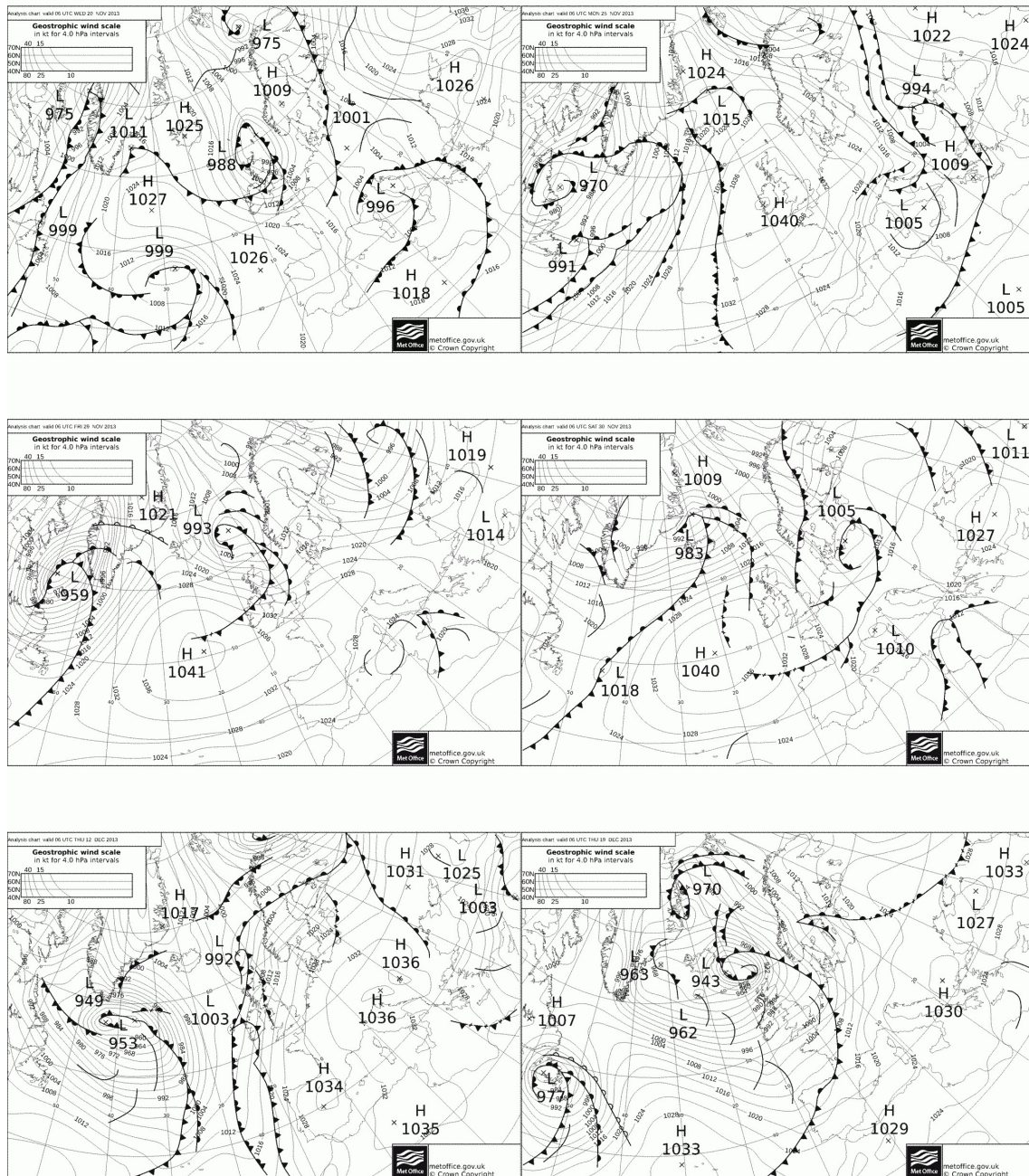


Figure S1. Synoptic meteorological situation November-December 2013 for some key dates from metoffice.gov.uk

Mean Precipitation

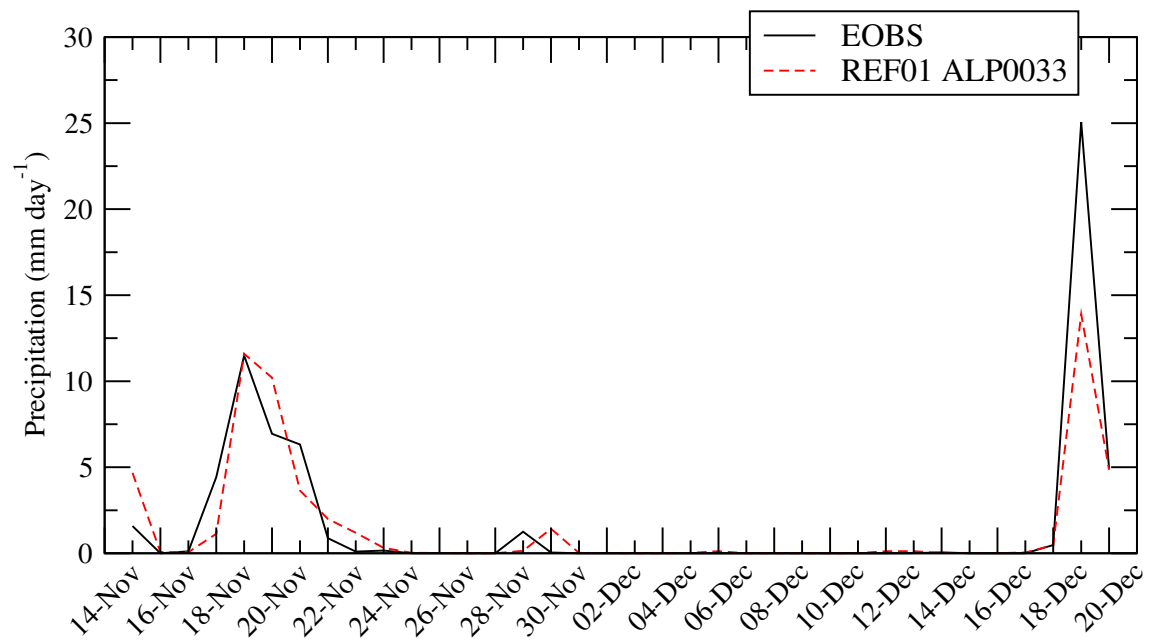


Figure S2. Evolution of the average precipitation simulated for the REF01 simulation over ALP0033 compared to E-OBS observations

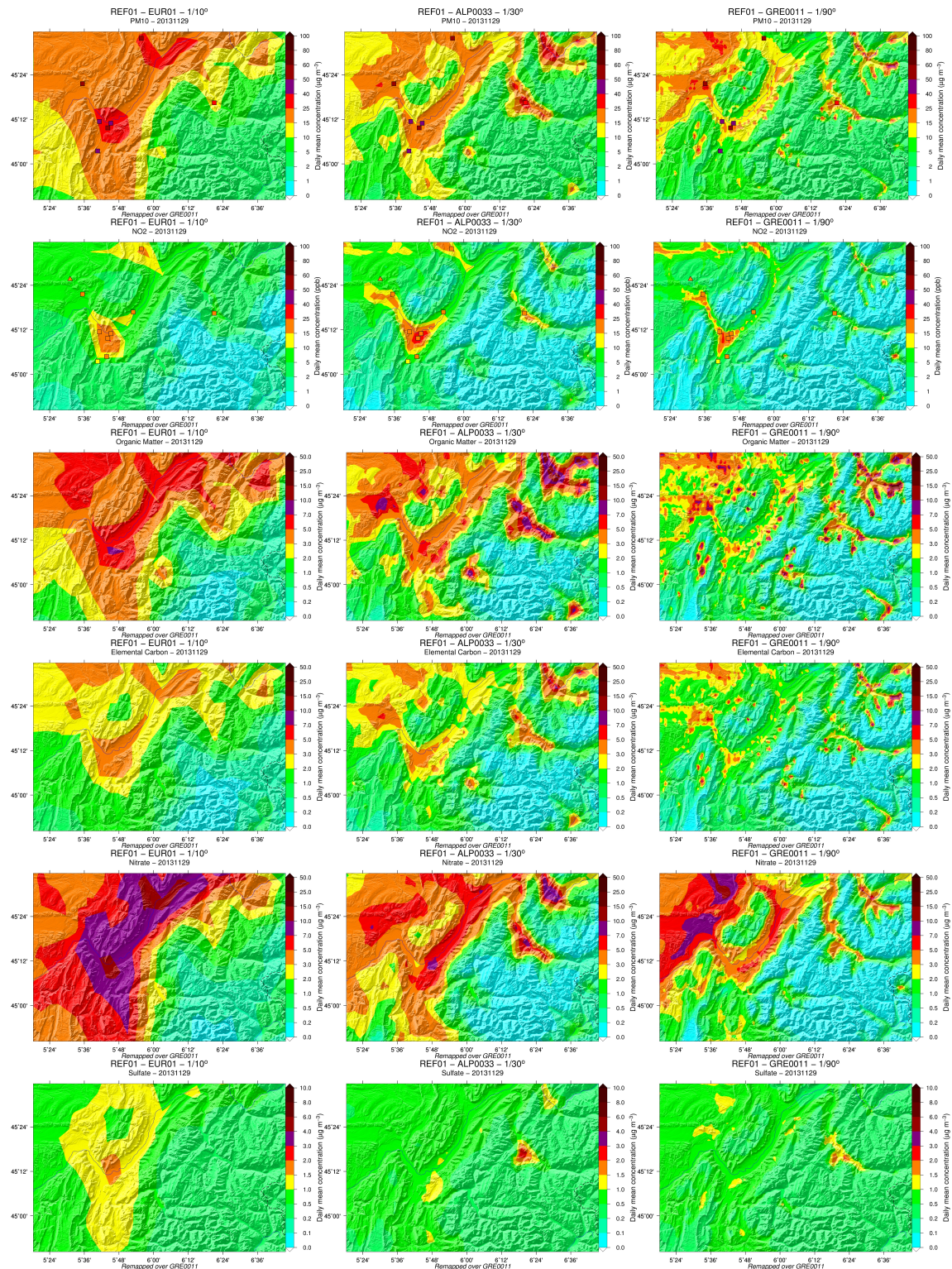


Figure S3. Impact of the horizontal resolution 1/10° - 1/30° - 1/90° (from left to right) on daily concentration fields on 11/12 for six pollutants and species (PM10, NO₂, OM, EC, Nitrate, Sulfate from top to bottom) over the Grenoble area (GRE0011). Colored squares represent the observations.

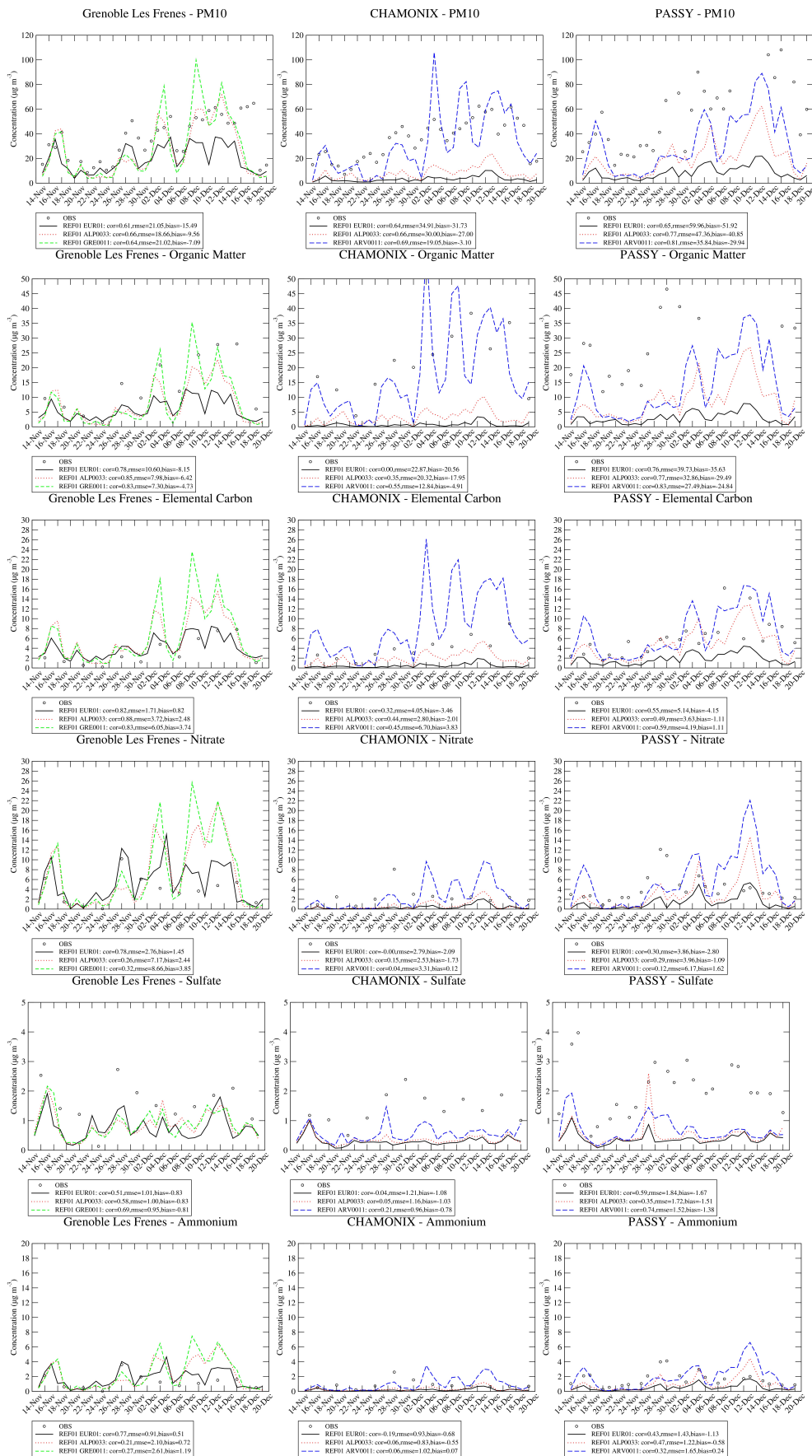


Figure S4. Daily time series of chemical species for the full period in Grenoble, Passy and Chamonix

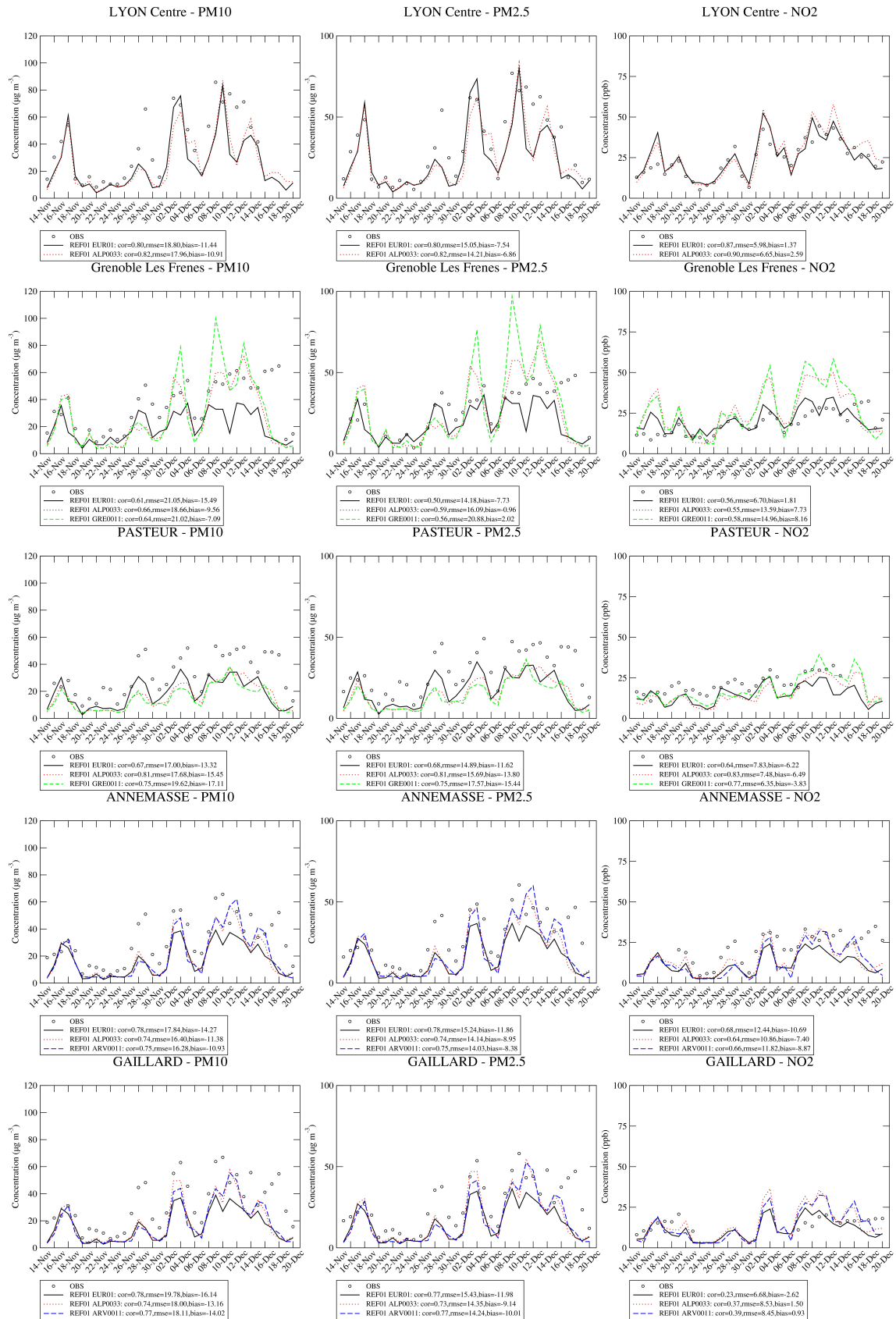


Figure S5. Daily time series of chemical species for the full period for PM10, PM2.5 and NO₂ for key stations over the ALP0033 domain

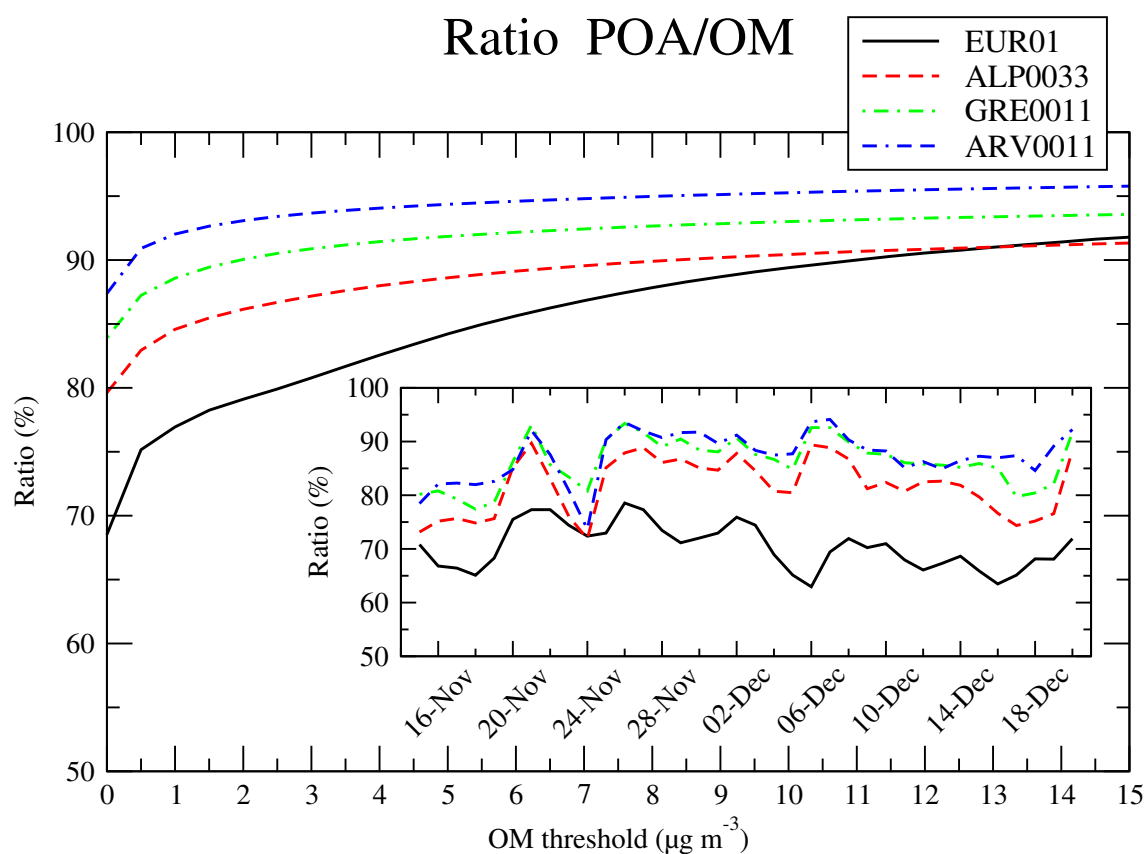


Figure S6. Mean simulated POA/OM ratio by minimum threshold on OM averaged over each domain. The encapsulated chart is the evolution of the average ratio over the studied period

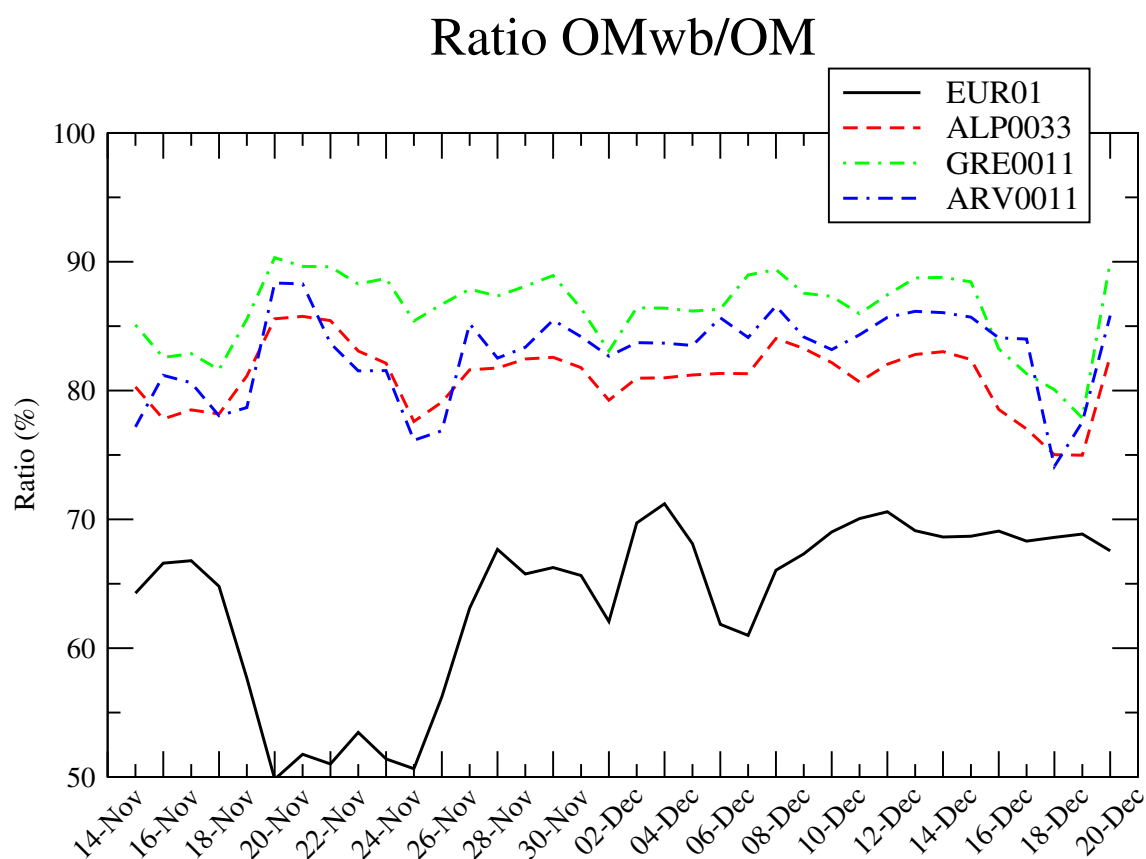


Figure S7. Evolution of the fraction of wood burning OM in the total OM fraction over the studied period

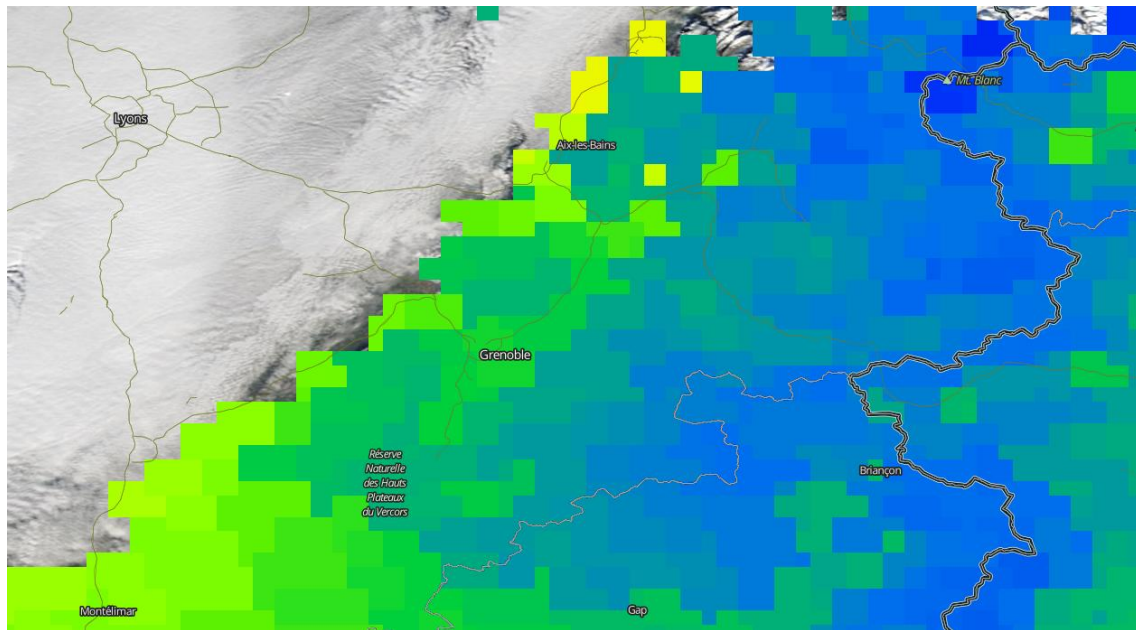


Figure S8. MODIS Precipitable Water Vapor layer shows the total amount of water vapor in a 5 km by 5 km column of the atmosphere, measured in centimeters (cm). Color scale ranges from blue to yellow (0 to 1.4 cm)

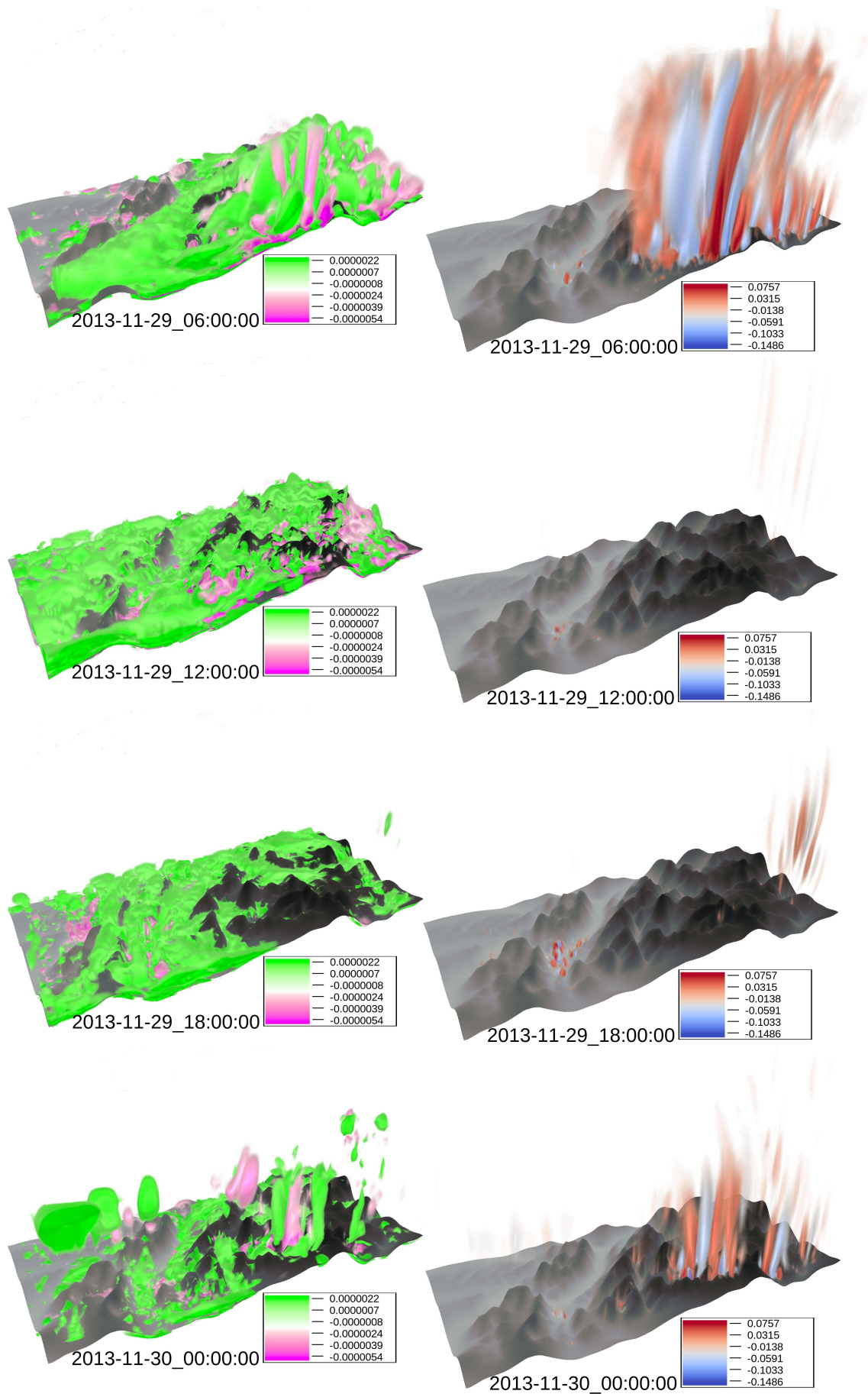


Figure S9. 6-Hourly evolution on 29/11/2013 of the difference CPL01 - CPL02 for the water vapor mixing ratio in kg kg^{-1} (on the left) and the vertical wind speed in m s^{-1} (on the right side)

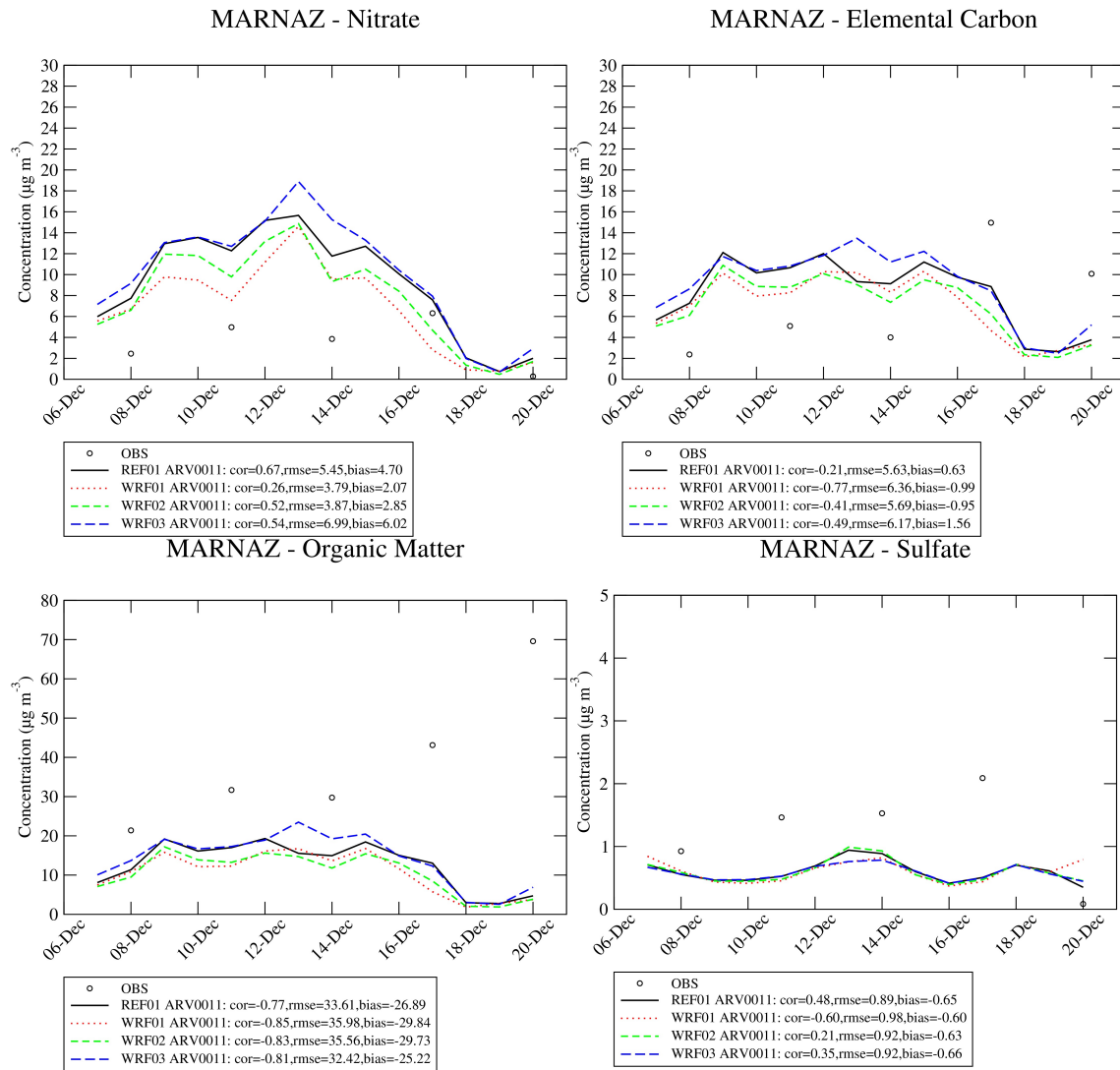


Figure S10. Impact of WRF settings on species concentrations at $1/90^\circ$ resolution (ARV0011) for the EPII period at Marnaz

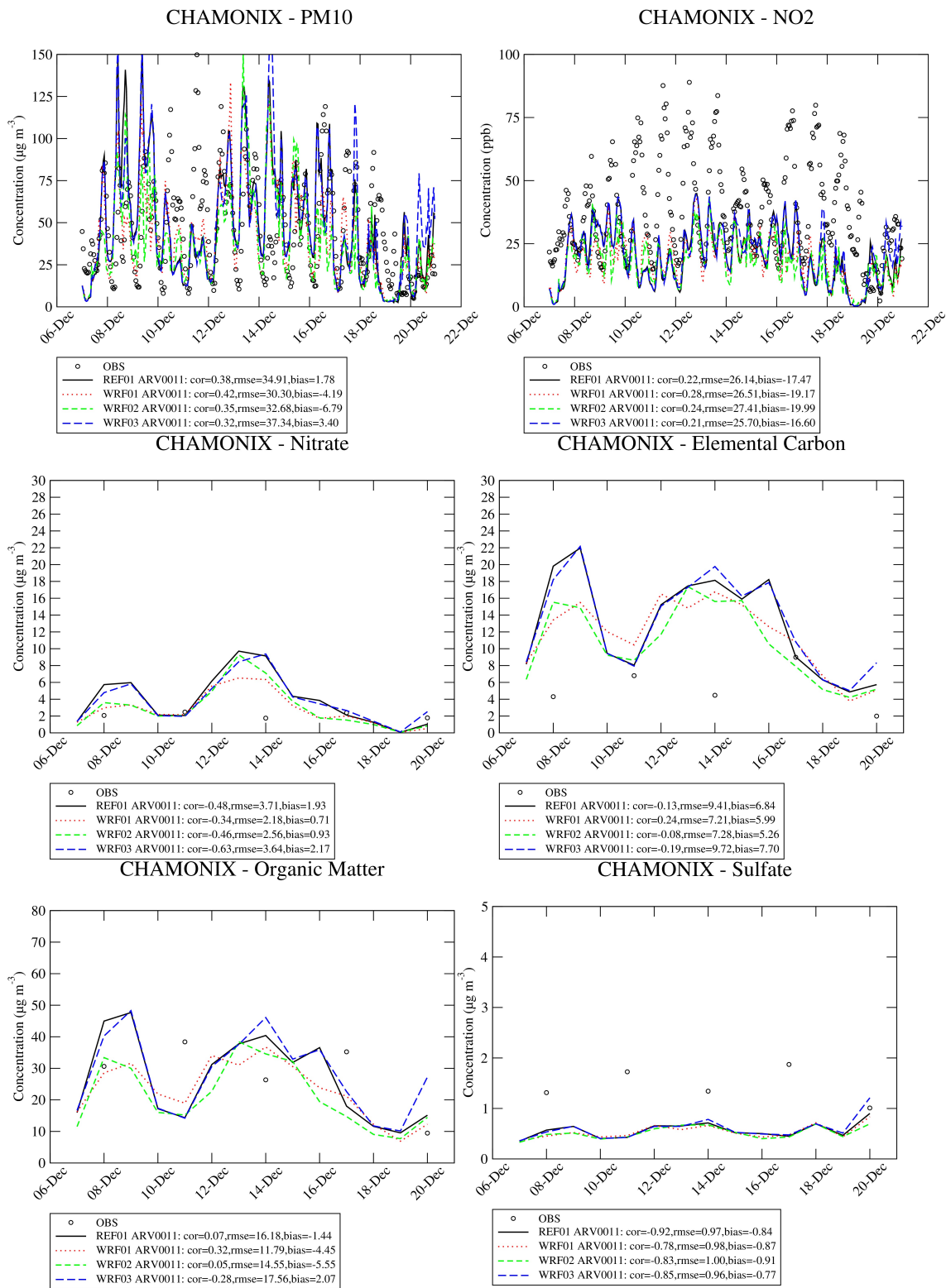


Figure S11. Impact of WRF settings on species concentrations at $1/10^\circ$ resolution (ARV0011) for the EPII period at Chamonix

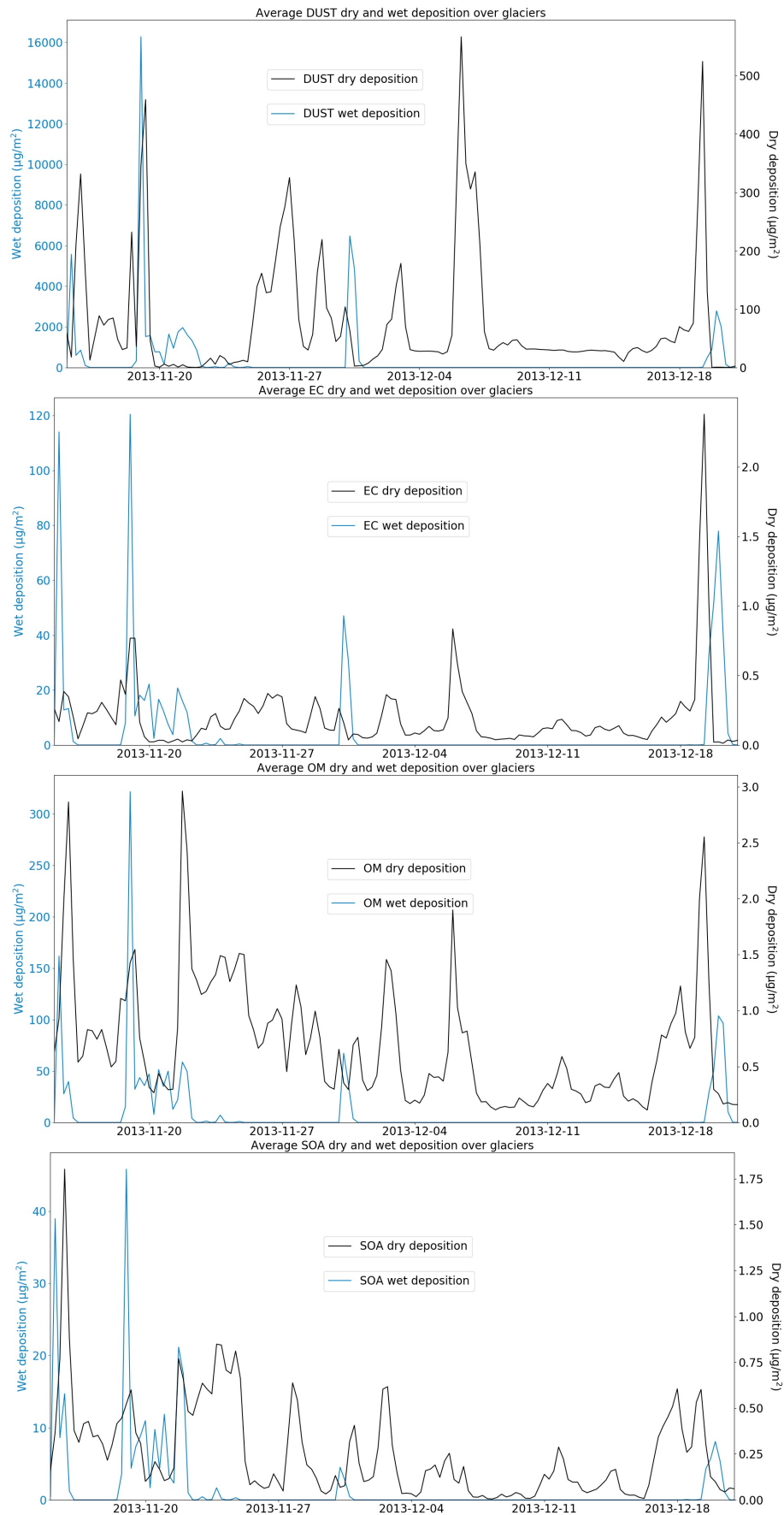


Figure S12. 6-hourly time evolution of the wet and dry deposition for DUST, EC, OM and SOA species over the Glaciers surrounding the Mt-Blanc

Table S1. List and location of the main air quality monitoring stations (PM10, PM2.5, NO, NO₂, O₃, SO₂) for error statistics

Station code	Station name	Longitude (°)	Latitude (°)	Typology
FR07001	Royat	3.047194	45.764668	Periurban
FR07002	Gravanches	3.143278	45.795612	Periurban
FR07003	Centre Ville	3.083333	45.77361	Urban
FR07004	Montferrand	3.113833	45.79728	Urban
FR07006	Gerzat	3.142917	45.8238	Periurban
FR07008	Delille	3.094583	45.78089	Urban
FR07009	Jardin Lecoq	3.0875	45.772167	Urban
FR07012	Le Puy Centre	3.883001	45.045001	Urban
FR07013	Montlucon Chateau	2.605	46.340001	Urban
FR07014	Aurillac Aerodrome	2.420194	44.898336	Periurban
FR07015	Sommet du Puy de Dom	2.964583	45.772167	Rural
FR07016	Montlucon Hippodrome	2.601	46.324	Periurban
FR07017	Aurillac Mairie	2.445168	44.931331	Urban
FR07018	Vals pres le Puy	3.876	45.030001	Periurban
FR07019	Issoire Centre	3.249306	45.544308	Urban
FR07020	Busset	3.515139	46.06028	Rural
FR07022	Paray le Fresil	3.600667	46.652668	Rural
FR07023	Besse et St Anastais	2.930361	45.51039	Rural
FR07029	Sembadel	3.687917	45.274727	Rural
FR07030	Place de Jaude	3.081889	45.77625	Urban
FR07031	Rageade	3.277361	45.10472	Rural
FR07032	Riom	3.115056	45.894196	Urban
FR07035	Clermont La Pardieu	3.134889	45.763557	Periurban
FR07037	Brezet - SDIS	3.155833	45.778885	Periurban
FR07038	Issoire Associations	3.248278	45.544533	Urban
FR07044	Moulins Ecole de musique	3.330981	46.56153	Urban
FR07045	Issoire Ecole Centre	3.248247	45.545422	Urban
FR07046	Neussargues	2.978781	45.12592	Rural
FR07049	MOULINS	3.331089	46.56187	Urban
FR07051	Beaulieu	3.155	45.769	Periurban
FR07052	Aurillac-Lagarde	2.441082	44.92008	Urban
FR07054	Le Puy-Causans	3.887001	45.039001	Urban
FR07055	Fay-sur-Lignon	4.226083333	44.9844444	Rural
FR07056	Pays du Mezenc	4.226006	44.98377	Rural
FR07057	Moulins Centre	3.340638889	46.5619722	Urban
FR07058	Montlucon	2.593945	46.340723	Urban
FR07059	Vichy	3.425694	46.130431	Urban
FR07060	Royat Periurban	3.046111	45.764111	Periurban
FR07061	Riom Periurban	3.122254	45.89674	Periurban
FR07202	Stade Leclanche	3.111111	45.807487	Urban
FR07203	La Monnerie	3.60328	45.86876	Rural
FR15001	Charavines	5.5178	45.4276	Rural
FR15002	Voiron	5.594383	45.36002	Urban
FR15003	Voreppe	5.645844	45.28472	Periurban
FR15007	Versoud	5.850339	45.2171	Periurban
FR15008	Villeneuve	5.736392	45.16139	Periurban
FR15012	Champagnier	5.726994	45.10927	Periurban
FR15013	Champ sur Drac	5.728653	45.07954	Periurban
FR15014	Vizille	5.770861	45.0793	Periurban
FR15015	Riouperoux	5.8971	45.0863	Periurban
FR15017	Fontaine Les Balmes	5.687023	45.190492	Urban
FR15018	Voiron Urbain	5.589419	45.360176	Urban
FR15031	Le Casset	6.4694	44.997	Rural
FR15038	St Martin d'Herès	5.7531	45.1828	Urban
FR15043	Grenoble Les Frenes	5.7356	45.1619	Urban
FR15044	Voreppe Volouise	5.638514	45.2818	Periurban
FR15045	Grenoble PeriurbSud	5.6767	45.0578	Periurban
FR15048	Gresivaudan Periurb	5.8822	45.2797	Periurban
FR15100	Chamrousse	5.193897	45.43	Rural

Table S2. List and location of the main air quality monitoring stations (PM10, PM2.5, NO, NO₂, O₃, SO₂) for error statistics (next)

Station code	Station name	Longitude (°)	Latitude (°)	Typology
FR15111	Chartreuse	5.867228	45.415558	Rural
FR15112	Parc du vercors	5.519031	45.0238	Rural
FR15113	Col d'Ornon	5.967839	45.0075	Rural
FR20004	ST JUST	4.820331	45.755318	Urban
FR20005	CROIX ROUSSE	4.819192	45.78	Periurban
FR20006	VILLETTE	4.865014	45.758057	Periurban
FR20007	UCHERE	4.794733	45.78639	Periurban
FR20009	MONTCHAT	4.8725	45.7478	Urban
FR20017	GERLAND	4.829794	45.73529	Urban
FR20018	POINT DU JOUR	4.7902	45.7486	Urban
FR20020	CROIX LUIZET	4.894028	45.77646	Urban
FR20021	CHARPENNES	4.867228	45.775276	Periurban
FR20025	VINATIER	4.893342	45.739445	Periurban
FR20027	ST GENIS LAVAL	4.796122	45.693333	Periurban
FR20035	IRIGNY	4.825564	45.678055	Periurban
FR20036	ST PRIEST	4.9131	45.6994	Periurban
FR20037	TERNAY	4.8022	45.6019	Periurban
FR20038	GIVORS	4.773028	45.58222	Periurban
FR20039	LES ORLETS	4.805003	45.54861	Periurban
FR20042	ST ROMAIN	4.858619	45.535	Periurban
FR20043	VENISSIEUX	4.8757	45.69	Periurban
FR20044	NEUVILLE	4.838894	45.878056	Periurban
FR20045	GENAS	4.9803	45.7317	Periurban
FR20046	VAULX EN VELIN	4.9247	45.7789	Urban
FR20047	COTIERE AIN	4.953958	45.823223	Periurban
FR20048	SAINT EXUPERY	5.0722	45.7533	Periurban
FR20049	HAUT BEAUJOLAIS	4.465711	45.96141	Rural
FR20061	VILLEFRANCHE Village	4.719637	45.986219	Urban
FR20062	LYON Centre	4.854214	45.757732	Urban
FR20067	Lyon 8eme	4.875669	45.72827	Urban
FR20068	VILLEFRANCHE PERIURB	4.796111	45.936275	Periurban
FR20077	Villefranche Centre	4.715566	45.990112	Urban
FR20204	COTEAUX_DU_LYONNAIS	4.598853	45.723415	Rural
FR27001	SALAISE sur SANNE	4.8037	45.3554	Periurban
FR27002	ROUSSILLON	4.805147	45.36782	Urban
FR27003	ROCHES DE CONDRIEU	4.766528	45.454517	Periurban
FR27004	Vienne Centre	4.875408	45.52597	Urban
FR27005	Sablons	4.770702	45.321845	Periurban
FR27006	PLAINE DE BIEVRE	5.174122	45.3978	Rural
FR27007	Bourgoin-Jallieu	5.270872	45.60822	Urban
FR27010	Plateau de Bonnevaux	5.181081	45.4609	Rural
FR27101	Sablons	4.777508	45.323055	Periurban
FR27102	Vienne Estressin	4.863903	45.539722	Periurban

Table S3. List and location of the main air quality monitoring stations (PM10, PM2.5, NO, NO₂, O₃, SO₂) for error statistics (next)

Station code	Station name	Longitude (°)	Latitude (°)	Typology
FR29421	COUBERTIN	4.389781	45.46672	Periurban
FR29423	ROANNE	4.074656	46.04111	Urban
FR29424	SAINT ETIENNE SUD	4.395422	45.42009	Urban
FR29425	FIRMINY	4.281681	45.387943	Urban
FR29426	SAINT-CHAMOND	4.515003	45.475327	Urban
FR29427	VEAUCHE	4.298547	45.565796	Periurban
FR29432	LOIRE RURAL	4.104447	45.51278	Rural
FR29436	PILAT	4.60175	45.33842	Rural
FR29437	ST-Just_ST-Rambert	4.246094	45.498383	Periurban
FR29439	LA TALAUDIERE	4.429667	45.481777	Periurban
FR29440	COL_OEILLON	4.615817	45.38958	Rural
FR33101	PASTEUR	5.928333	45.56472	Urban
FR33102	CHAMBERY LE HAUT	5.918611	45.59667	Urban
FR33103	BARBY	5.978889	45.57111	Periurban
FR33111	SAINT JEAN	6.349722	45.274723	Urban
FR33120	CHAMONIX	6.87	45.9225	Urban
FR33121	Albertville	6.389722	45.675	Urban
FR33201	LOVERCHY	6.118333	45.89528	Urban
FR33202	NOVEL	6.135556	45.916943	Urban
FR33211	ANNEMASSE	6.240556	46.19583	Urban
FR33212	GAILLARD	6.214858	46.19369	Urban
FR33220	PASSY	6.713611	45.92361	Periurban
FR33233	Aiguille du Midi	6.887319	45.878613	Rural
FR33235	SALLANCHES	6.63534	45.935294	Urban
FR33260	THONON les Bains	6.484722	46.374443	Urban
FR33301	Bourg en Bresse	5.224747	46.212215	Urban
FR33302	St Germain sur Rhone	5.820833	46.072224	Rural
FR33303	Ferney-Voltaire	6.1125	46.255833	Urban
FR33305	Bourg-en-Bresse	5.226389	46.211666	Urban
FR33307	Oyonnax Piscine	5.64195	46.25407	Urban
FR33367	MARNAZ	6.53339	46.05772	Periurban
FR33411	PLAN DU LAC	6.830278	45.34	Rural
FR33414	TERMIGNON	6.849756	45.261734	Rural
FR33720	Ugine_musee	6.4208	45.7467	Urban
FR36001	Valence Periurb. Sud	4.876289	44.870243	Periurban
FR36002	Valence Urb. Centre	4.893481	44.933514	Urban
FR36004	Annonay Urb centre	4.669708	45.24652	Urban
FR36005	Drome Rurale Sud	5.089872	44.520744	Rural
FR36008	Vercors Sud	5.415569	44.97111	Rural
FR36009	Montagne Ardechoise	4.289728	44.810833	Rural
FR36010	Ardeche Rurale Sud	4.289258	44.399685	Rural
FR36015	Vercors	5.4429	45.0255	Rural
FR36016	Monts D'Ardeche	4.5305	44.84756	Rural
FR36017	Drome Provencale Sud	4.854	44.351948	Rural
FR36018	Haut Buech	5.711119	44.672913	Rural
FR36019	Romans-sur-Isere	5.0443	45.0425	Urban
FR36021	Drome Rurale Sud-SND	5.278972	44.569443	Rural
FR36022	Aubenas_belvedere	4.384979	44.622277	Urban
FR36025	ANNONAY	4.725833333	45.2428056	Urban

