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# Improving the utility of atmospheric chemical composition vocabulary

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WMO OMM

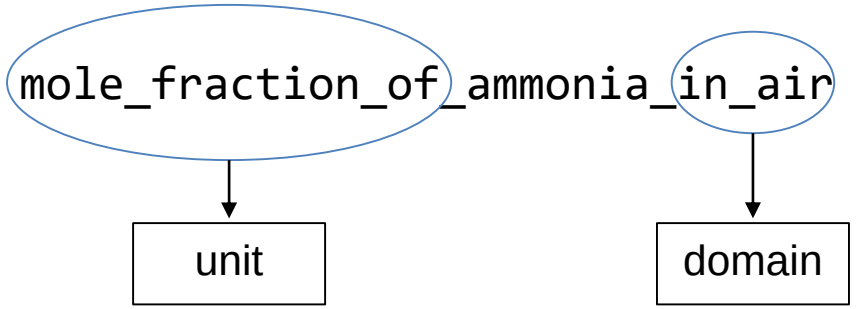
World Meteorological Organization
Organisation météorologique mondiale

# Motivation

**F**indable **A**ccessible **I**nteroperable **R**eusable Data

«findable» and «interoperable» require compatible vocabularies

Variable: `mole_fraction_of_ammonia_in_air` (NetCDF, CF Convention Standard Name)




How can this variable be expressed in other vocabularies with a different structure?

# Current situation

| Vocabulary | Variable structure, context |
|---|---|
| WIGOS Code Table 1-01-01 | Path structure, syntax:<br>[Domain]\[GAW Focal area]\[physical, or chemical subgroups[1-n]]\[name], [modifiers] |
| Common Code Table C-14 | No structure, description via «meaning_en» and «chemical formula» |
| CF Conventions: Standard Name Table | Fixed structure of standard names, syntax:<br>[surface]_[component]_standard_name_[at surface]_<br>[in medium]_[due to process]_[assuming condition] |
| OSCAR Requirements | Domain and Units |
| Air Quality Data Dictionary: Pollutants | Domain in label, syntax:<br>[substance] [(domain1+domain2…)] |

# Challenges

Examples: Mapping WIGOS 1-01-01 with C-14

- **Radionuclides**

  5 WIGOS entries with the path «Atmosphere\Radionuclide\...» are a subset of C-14

- **Pollen**

  Category does not exist in WIGOS, whereas in C-14 there are a few variables for pollen

- **Gases**

  Mapping partly possible with missing variables in both tables

- **Aerosols**
  - Mapping difficult due to variables on different levels
  - WIGOS has variables for Composition and optical/physical properties

# Examples: Gases

| WIGOS Code Table 1-01-01 | | | COMMON CODE TABLE C–14 | | |
|---|---|---|---|---|---|
| WMDR notation | path | name | CodeFigure | Meaning_en | ChemicalFormula |
| 589 | \Atmosphere\Gas\Greenhouse Gas\CFCs\C2Cl2F4 (1,2-dichlorotetrafluoroethane, CFC-114) | C2Cl2F4 (1,2-dichlorotetrafluoroethane, CFC-114) | 20006 | CFC-114 (1,2-dichloro-1,1,2,2-tetrafluoroethane) | ClF2C-CClF2 |
| 590 | \Atmosphere\Gas\Greenhouse Gas\CFCs\C2Cl3F3 (1,1,2-trichloro-1,2,2-trifluoroethane, CFC-113) | C2Cl3F3 (1,1,2-trichloro-1,2,2-trifluoroethane, CFC-113) | 20004 | CFC-113 (1,1,2-trichloro-1,2,2-trifluoroethane) | Cl2FC-CClF2 |
| 591 | \Atmosphere\Gas\Greenhouse Gas\CFCs\C2ClF5 (1-chloro-1,1,2,2,2-pentafluoroethane, CFC-115) | C2ClF5 (1-chloro-1,1,2,2,2-pentafluoroethane, CFC-115) | 20007 | CFC-115 (1-chloro-1,1,2,2,2-pentafluoroethane) | ClF2C-CF3 |
| 592 | \Atmosphere\Gas\Greenhouse Gas\CFCs\CCl2F2 (dichlorodifluoromethane, CFC-12) | CCl2F2 (dichlorodifluoromethane, CFC-12) | 20003 | CFC-12 (dichlorodifluoromethane) | CCl2F2 |
| 593 | \Atmosphere\Gas\Greenhouse Gas\CFCs\CCl3F (trichlorofluoromethane, CFC-11) | CCl3F (trichlorofluoromethane, CFC-11) | 20002 | CFC-11 (trichlorofluoromethane) | CCl3F |
| | | | 20005 | CFC-113a (1,1,1-trichloro-2,2,2-trifluoroethane) | Cl3C-CF3 |
| 594 | \Atmosphere\Gas\Greenhouse Gas\Halocarbons\CCl4 (carbon tetrachloride) | CCl4 (carbon tetrachloride) | 20016 | HCC-10 (carbon tetrachloride) | CCl4 |
| 595 | \Atmosphere\Gas\Greenhouse Gas\Halocarbons\CH3CCl3 (1,1,1-trichloroethane) | CH3CCl3 (1,1,1-trichloroethane) | 20017 | HCC-140a (1,1,1-trichloroethane) | Cl3C-CH3 |
| 332 | \Atmosphere\Gas\Greenhouse Gas\Halon\CBrClF2 (Halon 1211) | CBrClF2 (Halon 1211) | 20012 | Halon-1211 (bromochlorodifluoromethane) | CBrClF2 |
| 333 | \Atmosphere\Gas\Greenhouse Gas\Halon\CBrF3 (bromotrifluoromethane, Halon 1301) | CBrF3 (bromotrifluoromethane, Halon 1301) | 20013 | Halon-1301 (bromotrifluoromethane) | CBrF3 |
| | | | 20011 | Halon-1202 (dibromodifluoromethane) | CBr2F2 |
| | | | 20014 | Halon-2402 (1,2-dibromo-1,1,2,2-tetrafluoroethane) | BrF2C-CBrF2 |
| 534 | \Atmosphere\Gas\Greenhouse Gas\HCFCs\C2H3Cl2F (1,1-dichloro-1-fluoroethane, HCFC-141b) | C2H3Cl2F (1,1-dichloro-1-fluoroethane, HCFC-141b) | 20009 | HCFC-141b (1,1-dichloro-1-fluoroethane) | Cl2FC-CH3 |
| 535 | \Atmosphere\Gas\Greenhouse Gas\HCFCs\C2H3ClF2 (1-chloro-1,1-difluoroethane, HCFC-142b) | C2H3ClF2 (1-chloro-1,1-difluoroethane, HCFC-142b) | | | |
| 536 | \Atmosphere\Gas\Greenhouse Gas\HCFCs\C2H3F3 (1,1,1-trifluoroethane, HCFC-143a) | C2H3F3 (1,1,1-trifluoroethane, HCFC-143a) | | | |
| 537 | \Atmosphere\Gas\Greenhouse Gas\HCFCs\CHClF2 (chlorodifluoromethane, HCFC-22) | CHClF2 (chlorodifluoromethane, HCFC-22) | 20008 | HCFC-22 (chlorodifluoromethane) | CHClF2 |
| | | | 20022 | HCFC-141a (1,1-dichloro-2-fluoroethane) | Cl2HC-CH2F |

# Examples: Aerosols

– Example 1: Varables for inorganic anions

| WIGOS Code Table 1-01-01 | | | COMMON CODE TABLE C–14 | |
|---|---|---|---|---|
| WMDR notation | path | name | CodeFigure | Meaning_en |
| 616 | \Atmosphere\Aerosol\Composition\Inorganic anions\Chloride (Cl-), **PM2.5** | Chloride (Cl-), PM2.5 | | |
| 617 | \Atmosphere\Aerosol\Composition\Inorganic anions\Chloride (Cl-), **total aerosol** | Chloride (Cl-), total aerosol | | |
| 618 | \Atmosphere\Aerosol\Composition\Inorganic anions\Fluoride (F-), total aerosol | Fluoride (F-), total aerosol | | |
| | | | 62006 | Sulphate **dry** |
| 619 | \Atmosphere\Aerosol\Composition\Inorganic anions\Sulphate (SO4=), **corrected** | Sulphate (SO4=), corrected | | |
| 620 | \Atmosphere\Aerosol\Composition\Inorganic anions\Sulphate (SO4=), total | Sulphate (SO4=), total | 22 | Sulphate anion |
| 621 | \Atmosphere\Aerosol\Composition\Inorganic anions\Sulphate (SO4=), total, **PM10** | Sulphate (SO4=), total, PM10 | | |
| 622 | \Atmosphere\Aerosol\Composition\Inorganic anions\Sulphate (SO4=), total, PM2.5 | Sulphate (SO4=), total, PM2.5 | | |

# Examples: Aerosols

– Example 2: Generic terms in C-14 without correspondence in WIGOS vocabulary

| CodeFigure | Meaning_en | ChemicalFormula |
|---|---|---|
| 62000 | Total aerosol | |
| 62028 | Total aerosol hydrophilic | |
| 62029 | Total aerosol hydrophobic | |
| 62026 | Particulate matter (PM) | |
| 62020 | Smoke - high absorption | |
| 62021 | Smoke - low absorption | |
| 62022 | Aerosol - high absorption | |
| 62023 | Aerosol  - low absorption | |

# Approach

- Create an ad-hoc working group on atmospheric composition vocabulary «WG-ACV» reporting to TT-WIGOSMD and ET-ACDM
- Next steps:
  - Add definitions in WIGOS table 1-01-01
  - Check tables for errors and make corrections
  - Extend the mapping as far as possible
    - In simple cases: add missing terms from one vocabulary to the other
    - In cases with conceptual differences: find connections and dependencies
  - Establish governance mechanisms to keep vocabularies in sync