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WORLD METEOROLOGICAL ORGANIZATION
WEATHER CLIMATE WATER

Introducing the WMO Commission for Agricultural Meteorology Task Team 2.3 on Flux Measurements for Agriculture

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Introduction

As one of the eight technical commissions of the World Meteorological Organization (WMO), the Commission for Agricultural Meteorology (CAgM) provides guidance in the field of agricultural meteorology by studying and reviewing the available science and technology. CAgM covers four Focus Areas. Task Team 2.3 on Flux Measurements for Agriculture was newly created as part of Focus Area 2 on Science and Technology for Agricultural Meteorology.

Task Team 2.3 Members:

RA I : Rim Zitouna-Chebbi, National Researches Institute of Rural Engineering, Water and Forests, Ariana, Tunisia

RA II : Akira Miyata, Institute for Agro-Environmental Sciences, Tsukuba-shi, Japan

RA III: Humberto Ribeiro da Rocha, University of São Paulo, Brazil

RA IV: John Prueger, U.S. Department of Agriculture, ARS

RA V : Jason Beringer, University of Western Australia

RA VI: Francesca Ventura, Università di Bologna, Italy

Each Member represents a region of the world, which is subdivised as follows:

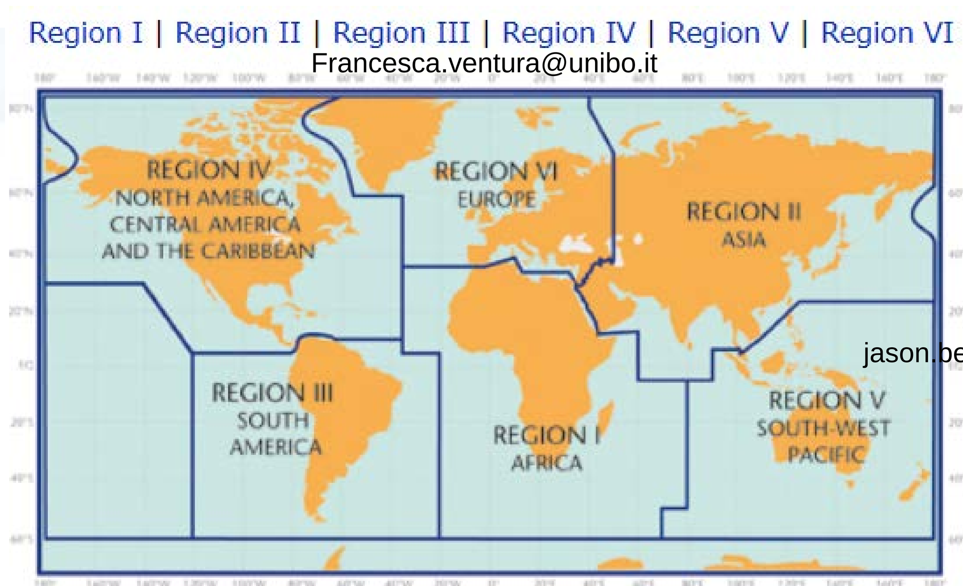

Figure 1. World region subdivisions according to WMO.

Terms of References

The terms of reference of Task Team 2.3 are as follows:

(a) Assemble a list of existing agricultural flux tower sites with a short description of the measured fluxes;

(b) Identify key experts for developing standards and regional guidelines of flux measurements for agriculture. Regional guidelines will account for the dominant constraints affecting flux measurements. The ad hoc experts will be invited to join the CAgM task team 2.3;

(c) Provide a report to CAgM on the state of flux measurements for agriculture.

Materials & Methods

A spreadsheet template was circulated to the Task Team Members of the six regions for wider circulation through the identified and referred PIs of the flux tower sites measuring over either crop or forage fields, improved pasture, and orchard. The following information was collected:

Site information:

Site_ID; Site_Name; Network affiliation (if any); PI_name; PI_email; PI_Affiliation; Latitude (deg. dec.); Longitude (deg. dec.); Elevation (m); Mean Annual Temperature (°C); Mean Annual Precipitation (mm); Field/Orchard Area (m); Crop type; forage type; Improved pasture; Orchard type;

Turbulent Flux information:

Flux_data_Start_date (YYYY-MM-DD);
Flux_data_End_date (YYYY-MM-DD);
Turbulent Flux codes:

1- momentum+ sensible heat fluxes
2- 1+ latent heat flux
3- 2+ CO2 flux
4- 3+ CH4 flux
5- 3+ N2O flux
6- 3+ NH3 flux
7- 4+ N2O flux
8- 5+ NH3 flux
9- 8+ CH4 flux

Weather data code:

1- weather station
2- 1+net radiation, soil heat flux
3 - 2+storage terms

Soil data code:

1- soil temperature
2- soil moisture
3- 1+2
4- soil fertility analyses
5- 3+4
6-soil respiration
7 3+6
8 5+6

Canopy data code:

1- canopy architecture
2- biomass
3- 1+2
4- plant composition analyses
5- 2+4
6- 3+4

Main management practices:

tillage
synthetic/organic fertilizers
irrigation
others

Soil texture

Drainage

Experimental objective

Environmental Challenges:

extreme temperature
heavy rainfall
flood
snow/ice
dust
hilly topography
wildlife
mesoscale circulation
others

Results

Across the regions, the main experimental objectives are related to irrigation and water use, crop rotation, management practices (fertilization, tillage, grazing intensity, etc.), quantifying GHG and other reactive N fluxes in relation to management practices, land use change (e.g., savanna to pasture) , impact of climate variations. Although the information we have so far is not complete, the tendency is to run almost year round. About one third of the sites (Fig. 2) are not part of a network. Referring to Fig. 3, more tower flux sites could be added in agricultural areas important for ensuring global food security.

Turbulent Flux global measured:	#Sites
1- momentum+ sensible heat fluxes	1
2- 1+ latent heat flux	19
3- 2+ CO2 flux	82
4- 3+ CH4 flux	16
5- 3+ N2O flux	6
6- 3+ NH3 flux	
7- 4+ N2O flux	10
8- 5+ NH3 flux	1
9- 8+ CH4 flux	1
Total	135

Environmental Challenges*:
Flood
Dry summer
extreme cold
heavy rainfall
snow/ice
dust
hilly topography
Wildlife

*lots of missing information

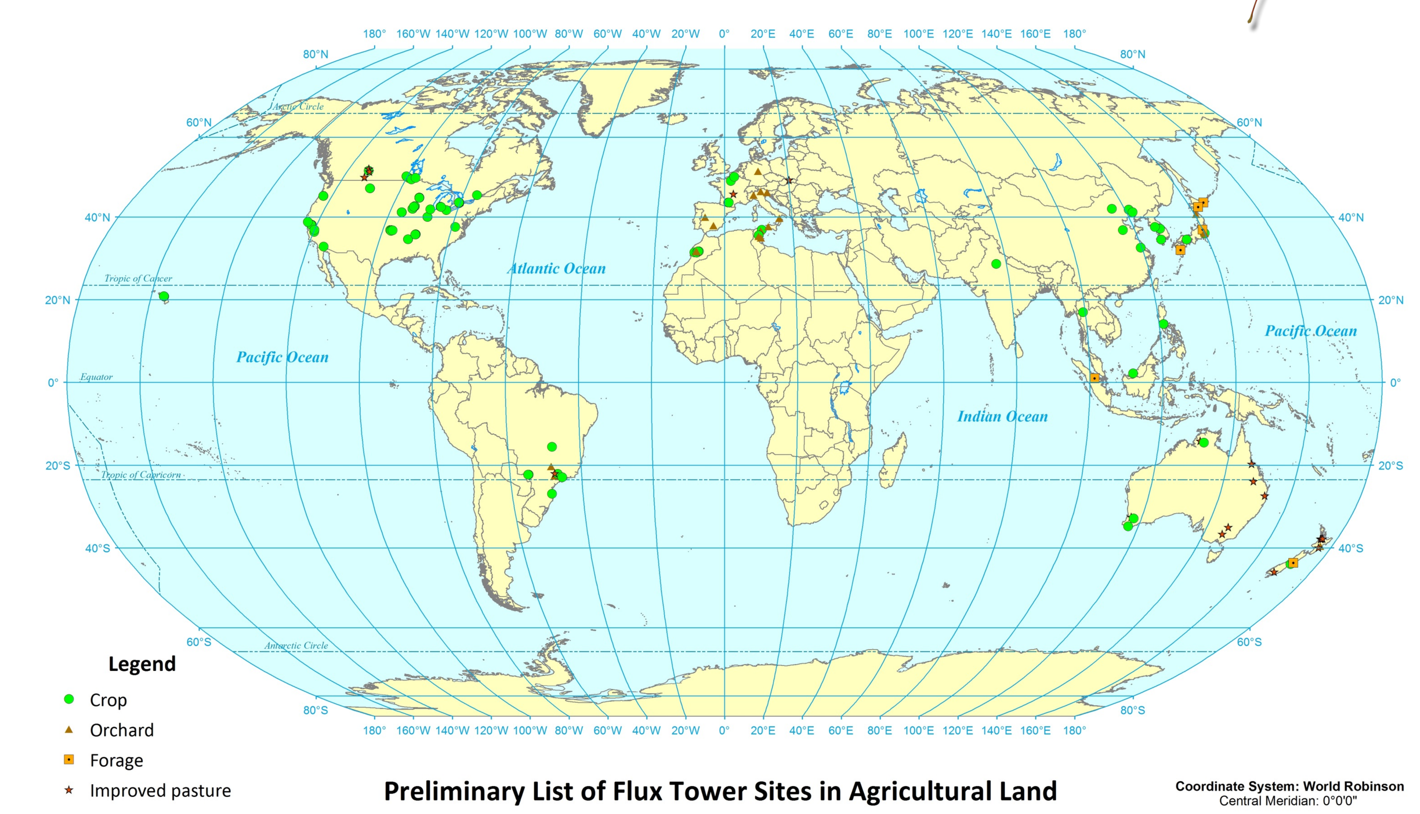

Figure 2. Preliminary inventory of the flux towers (~150) in crop (97) and forage fields (8), improved pastures (22) and orchards (22)

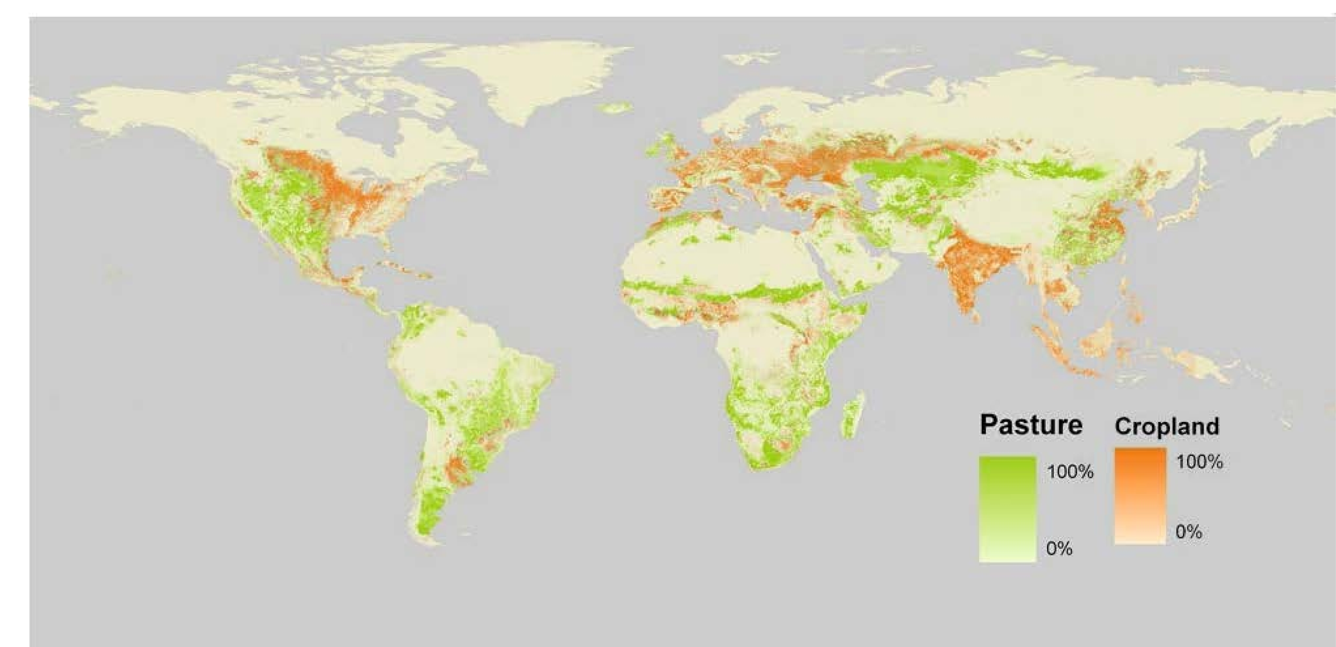

Figure 3. World map of cropland and pastureland established by the Center for Sustainability and the Global Environment (SAGE) at the University of Wisconsin-Madison in 2005

Conclusions

A more detailed study of vegetation type-year flux data could not be performed because of the incomplete information. We need the assistance of the micrometeorological community: 1) to identify flux tower sites measuring fluxes in agricultural areas (for example, India is installing ~40 flux towers that are not included in the database yet); 2) to provide complete information as described in M&M (~15 min per site); 3) to share and report innovative solutions to overcome environmental challenges and issue regional recommendations and 4) to establish standards for measuring fluxes often close to the surface and with limited fetch. The standards are particularly needed for trace gas fluxes such as methane, nitrous oxide and ammonia, which involves laser-based equipment and sophisticated instrumentation setup.

Acknowledgements

Task team 2.3 Members wish to thank all the PIs that took the time to fill the requested information.

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