

## **Whole Atmosphere Modelling Workshop: Developments in the context of space weather**

This workshop is intended to focus on the scientific and technical issues associated with developing atmospheric models that extend from the ground up to and including the thermosphere at about 600km. The goal of this effort is to develop models for improved ionospheric and thermospheric space weather forecasting, which include comprehensive representations of forcing from the lower atmosphere, as well as solar and geomagnetic forcing. In particular, we would like to develop forecast models capable of accurately capturing neutral density for satellite launch, re-entry and orbital operations, and elements of the ionosphere variability relevant to single and dual frequency GPS/GNSS systems.

The workshop will be at Deimos, Tres Cantos (near Madrid), Spain, on 13-15 June 2018.

For more information contact David Jackson ([david.jackson@metoffice.gov.uk](mailto:david.jackson@metoffice.gov.uk)), Tim Fuller-Rowell ([Tim.Fuller-Rowell@noaa.gov](mailto:Tim.Fuller-Rowell@noaa.gov)), or Dan Marsh ([marsh@ucar.edu](mailto:marsh@ucar.edu))

## **Agenda**

### **Wednesday 13 June**

1400-1410 :Welcome, Opening remarks (David Jackson, Sandra Negrin)

#### **Session 1: Introduction and motivation**

1410-1440: Sean Bruinsma (CNES): The H2020 project SWAMI: Development of a Whole Atmosphere Model and Kp Indices.

1440-1525: Tim Fuller-Rowell (University of Colorado): Why Forecast Space Weather with Whole Atmosphere Models?

*1525-1600: Coffee Break*

#### **Session 2: Atmospheric models: capabilities and limitations**

1600-1630: David Jackson (Met Office): SWAMI – a project to develop a European whole atmosphere model for improved satellite operations

1630-1700: Y. Miyoshi (Kyushu University): Vertical coupling processes simulated by a whole atmosphere-ionosphere coupled model GAIA

1700-1730: Dan Marsh (NCAR): The Community Earth System Model: A platform for atmospheric prediction from the surface to geospace

*1730-1900: Poster Session and Drinks Reception*

Eelco Doornbos (Delft University of Technology) : Comparison of GOCE observations of the thermosphere with WACCM-X simulations

O. Odayemi (University of Lagos): Investigation on Slab-Thickness and B0 over an Equatorial Station in Africa and Comparison with IRI Model

Isabel Fernandez:Gomez (DLR) : Thermosphere - Ionosphere dynamics of the 20 November 2003 superstorm modelled by CTIPe

## **Thursday 14 June**

### **Session 2: Atmospheric models: capabilities and limitations (cont.)**

0900-0930: Oleg Martynenko (York University): The Canadian Ionosphere and Atmosphere Model: its description and ability

0930-1000: Fabrizio Sassi (NRL): NRL's ground-to-space atmosphere-ionosphere prototype for R&D

1000-1030: Open Discussion on models – future developments, intercomparisons, etc?

### ***1030-1100: Coffee Break***

### **Session 3: Developing the whole atmosphere model building blocks**

1100-1130: Han-li Liu (NCAR): Whole Atmosphere Community Climate Model with Thermosphere and Ionosphere Extension (WACCM-X): Model Requirements, Structure, Capabilities and Validation

1130-1200: Manuel López-Puertas (Instituto de Astrofísica de Andalucía) Non-LTE energy budget of the middle and upper atmosphere: Status and implementation in GCMs

1200-1230: James Manners (Met Office): MLT radiation scheme developments in the UM

1230-1300: John Plane (University of Leeds): Developments in MLT Chemistry

1300-1315: Chris Kelly (University of Leeds): Nitrous oxide in the atmosphere: Chemistry-climate model simulations of a mesospheric-lower thermospheric source

### ***1315-1415: Lunch***

### **Session 3: Developing the whole atmosphere model building blocks (cont)**

1415-1445: Dan Griffin (University of Exeter): Extension of the Met Office Unified Model dynamical core, ENDGame, into the thermosphere

1445-1515: Steve Eckermann (NRL): Gravity Waves

### **Session 4: Dynamic drivers of the thermosphere and ionosphere**

1515-1545: Valery Yudin (University of Colorado): Tidal Variability in the Whole Atmosphere Models

### ***1545-1615: Coffee Break***

### **Session 4: Dynamic drivers of the thermosphere and ionosphere (cont)**

1615-1630: Yosuke Yamazaki (GFZ): Quasi-6 day wave effects on the equatorial ionosphere

1630-1645: Anna Morozova (University of Coimbra): Ionospheric and cosmic ray variations coupled with stratospheric modes in middle latitudes

1645-1715: Discussion on Sessions 3 and 4 - on future paths (eg new dynamical cores, innovations in parametrizations), and dynamic drivers (eg interaction of Gravity, Planetary and Kelvin waves with tides)

### **Session 6: Ionosphere and magnetosphere**

1715-1745: Dan Welling (University of Michigan): Modeling the Magnetosphere-Ionosphere System for WAM Applications: Challenges and Opportunities

*2030: Conference Dinner*

## **Friday 15 June**

### **Session 5: Data assimilation (DA) and model validation**

0930-1000: Anasuya Aruliah (UCL): CubeSats as “Space Weather Balloons”

1000-1030: Nick Pedatella (NCAR): Whole Atmosphere Data Assimilation in WACCMX+DART

1030-1045: Matt Griffith (University of Bath): Raising the Roof: Using the Unified Model to simulate the lower thermosphere. Results and validation.

1045-1115: Discussion on DA and validation

*1115-1145: Coffee Break*

### **Session 6: Ionosphere and magnetosphere**

1145-1215: Tzu-Wei Fang (University of Colorado): An Introduction of Ionospheric Models

1215-1245: Adrian Grocott (Lancaster University): Data driven ionospheric electric field models

1245-1300: Maria Walach (Lancaster University): Characterising and understanding temporal variability in ionospheric flows using SuperDARN data

*1300-1400: Lunch*

1400: **Session 7: Open Discussion** led by Fuller-Rowell, Marsh, Jackson

- a. What are the key whole atmosphere modelling challenges?
- b. How can we work together to meet them?
- c. Plan for future steps and the path to operations – eg another workshop.

Around 1500: Workshop closes

