Applications of satellite remote sensing in numerical weather and climate prediction

2016 Summer School

(Update on Mar 31, 2016)

Schedule: July 11-15, 2016

Language: English

Organizer: Key Laboratory of Mesoscale Severe Weather/Ministry of Education and School of Atmospheric Sciences, Nanjing University

Location: Nanjing University, Gulou campus, 22 Hankou Road, Nanjing, Jiangsu, PR. China

Topics and invited professors:

1. Fundamental theory and methodology on satellite remote sensing

   Dr. Jordan Gerth

   Scientist

   Cooperative Institute for Meteorological Satellite Studies (CIMSS)

   Space Science and Engineering Center (SSEC)

   University of Wisconsin – Madison
2. Cloud-aerosol-precipitation-climate interactions and the use of aircraft and satellite data

   Dr. Daniel Rosenfeld;

   Professor,

   Program of Atmospheric Sciences,

   Institute of Earth Sciences

   The Hebrew University of Jerusalem
3. Application of polar orbit and geostationary satellite observations, inverse methodology and satellite data assimilation etc.

   Dr. Jun Li

   Senior scientist

   Cooperative Institute for Meteorological Satellite Studies (CIMSS)

   Space Science and Engineering Center (SSEC)

   University of Wisconsin – Madison

Planned course sections and contents: (11-15 July, 2016)

The detail contents of lectures may vary according depending on each section time or be modified by the lecturers.

1. Fundamental theory and methodology on satellite remote sensing (Dr. Gerth)
Monday morning - Tuesday morning (total 9 hr plus discussions), 11-12 July, 2016

Each section will have a lecture followed by a lab. Ideally, students will have computers or access to computers that will run HYDRA with pre-selected case data for lab activities.

(**Attention: The conference room does not provide computers, so it is better to bring your own laptop to practice.**)

(1) Satellite remote sensing core concepts, including geostationary vs. polar satellite imaging; visible, infrared, and microwave radiation; Earth radiation budget; terminology of radiative energy; Planck function and brightness temperatures; reflected solar and thermal emission; non-homogeneous pixels

(2) Atmospheric absorption regions, weighting functions, surface emissivity, and multi-spectral band combinations to distinguish surface and cloud properties

(3) Advanced geostationary imagers, such as Advanced Himawari Imager, and meteorological applications, including diagnosis of synoptic features with water vapor imagery

2. Cloud-aerosol-precipitation-climate interactions and the use of aircraft and satellite data (Dr. Rosenfeld)
Tuesday afternoon - Thursday morning (total 12 hr plus discussions), 12-14 July, 2016

The lectures outline (some may take less and others may take more than one hour):

1) Introduction to the climate importance of cloud-aerosol interactions.
2) Aircraft documentation of the role of aerosols in cloud composition and precipitation forming processes.
3) The principles of satellite retrievals of cloud properties and precipitation forming processes.
4) Rendering satellite images by physically-based RGB color schemes
5) Satellite application to marine stratocumulus - from ship tracks to continental scale pollution with possible strong climate cooling effects
6) Satellite applications to aerosol effects on deep convective clouds, cloud invigoration and possible climate warming effects; aerosol radiative effects

7) Applications to aerosols effects on cloud electrification, severe convective storms and tropical cyclones, pyro-Cb
8) Detection of the effects of ice nucleating effects of natural and pollution aerosols on stratiform and convective clouds; glaciogenic cloud seeding
9) Satellite observations of interactions of desert dust with clouds, dusty convective gust fronts.
10) Satellite observations of interactions with large soluble aerosols and with sea spray; hygroscopic cloud seeding
11) Satellite retrievals of cloud base updrafts and CCN; Application to detecting pollution sources.
12) Application of satellite retrievals for parameterization of climate models and for high level assimilation.

3. Application of polar orbit and geostationary satellite observations, inverse methodology and satellite data assimilation etc. (Dr. Li)

Thursday afternoon - Friday afternoon (total 9 hr plus discussions), 14-15 July, 2016

(1) Introduction on the radiative transfer model and applications

(2) Introduction on inverse methodology and applications

(3) Satellite data assimilation in numerical weather prediction (NWP) models

(4) Introduction on the high spectral resolution infrared remote sensing and applications

(5) Quantitative products from the new generation of geostationary weather satellites and their applications

(6) Introduction on the observing system simulation experiment (OSSE) for future planning