APRES3

Antarctic Precipitation, Remote Sensing from Surface and Space

http://apres3.osug.fr/?lang=en

Principal investigator

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Areas of contribution

Polar atmospheric processes

Modelling and forecasting

Education

Observations

Outreach

Summary

Antarctic Precipitation, Remote Sensing from Surface and Space (APRES3) is a program to acquire in situ data to characterize precipitation in Antarctica (rate, size and shape of falling snow), use the data to calibrate, validate and contribute improve satellite climatology, improve cold microphysics of water condensation in meteorological and climate models, evaluate and validate the models using satellite climatology, and finally run forecasts of precipitation changes and impact on sea-level, in time to contribute IPCC6.

Description

There is no precipitation measurement network in Antarctica to evaluate the performances of climate models for this parameter. Yet, all models predict an increase of precipitation with global warming. Precipitation is the

single most important positive term of the ice sheet mass balance, and an increase of precipitation will moderate global sea-level rise due to other contributions. However, models disagree as to the amplitude of this moderation. They also disagree with respect to the current Antarctic precipitation.

The 1st climatology of Antarctic precipitation that allows an objective evaluation of models for present climate was recently assembled using CloudSat satellite radar data [Palerme et al., The Cryosphere, 2014]. The models from the CMIP5 (Climate Model Intercomparison Project 5) archive which most closely agree with the CloudSat climatology predict the largest Antarctic precipitation increase - and impact on sea-level – in the future [Palerme et al., Climate Dynamics, 2016]. However, the space – time coverage of the CloudSat climatology is partial and it should be completed using other satellite data. Also, data from field campaigns and in situ measurements are still in demand to properly calibrate and validate the satellite product.

The APRES3 project will test and adapt to Antarctica existing satellite precipitation retrieval methods using passive microwaves, and use this to complement CloudSat data to assemble a more comprehensive space - time satellite climatology of Antarctic precipitation. The project has and will deploy in situ measurement campaigns for the calibration and validation of satellite precipitation products. In these campaigns, radars and lidars are deployed to scan and profile the distribution and variability of hydrometeors and snow fall particles. Particle phase, size and shape are estimated, an information used to calculate snow fall rate on one hand, and directly compare with similar parameters estimated from space radars and radiometers on the other hand. This is used to calibrate, validate and improve satellite precipitation products.

Hydrometeor distribution, phase, size and shape measurements are also used to evaluate and improve the parameterization of cold microphysics of water vapor condensation and precipitation in meteorological and climate models. The current Antarctic precipitation in CMIP5 climate models ranges over a factor of 2. The project will asses and as necessary refine precipitation representation in the LMDZ (Laboratoire de Météorologie Dynamique Zoom) and MAR (Model Atmospheric Regional) global and regional atmospheric models respectively. The former model is the atmospheric component of the IPSL-CM (Institut Pierre-Simon Laplace – Climate Model) earth system model. The project will carry out predictions of global climate change including Antarctic precipitation and surface mass balance change, and impact on sea-level, with the improved and validated LMDZ model.

The French branch (http://www.apecs-france.org/) of the Association of Polar Early Career Scientists (APECS) designed the APRES3 web site (http://apres3.osug.fr/?lang=en) and manages the project communication and outreach components.

Timeline

2015-10-01 - 2019-09-25

Regional emphasis

Northern hemisphere: No

Southern hemisphere: Yes

Key project deliverables

- In situ characterization of Antarctic precipitation (snow fall rate, particle size, shade, phase, distribution) at Dumont d'Urville, Adélie Land,

- Calibration and validation of satellite remote sensing of precipitation in Antarctica,

- Improved/extended climatology of Antarctic precipitation from satellite remote sensing,

- Improved parametrization of cold microphysics in meteorological and climate models,

- Improve simulations and prediction of Antarctic precipitation and change.

Data management

Project repository, distribution on project website, visibility on the YOPP data portal.

Is data provided to WMO Global Telecommunication System

No

Real-time provision

Will be technically difficult due to the volume of data and limited communication with Antarctica. However, with provision for technical difficulties and support, GTS transmission will be considered.

Other information

The project will make the data available to the community as quickly as possible, with provision for publication since this is academic research supported by competitive grants with commitment to publish the results. The project will support efforts to make the data visible from the YOPP Data Portal.

Timelines

Location	Latitude	Longitude	Start date	End date	Activity
Dumont d'Urville	-66.4	140	2015-10-01	2016-03-25	First precipitation measurement/characterization field campaign
Dumont d'Urville	-66.4	140	2016-11-01	2017-01-25	Second precipitation measurement/characterization field campaign
Paris / Grenoble	40-45	0	2015-10-01	2019-09-25	Microphysics paramterizations, meteorological and climate model improvement, climate forecasts

Location	Latitude	Longitude	Start date	End date	Activity
Lausanne / Grenoble	45	0	2016-03-01	2019-09-25	Surface data, radar, lidar processing, comparison with remote sensing data