# MAGIC

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BROOKHAVEN
NATIONAL LABORATORY

Atmospheric System Research Science Team Meeting
Arlington, VA
Monday, March 12, 2012, 3:15-5:15 pm

# Agenda

| | |
|---|---|
| The MAGIC Project | Ernie Lewis |
| Leg0: Overview | Ernie Lewis |
| Leg0: Meteorology & motion data | Mike Reynolds |
| MAGIC Status (instruments, layout, tasks) | Brad Orr |
| Radars for MAGIC | Kevin Widener |
| Stable table status | Rich Coulter |

# MAGIC: ARM's First True Marine Deployment

MAGIC will deploy AMF2 aboard a Horizon Lines cargo container ship making regular trips between Los Angeles and Honolulu from Oct., 2012 to Sept., 2013 to investigate clouds, aerosols, and radiation.

Two Intensive Observational Periods (IOPs) are planned, one for Dec, 2012/Jan, 2013 and one for June/July, 2013.

Two technicians will be on board during the deployment (more during IOPs). Scientists can accompany as observers.

Los Angeles to Honolulu is 4100 km (2550 miles, or 2200 nautical miles).
The trip from Los Angeles to Hawaii takes $4\frac{1}{2}$ days.
The trip from Hawaii to Los Angeles takes $6\frac{1}{2}$ days.

The repeated transects, with 24 planned round trips between Los Angeles and Honolulu, will give seasonality data.

# MAGIC Science Team

**Principal Investigators**

Ernie R. Lewis (Brookhaven National Laboratory)

Warren J. Wiscombe (NASA Goddard Space Flight Center)

**Co-Investigators**

Bruce A. Albrecht (University of Miami)

Geoffrey L. Bland (NASA GSFC, Wallops Flight Facility)

Charles N. Flagg (Stony Brook University)

Stephen A. Klein (Lawrence Livermore National Laboratory)

Pavlos Kollias (McGill University)

R. Michael Reynolds (Remote Measurements & Research Company)

Stephen E. Schwartz (Brookhaven National Laboratory)

A. Pier Siebesma (KNMI, The Netherlands)

Joao Teixeira (Jet Propulsion Laboratory/California Institute of Technology)

Robert Wood (University of Washington)

Minghua Zhang (Stony Brook University)


MAGIC involves a unique collaboration between ARM and Horizon Lines.

Horizon is the nation's leading domestic ocean shipping and integrated logistics company.

Horizon Lines accounts for 37% of the total U.S. marine container shipments from the continental U.S. to Alaska, Puerto Rico, and Hawaii.

Horizon had revenues of more than $\$1.15 \times 10^9$ in fiscal 2009.

Horizon is the largest container shipping company operating under the Jones Act.

Horizon has a fleet of 20 ships, 15 of which are Jones Act classified.

# Horizon *Spirit* and *Reliance*

The Horizon *Spirit* and *Reliance* are Jones Act, Class C9 ships built in 1980.


They make trips between Los Angeles and Honolulu every two weeks.

They are 272 m long* and 30 m wide, with a maximum speed of 20 knots.

They have a crew of 22 people in addition to the captain.

They have a FEU (forty-foot equivalent unit) capacity of 1218.

* Length – 244 m, 272 m (from different websites), 845 feet (=256 m) from Horizon website

# MAGIC: Motivation

Marine clouds play a critical role in the global radiation budget and hydrological cycle, and clouds in the marine boundary layer exert an extremely large and poorly quantified influence.

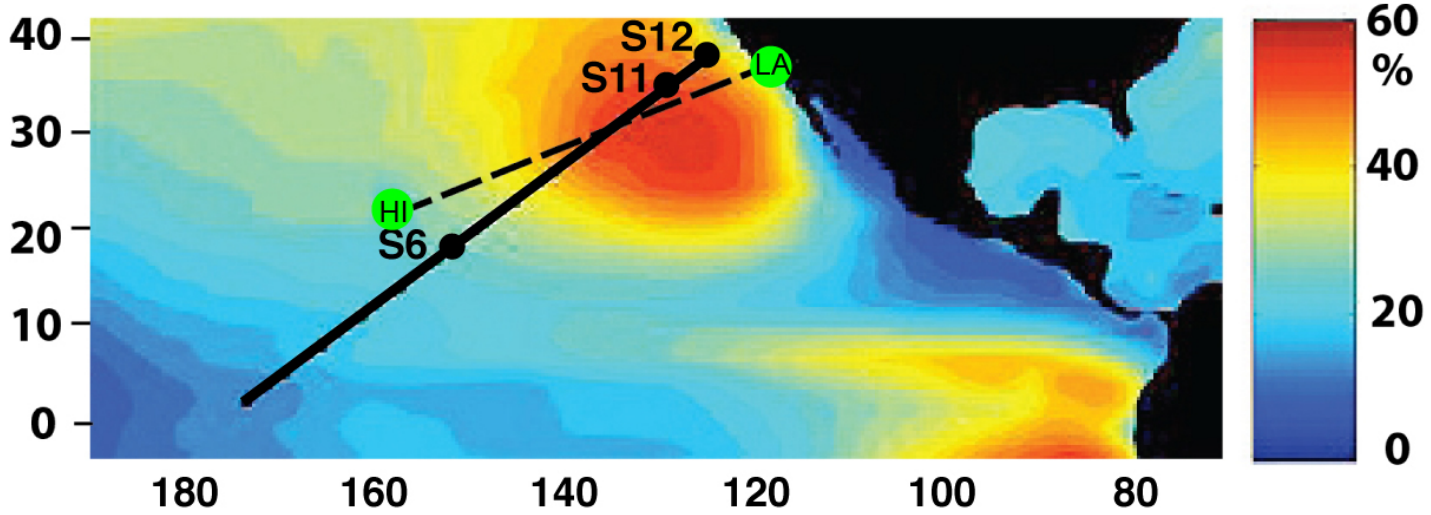
Along this transect there is a transition in cloud type from stratocumulus (Sc) to cumulus (Cu), and models have difficulty in accurately representing this transition.

The scientific objectives are:

1) improve the representation of the Sc-to-Cu transition in climate models by characterizing the essential properties of this transition

2) to produce the observed statistics of these Sc-to-Cu characteristics along these transects during the deployment period.

# Modeling Efforts Associated with MAGIC




Annual average low-level cloud cover, GPCI transect, & CGILS points **(based on Teixeira et al., 2011)**

**GPCI** - GASS Pacific Cross-section Intercomparison, led by J. Teixeira

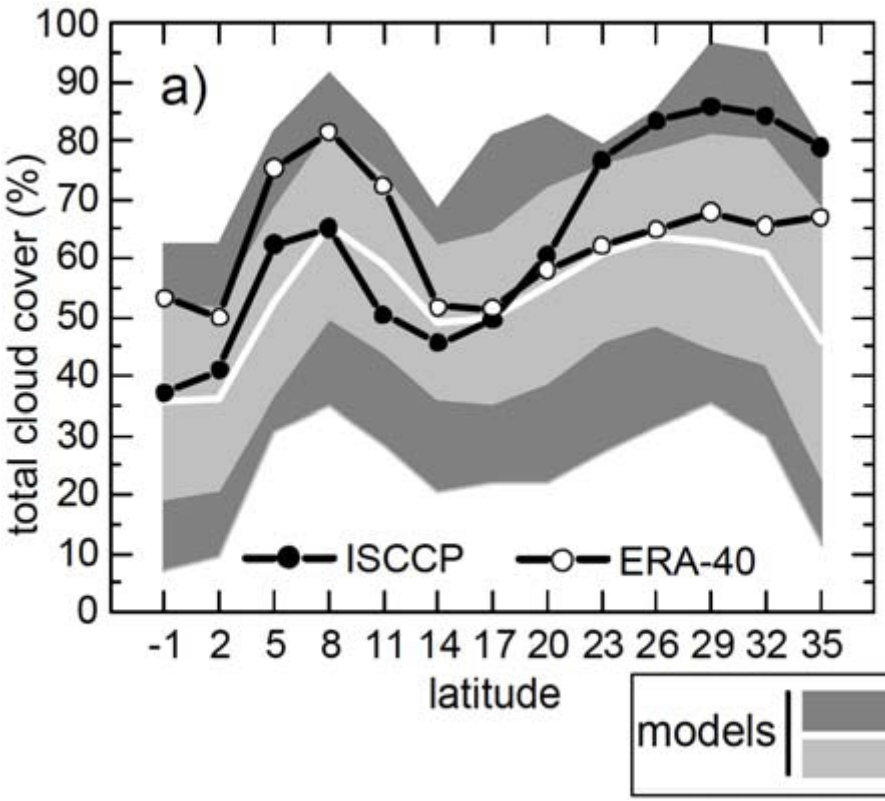
**CGILS** - CFMIP-GCSS Intercomparison of Large Eddy (LES) Models and Single Column Models (SCMs), led by M. Zhang and C. Bretherton

**EUCLIPSE** - European Union Cloud Intercomparison, Process Study & Evaluation Project, led by A. P. Siebesma

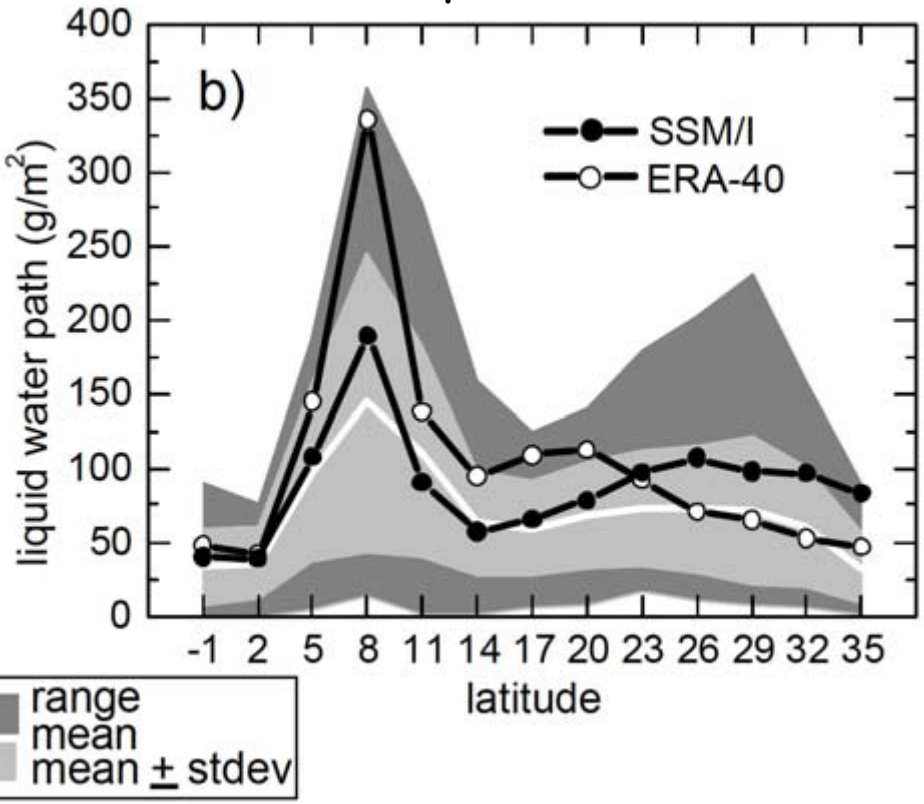
Two NSF/NOAA Climate Process Teams (J. Teixeira, R. Wood)

# Models Exhibit Some Disagreement

Total Cloud Cover




Total Liquid Water Path







**from Teixeira et al., 2011**

For JJA 1998 along GPCI

Ensemble results from 23 models; mean plus or minus standard deviation

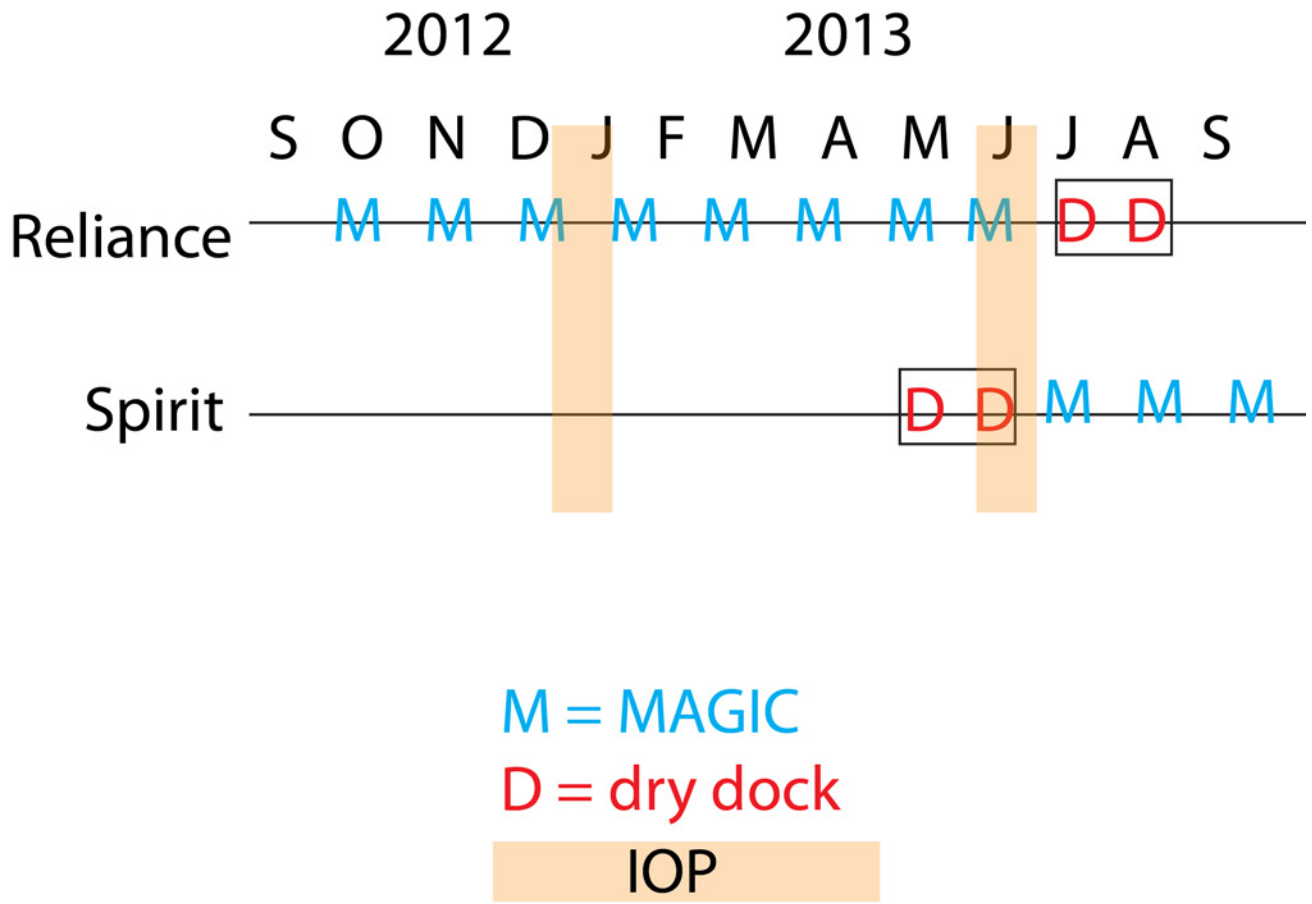
Range extends from minimum to maximum values.

# MAGIC Timetable

| | |
|---|---|
| Sept., 2012 | start setup on ship |
| Oct., 2012 | deployment begins on *Reliance* |
| Dec., 2012/Jan., 2013 | 1st IOP |
| May, 2013 | *Spirit* in dry dock* |
| June/July, 2013 | 2nd IOP |
| July, 2013 | *Reliance* in dry dock*; deploy on *Spirit* |
| Sept., 2013 | deployment finishes |

* Dry dock is 28-45 days plus another ~month for transit
Spirit must enter shipyard no later than May 14, 2013
Reliance must enter shipyard no later than July 8, 2013

# MAGIC Timetable




Reliance runs rhumb line (straight line on Mercator projection) westbound
Spirit runs great circle both ways
LA to Honolulu: 4075 km on rhumb line, 4063 km on great circle

# What Will Be Deployed?

Instrumentation:

- Three vans:
  - Radar (KAZR) van
  - Ops van
  - Aerosol Observing System (AOS)
- Modules

Ancillary measurements

Four sonde launches per day

Two technicians on board

Two intensive observational periods (IOPs), requiring additional personnel

Scientists on board as observers

# MAGIC Instrument List

## Radar (KAZR) van

- Marine W-band Arm Cloud Radar (M-WACR), vertically-stabilized
- Ka-band Zenith Radar (KAZR), vertically pointing
- Main data system (perhaps)
- Radar Wind Profiler (RWP) and its computing system

## Ops van

- High Spectral Resolution Lidar (HSRL)
- Atmospheric Sounder by Infrared Spectral Technology (ASSIST-II), vertically-pointing
- WACR data system

## Aerosol Observing System (AOS)

- Condensation Nucleus Counter (CNC)
- Cloud Condensation Nucleus Counter (CCN)
- Particle Soot Absorption Spectrometer (PSAP)
- Dry and humidified nephelometers (NEPH)
- Hygroscopic Tandem Differential Mobility Analyzer (HTDMA)
- Ozone (O3)
- Ultra-High Sensitivity Aerosol Spectrometer (UHSAS), for part of time

# MAGIC Instrument List (cont.)

## Modules

- Micropulse Lidar (MPL), polarized
- Total Sky Imager (TSI)
- Ceilometer (VCEIL)
- Microwave Radiometer (MWR), possibly two – a 2 channel and a 3 channel
- Infrared Scanning Autonomous Radiometer (ISAR)
- Infrared Thermometer system (2-IRT), one up, one down
- Portable Radiation Measurement Package (PRP) with SPN1
- Meteorology with two sonic probes (T, P, RH, precip)
- Solar Array Spectrometer, zenith and hemispherical (SAS-Ze, SAS-He)
- Sondes – four launches per day

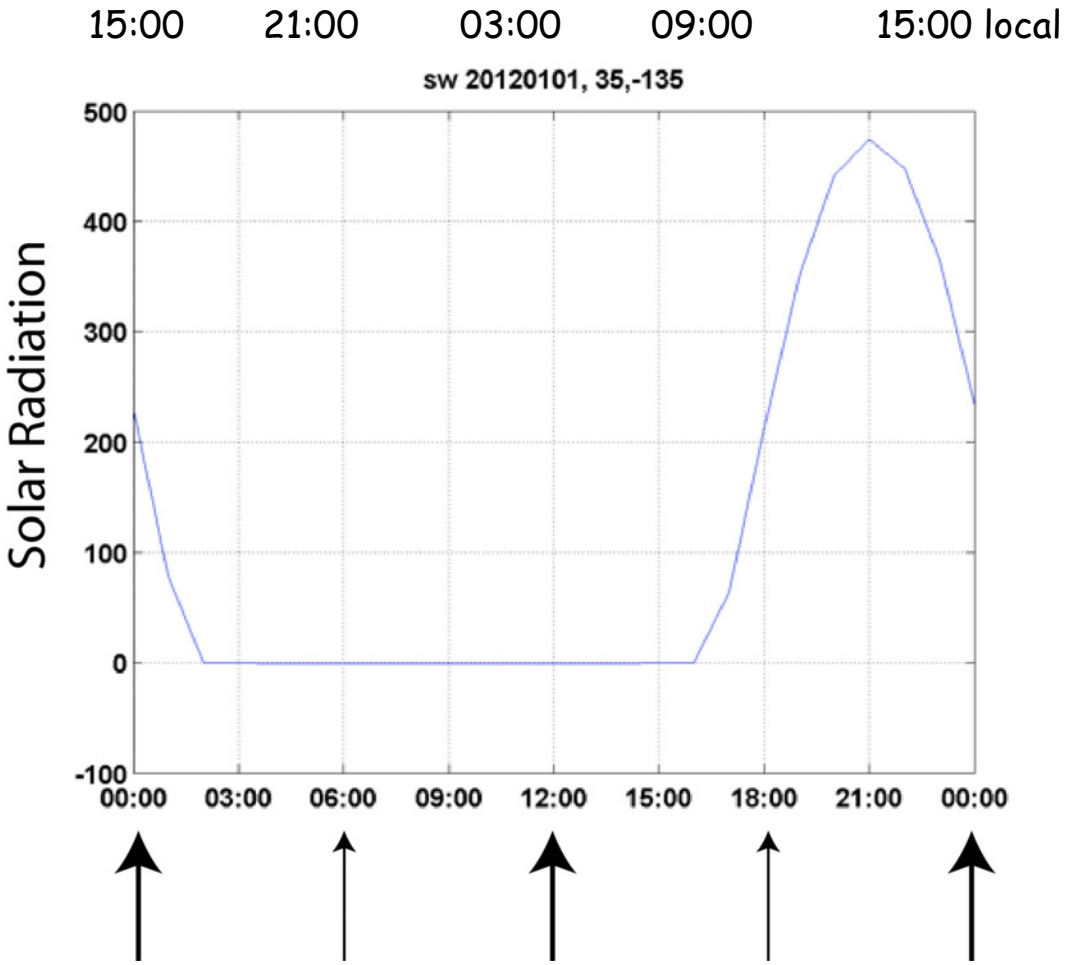
## Additional measurements

- Microtops II Sun Photometer (A. Smirnov, Marine Aerosol Network, NASA)
- Cloud observations for validation of satellite retrievals (L. Chambers, NASA)
- Video cameras - two each side, one up, one down (B. Asher, U. Washington)
- Collection of aerosol particles for individual analysis (C. Leck, U. Stockholm)
- Ocean color?
- Aircraft flyovers (Global Hawk, ATRAX, SPEC Learjet)?

# Sonde Launch Times

0:00 UTC = 16:00 Los Angeles = 14:00 Honolulu

**0:00**, 6:00, **12:00**, 18:00 UTC = **15:00**, 21:00, **03:00**, 09:00 local (at midpoint)



# MAGIC – Pending Topics

Status/timeline of radars, stable table, other instrumentation

Calibration plans

Marine hardening (vibration, fatigue, salt)

Backup plans for instrument failure (vibration, fatigue, salt)

Communications from ship to shore (internet, bandwidth, cost, etc.)

Data availability (possibly different for different instruments)

Get your TWIC (http://www.tsa.gov/twic)

# Additional Information

Ernie Lewis: elewis@bnl.gov

Updates (~weekly)

## Websites:

http://www.ecd.bnl.gov/MAGIC.html

http://www.rmrco.com/cruise/magic/

http://www.arm.gov/campaigns/amf2012magic

## Posters:

MAGIC: ARM's First Shipboard Deployment
(MAGIC Science Team)

AMF2 Status Update: Engineering Efforts for the MAGIC Campaign
(B. Orr and M. Ritsche)

Development and Control of a Stable Table Platform for Shipborne Measurements
(R. Coulter and T. Martin)