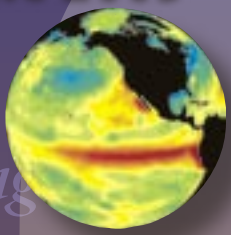
NATO
OTAN

NATO Advanced Study Institute

Seasonal to Interannual Climate Variability

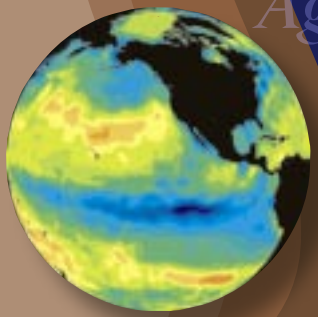
– its Prediction and Impact on Society –

Gallipoli (Italy), 23 May – 3 June 2005



Disaster Management

Agricultural Planning



Disease Prevention

Fishing Control

Energy Supply

Organizing Committee

Dr Alberto Troccoli, Director (ECMWF)

Dr Omar Baddour, Co-Director (Moroccan Met Service)

Prof David Anderson (ECMWF)

Dr Mike Harrison (UK Met Office)

Dr Simon Mason (IRI)

Seasonal to Interannual Climate Variability – its Prediction and Impact on Society –

The objective of this ASI is twofold. The first is to expose the four main components of seasonal to interannual climate forecasting systems along with several illustrative examples for each component:

A Generation of initial conditions for dynamical model forecasts

B Dynamical models and their coupling

C Statistical modelling, calibration and model output assessment

D Application of forecast products to specific users with emphasis on applications related to security.

The second is to offer a judgment of the limitations and prospects of seasonal to interannual climate forecasting systems. Ways to improve the communications between modellers, forecasters, and applications experts in order to more effectively obtain potential benefits for this emerging science will also be addressed.

For more information please visit

http://www.ecmwf.int/staff/alberto_troccoli/nato_asi/index.html

The NATO ASI will be held at

Ecoresort Le Sirene'
Litoranea Gallipoli – S. Maria di Leuca
73014 Gallipoli LE
Italy
Tel. ++39 0833 202536
www.attiliocaroli.it

Contents

Week 1 **23 May – 28 May 2005**

	Mon 23	Tue 24	Wed 25	Thu 26	Fri 27	Sat 28
8.30–9.15	Opening	A1	B1	B2	C1	C1
9.30–10.15	OV	A2	B1	B2	C1	C1
10.30–11.00	Coffee break					
11.00–11.45	OV	A2	B3	B1	C2	C3
12.00–12.45	WMO	A1	B3	B1	C2	C3
13.00–14.00	Lunch					
14.00–14.45	OV	B2	Problem A	Problem B	Solution A	
15.00–15.45	OV	B2	Problem A	Problem B	Solution B	
16.15–17.00	A1	B3	Problem A	Problem B		
17.15–18.00	A1	B3				
20.30–22.00				Panel Session		

Week 2 **30 May – 3 June 2005**

	Mon 30	Tue 31	Wed 1	Thu 2	Fri 3
8.30–9.15	C2	D1	D1	D3	CONC
9.30–10.15	C2	D1	D4	D4	CONC
10.30–11.00	Coffee break				
11.00–11.45	C3	D2	D4	D4	Panel Session
12.00–12.45	C3	D2	D3	D1	Panel Session
13.00–14.00	Lunch				
14.00–14.45	Problem C	D3	FSU	Problem D	
15.00–15.45	Problem C	D3	D2	Problem D	
16.15–17.00	Problem C	Solution C	D2	Solution D	
20.30–22.00			Panel Session		

Opening	Gen. Roberto Sorani On. Lorenzo Ria Sen. Maria Rosaria Manieri
OV	Prof David Anderson
A1	Dr Joe Tribbia
A2	Dr Alberto Troccoli
B1	Prof Paul Schopf
B2	Prof Brian Hoskins
B3	Dr Antonio Navarra
C1	Dr Omar Baddour
C2	Dr David Stephenson

C3	Dr Simon Mason
D1	Dr Mike Harrison
D2	Dr Abdallah Mokssit
D3	Dr Paul Llanso
D4	Dr Michael Glantz
CONC	Dr Michael Coughlan
Panel Sessions Chair	Dr Jim Williams
WMO	Mr Penehuro Lefale
FSU	Prof James O'Brien

Timetable of extra-curricular activities

Most of these activities are kindly offered by the Province of Lecce.

Date	Time	Programme
Mon 23 May	21.30–21.45	Welcome by Ing. Antonio Rizzo (Lecce Province)
	21.45–23.00	Welcome evening with music
Wed 25 May	18.00–19.00	Dinner at Le Sirene'
	19.30–22.30	Visit to Gallipoli
Fri 27 May	20.30–23.00	Music evening
Sat 28 May	14.30–20.30	Visit to Lecce
	21.00–22.00	Dinner at Le Sirene'
Sun 29 May	9:00–13.00	Visit to Otranto.
	13.30–14.30	Lunch at Le Sirene'
	16.30–19.00	Visit to Leuca
	19.00–21.00	Dinner at "Le Bagnarole" (Leuca) accompanied by a degustation lecture
	21.00–22.30	Spectacle of folk music and dance, typical of the Salento area, by the Ariacorte group
	23.00	Return to Le Sirene'
Tue 31 May	17.45–20.00	Visit to the Grecia Salentina
	20.00–21.00	Dinner at Le Sirene'
Thu 2 June	20.30–23.00	Farewell evening with music at Le Sirene'

Monday 23 May

Opening / welcome lectures

8.30–8.45 Gen. Roberto Sorani

8.45–9.00 Sen. Maria Rosaria Manieri

9.00–9.15 On. Lorenzo Ria

Overview — Prof David Anderson

9.30-10.15 **Lecture OVa** — *The basis for seasonal forecasting*

- Interaction between the atmosphere and ocean
- Implications for forecasting
- El Niño, impacts on the global climate, teleconnections, EQSOI, thermocline adjustments
- Hurricane prediction
- Dealing with uncertainty and chaos (the need for ensembles)

11.00-11.45 **Lecture OVb** — *Pedagogical models of the coupled system*

- The idea of reduced gravity
- Internal Kelvin and planetary waves
- Simple ideas of how ENSO might work
- Dealing with a fast and slow system
- The possible role of the intraseasonal oscillation and westerly wind bursts

WMO Lecture — Mr Penehuro Lefale

12.00-12.45 *The World Climate Programme of WMO: Linking climate science to society*

- Improvement in the ability to forecast climatic variations
- Understanding physical processes driving the climate system
- Role of the WMO - World Climate Programme
- Climate information and prediction services
- Current international climate activities

Overview — Prof David Anderson

14.00-14.45 **Lecture OVc** — *Coupled model forecasts*

- The ingredients of a forecast system
- The importance of the ocean state
- How to create an ensemble of forecasts
- Different strategies for initialising coupled forecasts

15.00-15.45 **Lecture OVd** — *Evaluation of forecasts*

- Different metrics
- Multi-model approach
- Comparing physical models with statistical models of ENSO
- Nonlinear transfer relations from meteorology to applications

Module A — Initial conditions preparation via data assimilation

Atmospheric data assimilation — Dr Joe Tribbia

16.15-17.00 **Lecture A1a** — *Historical perspective*

- Text book vs reality of model start-up
- First attempts - interpolation (Doos, Cressman)
- Statistical ideas (Eliassen, Gandin)
- Multivariate OI
- Variational methods and Kalman Filter

17.15-18.00 **Lecture A1b** — *Statistical and variational methods*

- Relationship between statistical and variational methods
- Statistical perspective: OI to KF
- Variational perspective: 3-D Var and 4-D Var

20.30-21.30 **Dinner**

21.30-21.45 **Welcome by Ing. Antonio Rizzo**

21.45-23.00 **Welcome evening with music**

Tuesday 24 May

Atmospheric data assimilation — Dr Joe Tribbia

8.30-9.15 **Lecture A1c** — *Balance issues*

- Balance Issues: Normal Mode and NNMI
- The slow manifold
- Variational Constraints

Ocean data assimilation — Dr Alberto Troccoli

9.30-10.15 **Lecture A2a** — *Observations and assimilation methods for the ocean*

- A digression on data assimilation: its relevance on every-day decisions
- Comparison of observations in the ocean and the atmosphere
- Methods used by prediction centres for preparing ocean initial conditions
- Other more advanced methods available

11.00-11.45 **Lecture A2b** — *Impact of assimilation on seasonal to inter–annual climate predictions*

- Comparison of available oceanic initial conditions
- Evolution of oceanic features during the forecasts
- Impact of data assimilation on seasonal to interannual climate predictions skill
- What assimilation methods are going to be used in the medium term for initialising the ocean?
- Can we cost/benefit assimilation methods using forecast skill as our metric?

Atmospheric / Coupled data assimilation — Dr Joe Tribbia

12.00-12.45 **Lecture A1d** — *Current / Future Methods*

- Ensemble Filters
- Variational/Ensemble mixes
- Coupled data assimilation: arguments for and against
- Climate drift and systematic biases

Module B — Dynamical models and their coupling

Atmospheric models — Prof Brian Hoskins

14.00-14.45 **Lecture B2a** — *Basic atmospheric processes*

- Basic parameters and balanced motion
- Zonally averaged circulation
- Rossby waves
- Response to orographic forcing
- Response to large-scale thermal forcing
- Monsoons & subtropical; anticyclones
- Intra-seasonal oscillation, equatorial waves and tropical cyclones

15.00-15.45 **Lecture B2b** — *Atmospheric models and tests of their performance*

- Basic equations and computational schemes
- Parametrization
- Tests of climate performance with specified boundary conditions
- Weather forecasting test

Coupled models — Dr Antonio Navarra

16.15-17.00 **Lecture B3a** — *The Zen and the art of coupled general circulation models (I)*

- Main actors and casting
- Implementation and major components

17.15–18.00 **Lecture B3b** — *The Zen and the art of coupled general circulation models (II):*

- Forecasting
- Space and time variations of predictability
- The role of scale interaction: MJO and predictions.
- Are we too much obsessed by the tropics ?

19.00-20.00 **Dinner**

FREE EVENING

Ocean models — Prof Paul Schopf

8.30-9.15 **Lecture B1a** — *What they can and can not simulate on seasonal to interannual timescales*

- Essential physics of the tropical oceans
  - *Thermocline, mixed layer, advection, entrainment, heating*
- Brief survey of ENSO mechanisms
  - *Bjerknes, delayed oscillator, recharge, advective, western Pacific (short, to illustrate ocean proc-esses)*
- Model hierarchy
  - *Shallow water, Cane-Zebiak, 2 1/2 layer, Poseidon & Gent-Cane, OGCMS z- and hybrid coordinates*
  - *what processes they capture*
  - *what processes they omit*
  - *where will improvements come?*
- Relationship between ocean models and theory
  - *How each model in the hierarchy works and why going up the tree is not always better*

9.30-10.15 **Lecture B1b** — *Strategies for re-ducing errors in ocean models*

- Anomaly models vs. GCMs
- Controlling drift explicitly or through data assimilation
- Mixing and Entrainment
- What we know, what we don't know
- Turbulence models, mixed layers, deep-cycle turbulence, internal waves and mixing
- Mixing heat vs. momentum
- Resolution, tropical instability waves, shallow recirculations, small scale air-sea feedbacks

Coupled models — Dr Antonio Navarra

11.00-11.45 **Lecture B3c** — *Sources of Predictability*

- Measuring predictability
- SST induced variations
- Separation of variance and other techniques

12.00-12.45 **Lecture B3d** — *A future for seasonal forecasts*

- Strategies for reducing coupled model errors
- Views on the efficacy and limitations of future coupled models for seasonal prediction

Problem Module A

14.00-14.45 **Problem Presentation** — Dr Alberto Troccoli

15.00-15.45 Practising time

16.15-17.00 Practising time

18.00-19.00 **Dinner**

19.30-22.30 **Visit to Gallipoli**

Atmospheric models — Prof Brian Hoskins

8.30–9.15 **Lecture B2c** — *Model performance*

- Extra-tropics
  - *Seasonal means*
  - *Storm-tracks*
  - *Blocking*
- Tropics
  - *Seasonal means*
  - *Diurnal variation of convection*
  - *Monsoons*
  - *Variability*

9.30–10.15 **Lecture B2d** — *Prospects for improving models*

- Computational schemes
- Diagnosis of observed and model data
- Single time-step
- Aqua-planet integrations
- Parametrization development
  - *Use of cloud resolving models*
  - *Very high-resolution models*
  - *New approaches*
- Interaction of dynamics & physics

Ocean models — Prof Paul Schopf

11.00-11.45 **Lecture B1c** — *Limitations and strategies for future development*

- Shallow tropical cells and the maintenance of the "cold tongue"
- Is the cold tongue bias a problem in equatorial ocean mixing or broad scale?
- On the relationship between cold tongue heat fluxes and mid-latitudes
- What causes ENSO variability?
- Predicting the predictability — is there a relationship between the mean state and ENSO?
- Does the mean state change ENSO?
- Does ENSO change the mean state?
- Can the skill of ENSO forecasting be deduced *a priori*?

12.00-12.45 **Lecture B1d** — *Sources of variability in ENSO*

- Sources of variability in ENSO: nonlinear, chaotic, damped or stochastically forced system?
- Where do the uncertainty come from?
- Implications on the predictability and loss of predictive skill
- "Interactive ensemble" strategy for identifying the role of "noise" in predictability
- Consequences of Cane's non-linear view vs Flugel and Chang's stochastic view.

Problem Module B

14.00–14.45 **Problem Presentation** — Prof David Anderson

15.00–15.45 Practising time

16.15–17.00 Practising time

19.00–20.00 **Dinner**

Panel session — Dr Jim Williams

20.30–22.00 *THEME: General circulation models (GCMs): prospects and limitations for seasonal to interannual climate forecasting*

Module C — Statistical modelling, calibration and model output assessment

Statistical Modelling — Dr Omar Baddour

8.30–9.15 **Lecture C1a** — *Statistical models as a complement and/or an alternative to dynamical models*

- Need for using statistical models
- Scientific basis of statistical models for seasonal forecast
- Opportunities for using statistical models in seasonal forecast

9.30–10.15 **Lecture C1b** — *A selection of statistical models and an overview of their uses*

- Mutliple linear regression (MLR) as typical method for statistical modelling in seasonal forecast
- Steps for building a sound MLR model
- Other Methods

Calibration — Dr David Stephenson

11.00–11.45 **Lecture C2a** — *Introduction to Probability Forecasting*

- Reasons for why we should issue probability forecasts
- Types of probability forecast
- Frequentist and subjective interpretations of probability
- Joint and conditional probabilities
- The Prosecutor's fallacy

12.00–12.45 **Lecture C2b** — *Bayesian probability forecasts for binary events*

- Unbelievable frequentist estimates
- Subjective estimates using Bayes' theorem
- Bayesian estimation that uses prior information
- Example of ensemble forecasts with different priors

Problem Module A

14.00–14.45 Problem Solution by select groups of participants

Problem Module B

15.00–15.45 Problem Solution by select groups of participants

19.00-20.00 **Dinner**

20.30-23.00 **Music evening**

Statistical Modelling — Dr Omar Baddour

8.30–9.15 **Lecture C1c** — *Comparison of forecasts from statistical and dynamical models*

- Examples for Africa

9.30–10.15 **Lecture C1d** — *Options for future development of statistical models*

- Scientific and technical side
- Capacity building issues
- Other issues

Model Output Assessment — Dr Simon Mason

11.00–11.45 **Lecture C3a** — *One-tiered vs two-tiered forecasting*

- Definitions
- Reasons for two-tiered forecasting
- Problems with two-tiered forecasts
- Alternatives

12.00–12.45 **Lecture C3b** — *Systematic model error correction*

- Simple mean and variance bias corrections
- Correcting for forecast accuracy
- Correcting for spatial errors

14.30-20.30 **Visit to Lecce**

21.00-22.00 **Dinner at Le Sirene'**

Calibration — Dr David Stephenson

8.30–9.15 **Lecture C2c** — *Bayesian calibration and combination*

- Calibration and combination issues
- A conceptual framework for forecasting
- Forecast Assimilation
- Example 1 *Nino-3.4 index forecasts*
- Example 2 *Equatorial Pacific sea surface temperatures*
- Example 3 *South American precipitation forecasts*

9.30–10.15 **Lecture C2d** — *Verification of Probability Forecasts*

- Scores (loss functions) for binary forecasts
- Mean Absolute, Brier, and logarithmic scores
- Propriety and equitability
- Scores for other types of probability forecast

Model Output Assessment — Dr Simon Mason

11.00–11.45 **Lecture C3c** — *Introduction to downscaling*

- Reasons for downscaling
- Spatial vs temporal downscaling
- Dynamical vs statistical downscaling
- MOS and perfect prog
- Examples

12.00–12.45 **Lecture C3d** — *Multi-model ensembling*

- Multi-model ensembling vs large-ensembles from single models
- Comparison of various approaches: pooling, regression-based weights, Bayesian weighting
- Bayesian estimation that uses prior information
- Example of ensemble forecasts with different priors

Problem Module C

14.00–14.45 **Problem Presentation** — Dr Simon Mason

15.00–15.45 Practising time

16.15–17.00 Practising time

19.00-20.00 **Dinner**

FREE EVENING

Module D — Application of forecast products to specific users with emphasis on applications related to security

S-I Predictions – An Overview of its role in decision making — Dr Mike Harrison

8.30–9.15 **Lecture D1a** — *Broad background to the management and social structures*

- The relationships between climate variability and climate change, and the role of applications
- Decision frameworks — requirements for climate information from the user perspective
- Language and communications — the ease with which climatologists and users

9.30–10.15 **Lecture D1b** — *Delivery of forecasts to users*

- The presentation of forecast information
- Verification, its presentation and role in applications
- The role of data alongside predictions
- The history and status of Regional Climate Outlook Forums
- Delivery to remote communities — RANET

Regional approach and its evaluation — Dr Abdallah Mokssit

11.00–11.45 **Lecture D2a** — *The genesis of the Long Range Forecast need in North African region and in a country like Morocco*

- Geographical, climatological and economical context
- Potential of seasonal forecasts for North Africa
- Seasonal forecast as a tool for decision making in sectors such as water resource management, agricultural campaign monitoring, cereals purchases planning.

12.00–12.45 **Lecture D2b** — *The Scientific Research followed to reach that needs*

- Running GCM for climate predictions over Mediterranean countries
- North Atlantic oscillation and its correlation with Moroccan rainfall

Applications of S-I forecasts to the health sector — Dr Paul Llanso

14.00–14.45 **Lecture D3a** — *Identifying the basic relationships between climate and the health outcomes*

- Significance of climate information to health
- Health terminology
- Some climate/health relationships
- Partnerships between climate experts and their health counterparts

15.00–15.45 **Lecture D3b** – *Digging and cleaning needed datasets*

- Finding data – climatic; health related
- Overcoming problems

Problem Module C

16.15–17.00 Problem Solution by select groups of participants

17.45-20.00 **Visit to the Grecia Salentina**

20.00-21.00 **Dinner**

S-I Predictions –
An Overview of its role in decision making — Dr Mike Harrison

8.30–9.15 **Lecture D1c** — *History and current status of applications*

- The role of indigenous knowledge
- Optimal benefits for American corn
- 'Prediction' using data alone

Climate-related decision making under uncertainty —
Dr Michael Glantz

9.30–10.15 **Lecture D4a** — *Early warning systems (EWS)*

- Role of Governments for EWS
- All governments need EWSs more then they realize
- Early warning systems must be viewed holistically

11.00–11.45 **Lecture D4b** — *El Niño knowledge for early warning and sustainable development*

- Potential impacts on people, infrastructure and ecosystems
- Mid- to long-range planning
- El-Niño forecasts as supplement to local knowledge of climate-society-environment interactions

Applications of S-I forecasts to the health sector — Dr Paul Llanso

12.00–12.45 **Lecture D3c** — *Demonstration of an application*

- Statement of the health outcome and the suspected climate relationship
- Analysis of data
- Evaluation of result
- Development of an operational service
- Evaluation of the service

FSU Lecture — Prof James O'Brien

14.00–14.45 *Mitigating ENSO effects in Florida for agriculture and wild fires*

- ENSO signal in Florida
- Mitigable impacts of ENSO in Florida
- Methods to mitigate:
  - *Wild fires, oranges, strawberries, potatoes, hay, fish ponds, severe freezes, etc.*

Regional approach and its evaluation — Dr Abdallah Mokssit

15.00–15.45 **Lecture D2c** — *Development of tools and forecast products and elaboration of the monthly bulletin in the discussion-validation process*

- Creation of 5 regions for Morocco
- Definition of model derived indices for precipitation
- Compilation of the advanced international centers LRF outputs with the local product to come with a concluding synthesis
- Establishment of the negotiation process with users trough simple exchange as well as specialized workshops.

16.15–17.00 **Lecture D2d** — *Evaluation of the scores and improvement of the process*

- Auto-verification task to measure the added value of the LRF products
- External user evaluations
- Added value of the LRF on the decision making in water resource and reforestation sector
- Quality of the forecasting of winters, on Morocco, of one system of ensemble forecasting: DEMETER project

19.00-20.00 **Dinner**.

Panel session — Dr Jim Williams

20.30–22.00 *THEME: Are seasonal forecast users benefitting from the extra information coming from GCMs?*

Applications of S-I forecasts to the health sector — Dr Paul Llanso

8.30–9.15 **Lecture D3d** — *Establishing operational services*

- User-directed investigation of target health outcomes
- Survey of operational services
- Resources

Climate-related decision making under uncertainty — Dr Michael Glantz

9.30–10.15 **Lecture D4c** — *Flashpoints as an approach to understanding environmental stresses*

- Incremental changes to the environment
- Consequences of the build up incremental changes
- Thresholds of change: the "flashpoints"
- Areas of Concern (AOCs), hotspots, flashpoints, and fire-points

11.00–11.45 **Lecture D4d** — *Climate Affairs: A holistic approach to climate issue*

- Society is now an integral part of the global climate sys-tem
- Educating educators about "Climate Affairs" broadens their perspective on the importance of climate-related in-formation
- Climate Ethics is an important component of Climate Affairs

S-I Predictions – An overview of its role in decision making — Dr Mike Harrison

12.00–12.45 **Lecture D1d** — *Future of services incorporating seasonal to interannual predictions*

- Flagship projects and future developments
- Environmental stresses
- Issues of ownership
- Regional Climate Centres

Problem Module D

14.00–14.45 **Problem Presentation** — Dr Simon Mason

15.00–15.45 Practising time

16.15–17.00 Problem solution by select groups of participants

19.30-20.30 **Dinner**

20.30-23.00 **Farewell evening with music at Le Sirene'**

Conclusions — Dr Michael Coughlan

8.30–9.15 **Lecture COa** — *Climate Variability and Change: the overlaps and the differences*

- *Distinguishing climate variability and climate change*
- *Mitigation and adaptation*
- *The politics of climate variability and the politics of climate change*

9.30–10.15 **Lecture COb** — *Summing up the Programme*

- What do we know? What don't we know?
- Where will we see further progress?
- How do we best put it altogether?

Panel session — Dr Jim Williams

11.00-13.00 *Theme: How can we improve communication between modellers, forecasters, and application specialists*

13.00–13.15 **Arrivederci speech** — Dr Alberto Troccoli

Lecturers

Prof David Anderson

ECMWF
Shinfield Park, Reading RG2 9AX, UK

david.anderson@ecmwf.int

Mr Omar Baddour

Cité administrative,
Résidence WAFAE, IM. K, N°8. Aviation, Rabat, Morocco

baddour@marocmeteo.ma
o_baddour@yahoo.com

Dr Mike Coughlan

Bureau of Meteorology
National Climate Centre, PO Box 1289K, Melbourne,
Victoria, 3001, Australia

m.coughlan@bom.gov.au

Dr Michael Glantz

Environmental and Societal Impacts Group
National Center for Atmospheric Research
Box 3000, Boulder, CO, 80307, USA

glantz@ucar.edu

Dr Mike Harrison

Met Office
FitzRoy Road, Exeter EX1 3PB, UK

michael.harrison3@which.net

Lecturers

Prof Brian Hoskins

Department of Meteorology, University of Reading,
Reading RG6 6BB, UK

b.j.hoskins@reading.ac.uk

Dr Paul Llanso

56 Cedar Summit Rd, Asheville, NC 28803, USA

pdllanso@charter.net

Dr Simon Mason

IRI, Columbia University,
61 Route 9W, PO Box 1000,
Palisades, NY 10964-8000, USA

simon@iri.columbia.edu

Mr Abdallah Mokssit

Direction de la Météorologie Nationale,
Face Préfecture Hay Hassani,
B.P 8106 Casablanca-Oasis, Casablanca, Morocco

mokssit@marocmeteo.ma

Dr Antonio Navarra

INGV
v. Donato Creti 12, 40128 Bologna, Italy

navarra@bo.ingv.it

Lecturers

Prof Paul Schopf

School of Computational Sciences
George Mason University, 4041 Powder Mill Rd.
Suite 302, Calverton, MD 20705, USA

schopf@scs.gmu.edu

Dr David Stephenson

Department of Meteorology
University of Reading, Reading RG6 6BB, UK

D.B.Stephenson@reading.ac.uk

Dr Joe Tribbia

National Center for Atmospheric Research
1850 Table Mesa Drive, Boulder, CO 80305, USA

Tribbia@ncar.ucar.edu

Dr Alberto Troccoli

ECMWF
Shinfield Park, Reading RG2 9AX, UK

a.troccoli@ecmwf.int

Dr Jim Williams

Mount Ararat, Cave Hill, Maidstone ME15 6DX, UK

mountararat@btinternet.com

Guest Speakers

Mr Penehuro F. Lefale

World Climate Application and Services Programme
World Meteorological Organization (WMO)
7 bis, avenue de la Paix, CH 1211 Geneve 2, Switzerland

PLefale@wmo.int

Sen Maria Rosaria Manieri

Senatrice della Repubblica Italiana
Provincia di Lecce, Via Ugo Botti, 1 73100 Lecce, Italy

Prof James O'Brien

Center for Ocean-Atmospheric Prediction Studies/FSU
2035 E. Paul Dirac Drive, R.M. Johnson Bldg. – Suite 200
Tallahassee, FL 32310, USA

jim.obrien@coaps.fsu.edu

On. Lorenzo Ria

Deputato della Repubblica Italiana
Corso Vittorio Emanuele II, 18 73057 Taviano, Italy

lorenzoria@lorenzoria.it

Ing. Antonio Rizzo

Servizio "Economia del Territorio"
Provincia di Lecce, Via Ugo Botti, 1 73100 Lecce, Italy

arizzo@provincia.le.it

Gen. Isp. Roberto Sorani

Ufficio Generale per la Meteorologia
Roma, Italy

sorani@meteoam.it

Students

Nina Aleksovska

Hydrometeorological Service, Skupi BB1000, Skopje
Republic of Macedonia

naleksovska@meteo.gov.mk

Vesselin Alexandrov

National Institute of Meteorology and Hydrology
66 Tzarigradsko shose Blvd., BG-1784 Sofia, Bulgaria

Vesselin.Alexandrov@meteo.bg

Maura Amici

Hydrology and Servizio Protezione Civile, Regione Marche,
Via Cameranense, 160029, Ancona, Italy

maura.amici@regione.marche.it

Dmytro Basharin

Marine Hydrophysical Institute (MHI) of the Nati
2 Kapitanskaya st., 99011 Sevastopol, Ukraine

dbasharin@mail.ru

John Glenn Bellow

COAPS Center for Ocean-Atmosphere Prediction Services
Florida State University, 2035 E. Paul Dirac Drive
Tallahassee, FL 32310, USA

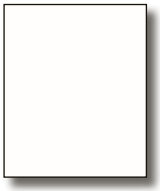
bellow@coaps.fsu.edu

Anca Marina Brookshaw

Met Office
Fitzroy Road, Exeter, EX1 3PBUK, United Kingdom

anca.brookshaw@metoffice.com

Students



Robert J. Burgman

George Mason University/C.O.L.A.
4041 Powder Mill Road, Suite 302, Calverton MD 20705
USA

burgman@cola.iges.org

Natalia Calvo

Universidad Complutense de Madrid
Fac.CC.Fisicas (UCM), Avda.Complutense sn 28040
Madrid, Spain

nataliac@fis.ucm.es

Andrea Carril

INGV
Via Donato Creti 12, Bologna, Italy

carril@bo.ingv.it

Jessie Cherry

Columbia University/Lamont-Doherty Earth Observatory
LDEO
Ocean 20661 Route 9W, Palisades, NY 10964, USA

jcherry@ldeo.columbia.edu

Michelle Colley

UK Climate Impacts Programme (UKCIP)
Union House, 12-16 St Michael's Street, Oxford, OX1 2DU
United Kingdom

michelle.colley@ukcip.org.uk

Katie Coughlin

University of Washington / University of Reading
University of Washington, Box 352420, Seattle WA 98195
USA

katie@amath.washington.edu

Students

Mohamed Abd El-Rhman Ali Dawod

Egyptian Meteorological Authority
Kobry El-Qoubba, P.O. Box: 11784 C, Egypt

mo_dawod@hotmail.com

Jens Debernard

Norwegian Meteorological Institute
P.O.Box 43 Blindern, 0313 Oslo, Norway

jens.debernard@met.no

Elia Diez

I.N.M. Spain
C/Leonardo Prieto Castro, 8 28071 Madrid, Spain

elia@inm.es, icg@inm.es

Elias Dimitriou

Hellenic Centre for Marine Research
46.7Km Sounio-Anavissos Ave.,
19013, Anavissos Attikis, Greece

elias@ath.hcmr.gr

Juan Sebastian Fontecilla

Canadian Meteorological Center
2121, route Transcanadienne, Dorval, Québec, H9P 1J3
Canada

juan-sebastian.fontecilla@ec.gc.ca

M. Dolores Frias

University of Salamanca
Dpto. Fisica General y de la Atmosfera
Plaza de la Merced s/n, 37008 Salamanca, Spain

dfrias@usal.es

Students

Alexandre Gagnon

Scripps Institution of Oceanography
University of California, 9500 Gilman Drive, La Jolla, Ca
USA

agagnon@ucsd.edu

Yoshie Goto

Center for Ocean-Atmospheric Prediction Studies
Florida State University, Suite 200 Johnson Building
Tallahassee FL 32306-2840, USA

yoshie@coaps.fsu.edu

Annette Guldberg

Danish Meteorological Institute
Lyngbyvej 100DK, 2100 Copenhagen, Denmark

ag@dmi.dk

Murat Gunduz

Inst. of Marine Sciences, Middle East Technical University,
Orta Dogu Teknik Universitesi, Deniz Bilimleri Enstitusu,
pk.28, 33731, Erdemli/Mersin, Turkey

gunduz@ims.metu.edu.tr

Mosaad Hassanein

Central Laboratory for Agricultural Climate (CLAC)
Egypt

dr_mosaadkotb2003@yahoo.com

Richard Hewston

University of East Anglia
Department of Environmental Science
University of East Anglia, Norwich, NR4 7TJ, UK

r.hewston@uea.ac.uk

Students

Antoni Jordi

Imedea (CSIC – UIB)
Miquel Marquès, 21, 07190 Esporles, Illes Balears, Spain

vieaajb@uib.es

Alicia Karspeck

National Center for Atmospheric Research (NCAR)
Box 3000, Boulder, CO 80307, USA

aliciak@ucar.edu

Valentina Khan

Hydrometeorological Research Center of the Russian Federation, 9–11, Bolshoy Predtechensky Pereulok, Moscow, 123242, Russia

khan@mecom.ru

Morten Ødegaard Køltzow

University of Oslo / Norwegian Meteorological In Norwegian Meteorological Institute
P.O.Box 43, Blindern, N-0313 Oslo, Norway

famo@met.no

Marina Kordzakhia

The Department of Hydrometeorology of the Ministry
150, David Agmashenebeli Av. 0112, Tbilisi, Georgia

g.kordzakhia@web-sat.com

Narasimhan Larkin

US Forest Service
PNW Research Station 400 N., 34th St #201,
Seattle, WA 98103, USA

larkin@fs.fed.us

Students

Lea Marjatta Leskinen

Finnish Meteorological Institute
Weather Warning Services, P.P. Box 503,
00101 Helsinki, Finland

lea.leskinen@fmi.fi

Paulo-Sérgio Lucio

Centre of Geophysics of Evora
Rua Romão Ramalho, 59, 7000-554 Evora, Portugal

pslucio@uevora.pt

Pascal Mailier

University of Reading
Department of Meteorology, PO Box 243,
Reading RG6 6BB, United Kingdom

p.j.a.mailier@reading.ac.uk

Constantin Mares

Institute of Geodynamics of the Romanian Academy
19-21 J.-L. Calderon Str., R-70201 Bucharest 37, Romania

constantin_mares_ro@yahoo.com

Ileana Mares

Institute of Geodynamics of the Romanian Academy
19-21 J.-L. Calderon Str., R-70201 Bucharest 37, Romania

ileana_mares@geodin.ro

Albert Martis

Meteorological Service Netherlands Antilles
Meteo-Building Seru Mahuma,
Curacao, Netherlands Antilles

albmartis@meteo.an

Students

Cheikh Mbodj

Environment and Rural Development Ministry
Direction de l'Agriculture, Service Agrométéorologie
PO 180 Nouakchott, Mauritania

cheikh_mbodj@yahoo.fr

Paul-Antoine Michelangeli

Climpact
Universite P. et M. Curie, Boite 101 – Tour 45 – Couloir 45/464, place Jussieu, 75232 Paris Cedex 05, France

pam@climpact.com

Ernesto Munoz

University of Maryland – Earth System Science ESSIC
2207 Computer and Space Sciences Building #224
College Park, MD 20742-2465, USA

emunoz@essic.umd.edu

Warwick Norton

Dept of Meteorology
University of Reading, Earley Gate, Reading RG6 6BB, UK

W.A.Norton@reading.ac.uk

Mirta Patarcic

Croatian Meteorological and Hydrological Service
Gric 3HR, 10000 Zagreb, Croatia

patarcic@cirus.dhz.hr

Kathy Pegion

George Mason University
4041 Powder Mill Rd, Suite 302, Calverton,
MD 20705-3106, USA

kpegion@cola.iges.org

Students

Malaquias Pena Mendez

Science Applications International Corp. at EMC-NCEP-NOAA, 5200 Auth Rd. Room 807,
Camp Springs, MD, 20716, USA

malaquias.pena.mendez@noaa.gov

Sjoukje Philip

KNMI
Postbus 201, 3730 AE De Biltthe, Netherlands

philip@knmi.nl

Anna Pirani

Meteo-France
CNRM/GMGEC/MEMO, 42,ave Coriolis,
31057 Toulouse, France

anna.pirani@cnrm.meteo.fr

Oleg Pokrovsky

Main Geophysical Observatory
Karbyshev str.7, 194021, St.Petersburg, Russia

pokrov@main.mgo.rssi.ru

Antonio-David Pozo-Vazquez

University of Jaen
Departamento Fisica, Edif. A-3, Campus Lagunillas
23071, Jaen, Spain

dpozo@ujaen.es

Cristina Primo Ramos

University of Cantabria
c/Los Caños, 6, 7D Santander, Spain

primo@ifca.unican.es

Students

Christel Prudhomme

Centre for Ecology and Hydrology
Maclean Building, Wallingford OX10 8BB, United Kingdom

C.Prudhomme@ceh.ac.uk

Angelo Riccio

Inst. of Applied Sciences
Via De Gasperi, 5, 80133 Napoli, Italy

angelo.riccio@uniparthenope.it

Irina Rudeva

P.P. Shirshov Institute of Oceanology
RAS 36, Nakhimovsky ave., Moscow, 117997, Russia

rudeva@sail.msk.ru

Reija Ruuhela

Finnish Meteorological Institute
P.O.Box 503, FIN-00101 Helsinki, Finland

reija.ruuhela@fmi.fi

Salah Sahabi Abed

Hydrometeorological Institute for Training and R IHFR
cité des HLM, Gambetta, Oran, 31000, Algeria
salah_sahabi@yahoo.com

Serhat Sensoy

Turkish State Meteorological Service
P.O. Box:401, 06120 Kalaba, Ankara, Turkey

ssensoy@meteor.gov.tr

Students

Laila Shahin

Jordan Meteorological Department
P.O. Box 341011, Amman civil airport-Marka,
11134 Amman, Jordan

laila_n_shahin@yahoo.com

Gregor Skok

University of Ljubljana
Faculty of Mathematics and Physics, Jadranska 19,
SI-1000 Ljubljana, Slovenia

Gregor.Skok@fmf.uni-lj.si

Lidija Srnec

Meteorological and Hydrological Service
Gric 3, HR-10000 Zagreb, Croatia

srnec@cirus.dhz.hr

Gintautas Stankunavicius

Vilnius University
Dept. of Hydrology & Climatology, Ciurlionio 21/27
LT-03101 Vlinius, Lithuania

gintas.stankunavicius@gf.vu.lt

Matthew James Swann

Climatic Research Unit
University of East Anglia, Norwich NR4 7TJ, UK

m.swann@uea.ac.uk

Qiaobin Teng

CCCMA/ CCRM Climate Research Branch
Meteorological Service of Canada, 4905 Dufferin Street,
Downsview, Ontario M3H 5T4, Canada

Qiaobin.Teng@ec.gc.ca

Students

Caroline C Ummenhofer

Centre for Environmental Modelling and Prediction
School of Mathematics, University New South Wales
Kensington, NSW 2052 Sydney, Australia

ccumm@maths.unsw.edu.au

Liliana Florentina Velea

National Administration of Meteorology
Sos. Bucuresti-Ploiesti 97, 013686, Bucharest, Romania

velea@meteo.inmh.ro

Stefania Vergari

Italian National Weather Service
CNMCA Climatologia Aeroporto "De Bernardi" 9 Brigata Aerea, via Pratica di Mare, Pomezia 00040 Rome, Italy

vergari@meteoam.it

Andreas Philipp Weigel

MeteoSwiss, ETH Zurich Climate Services,
MeteoSwissKraehbuehlstrasse 58, Postfach 5148044
Zuerich, Switzerland

andreas.weigel@env.ethz.ch

Xiuhua Zhu

Max Planck Institute for Meteorology
Bundesstr 5320146, Hamburg, Germany

xiuhua@dkrz.de

Emergency phone numbers

	Phone number
Hotel Le Sirene'	0833 202536
ER - Ambulance	0833 273787
Emergency Doctor	0833 266250
Hospital "Sacro Cuore di Gesu"	0833 270111
Police	0833 267711
Carabinieri	0833 266190
Fire Brigade	0833 202222
Train information	0833 266214
Post Office via Quartini	0833 267511
Post Office via Genova	0833 261776
Information Office - Pzza Imbriani, 9	0833 262529
Information - Pro Loco - Via D'Elia,1	0833 262386
Aeroporto di Brindisi "G. Papola"	0831 411711/411720
Aeroporto di Bari-Palese	080 5800200

The Salento area

'Il Salento' is the peninsular better known as the heel of Italy. It comprises the provinces of Lecce, Brindisi and Taranto and has history by the bucket, as well as 80% of Puglia's 829 km of coast.

It once extended over a bigger territory, stretching as far as Matera in Basilicata. Called 'Terre d'Otranto' the Greek towns of Otranto, Nardò, Galatina and Gallipoli dominated the thousands of small villages along the coast and those dispersed in the interior. Interestingly, a grotto was found last century near Porto Badisco. It was here that the prehistoric inhabitants of Salento sought refuge. Their presence can be confirmed by many hand paintings made of bat droppings or 'guano' on the inner walls. Thankfully, the Cretans arrived from across the Mediterranean and the history of Salento took a culturally upward shift. They founded Lecce and the city remains the cultural soul of Salento.

For Salento, the annual mean temperature is 17°C. With the humid, warm scirocco wind coming from the south the average can rise to 25°C. In other words, it's mild to hot throughout the year. The coast is a mix of rocky then sandy stretches. For the sandy bits try San Cataldo, San Foca and Torre dell'Orso and Ugento. For the rocky stretches try Santa Cesarea, Santa Maria di Leuca, Castro, Tricase and Gagliano del Capo. Take your choice, but nothing can beat a dive into the crystal clear waters from a sun bathed (lowish) cliff.

There are seven types of museum in Salento. They are classed as 'Archeologici', 'Artistici', 'Artistico-Archeologici', 'Demo-Etno-Antropologici', 'Naturalistici', 'Tecnico-Scientifici' and 'Specializzati'. The best are the 'Museo Civico' for all things Magna Grecia and the 'Museo Archelogico Provinciale', both at Lecce. Also of note is the Museum of Pre-Classical Civilization in Puglia at Ostuni. Here the remains of the oldest 'mother' in the world can be found. Over 20,000 years old, the woman was seemingly sacrificed in a cavern in the city along with her unborn baby. . . Very grim.

Acknowledgements

It would have not been possible to organise this ASI course without the collaboration and support of many people:

Elena Bertocco (ASI Secretary),

the members of the Organising Committee –
Omar Baddour, David Anderson (thank you David for your repeated encouragements), Mike Harrison and Simon Mason,

Rob Hine (graphic creator),

Nando Micaletto (technical & local expert),

Lynne Nolan (NATO Environmental and Earth Science & Technology Programme Secretary),

Annamaria Caputo (Manager Caroli Hotels),

Rino Belloni (Lecce province contact),

Antonio Rizzo (Lecce province manager),

plus all the other helpful people whom I have failed to mention in this list.

And the sponsors deserve a page on their own (*please turn to the back cover*).

Alberto Troccoli
Director of the ASI

Notes

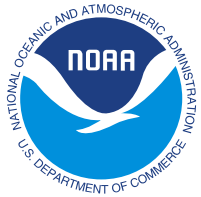
Notes

Notes

Notes

Notes

Notes



WMO

ECMWF

INTERNATIONAL

SECRETARIAT